ENVIRONMENTAL IMPACT ASSESSMENT REPORT
AND
ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT
FOR LISTED ACTIVITIES ASSOCIATED WITH THE CONSTRUCTION AND OPERATION OF CHICKEN REARING HOUSES.

SUBMITTED FOR AN ENVIRONMENTAL AUTHORISATION LODGED IN TERMS OF SECTION 24 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) READ WITH REGULATION 19 OF THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS TAKING PLACE ON PORTION 3 OF THE FARM KAMEELZYNKRAAL 547 JR, CITY OF TSHWANE METROPOLITAN MUNICIPALITY, GAUTENG PROVINCE

NAME OF APPLICANT: EGGSPERT KAMEELZYNKRAAL (PTY) LTD
FILE REFERENCE NUMBER: GAUT: 002/21-22/E2900
APPLICATION PROPERTY: PORTION 3 OF THE FARM KAMEELZYNKRAAL 547 JR

November 2021

BECS Environmental (Pty) Ltd
In association with BECS Services (Pty) Ltd

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IMPORTANT NOTICE

Unless an Environmental Authorisation (EA) can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme Report (EIAR/EMP) in terms of the National Environmental Management Act no 107 of 1998 (as amended) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation, or damage to the environment.

In terms of section 16(3)(b) of the Environmental Impact Assessment (EIA) Regulations, GN 982 of 2014 (as amended) in terms of the NEMA, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority (CA) and in terms of section 17(1)(c) the CA must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed EIAR/EMP required in respect of applications for an EA for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template.

It is furthermore an instruction that the Environmental Assessment Practitioner (EAP) must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the EIAR/EMP, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with uninterpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT

The objective of the EIA process is to, through a consultative process—

a. determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
b. describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
c. identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
d. determine the—-
    i. nature, significance, consequence, extent, duration, and probability of the impacts occurring to inform identified preferred alternatives; and
    ii. degree to which these impacts—
        aa. can be reversed;
        bb. may cause irreplaceable loss of resources, and
        cc. can be avoided, managed, or mitigated;
e. identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
f. identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
g. identify suitable measures to manage, avoid or mitigate identified impacts; and
h. identify residual risks that need to be managed and monitored.

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ADDENDUMS

ABBREVIATIONS

AIA	Archaeological Impact Assessment
CBA	Critical Biodiversity Areas
CoT	City of Tshwane
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECA	Environmental Conservation Act 73 of 1989 as amended
EIA	Environmental Impact Assessment
EIA/EMP	Environmental Impact Assessment Report/Environmental Management Programme
EIA Regulations	Environmental Impact Assessment Regulations, GN982 of 2014 (as amended) in terms of NEMA
ESA	Ecological Support Areas
ESR	Environmental Scoping Report
GA	General Authorisation
GDARD	Gauteng Department: Agriculture and Rural Development
GPEMF	Gauteng Provincial Environmental Management Framework
GSDF	Gauteng Spatial Development Framework
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties

IDP	Integrated Development Plan
WUL	Water Use License
WULA	Water Use License Application
LED	Local Economic Development
LIA	Late Iron Age
LSA	Later Stone Age
NDEA	National Department of Environmental Affairs
NEMA	National Environmental Management Act No 107 of 1998 (as amended)
NEMAQA	National Environmental Management: Air Quality Act No 39 of 2004 (as amended)
NEMBA	National Environmental Management Biodiversity Act No 10 of 2004 (as amended)
NEMWA	National Environmental Management Waste Act 59 of 2009 (as amended)
NFA	National Forest Act No 84 of 1998
NHRA	National Heritage Resources Act No 25 of 1999
NVFFA	National Veld Fires and Forest Act No 101 of 1998 (as amended)
NWA	National Water Act no 36 of 1998 (as amended)
RoD	Record of Decision
SAHRA	South African Heritage Resources Agency

Executive summary

Applicant

BECS Environmental has been appointed by Eggspert Kameelzynkraal (Pty) Ltd to apply for an environmental authorisation in terms of the National Environmental Management Act no 107 of 1998 (as amended) (NEMA), for the construction and operation of chicken rearing houses. BECS Environmental is also applying for a water use license application (WULA) in terms of the National Water Act No 36 of 1998 (as amended) (NWA). The Gauteng Department of Agriculture and Rural Development (GDARD) gave confirmation of receipt of the application for environmental authorisation on the 11th of June 2021. The application has been assigned the following reference number Gaut: 002/21-22/E2900. The environmental scoping report was received on the 26th of July and was acknowledged with a letter sent from GDARD on the 30th of July 2021. A letter of acceptance of the environmental scoping report was received on the 19th of August 2021. Please refer to Addendum 5 for proof of all above-mentioned communication.

The acceptance of the final scoping report received from GDARD on the 19th of August 2021, included comments for the consideration of the EAP. The draft EIA was acknowledged on the 27th of October and similar comments were then sent on the draft EIA on the 2nd of November 2021.These aspects are covered under PART B, Section n) Specific information required by the competent authority.

Refer to Table 1 below for a description of the applicant. Portion 3 of the farm Kameelzynkraal 547 JR is owned by Eggspert Kameelzynkraal (Pty) Ltd. The title deeds and registration certificate are attached as Addendum 4A to this report.

Table 1: Description of the applicant

Project applicant	Eggspert Kameelzynkraal (Pty) Ltd
Trading name	Eggspert Kameelzynkraal
Contact person	Stephan Botha
Designation	Operations Manager
Telephone number	+27 82 789 7310
E-mail address	stephan.botha@eggsperteggs.co.za

Project description

The proposed activities are as follows:

- The development and related operation of facilities or infrastructure for the concentration of more than 5,000 poultry per facility situated outside an urban area, excluding chicks younger than 20 days and more than 25,000 chicks younger than 20 days per facility situated outside an urban area,
- The development and related operation of hatcheries or agri-industrial facilities outside industrial complexes where the development footprint covers an area of 2,000m² or more,
- The clearance of an area of 1ha or more, but less than 20ha of indigenous vegetation,
- The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution, or effluent,
- The development of reservoirs, excluding dams, with a capacity of more than 250m³ in sites identified as CBAs or ESAs in the Gauteng Conservation Plan or in bioregional plans; or sites identified within threatened ecosystems,
- The development of 4m wide road with a reserve less than 13.5m in sites identified as CBAs or ESAs in the Gauteng Conservation Plan or in bioregional plans; or sites identified within threatened ecosystems, and
- The clearance of an area of 300m² or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan within CBAs or ESAs identified in the Gauteng Conservation Plan or bioregional plans.

Summary of impacts

- Existing vegetation at all structure footprints will be removed and footprints will be covered with concrete, paving and gravel depending on the structure type. It will cause the productive soil potential (land capability) at all structure footprints to cease in terms of crop farming (grain and vegetables) and rangeland (meat – cattle and sheep), although the chicken farm will produce meat without using the productive potential of the soil resource
- Areas will be cleared and levelled where necessary, site office may be temporary structures and machinery, building supplies and temporary staff facilities (excluding accommodation) will be

housed here. This could lead to the loss of vegetation and/or species of conservation concern, alteration and loss of microhabitats, altered vegetation cover, increased erosion and contamination of soil and groundwater.

- Disturbance of resident bird species is usually caused by construction activities and is therefore short term but can also continue over the long term into the operational and maintenance phases.
- The site is vulnerable to hunting/trapping by farm workers/construction workers. Harassing and hunting by farm workers/ construction workers could be expected.
- There are no wetlands on the proposed site, however, wetlands within the 500 metre ESA, surrounding the study site, may experience changes to flood attenuation, streamflow regulation, erosion control, carbon storage and other features.
- Over-abstraction of groundwater from boreholes is likely to lead to depletion of the water levels in the area over time. Over-abstraction of groundwater from a borehole can potentially draw poorer water quality from the adjacent geohydrological environment into the borehole.
- During the proposed construction and operational phases, surface and subsurface impacts may take place. These activities can lead to irreparable damage or complete destruction of heritage resources if not correctly managed.
- The development footprint is situated on a geological layer with a high palaeontological sensitivity. As such, activities could lead to the destruction of Fossil Heritage.

PART A

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

a) Details of the environmental assessment practitioner

This section includes the following: Details of the environmental assessment practitioner (EAP); expertise of the EAP, which includes the qualifications of the EAP (with evidence) and a summary of the EAP's experience - in carrying out the EIA Procedure; and a declaration that the EAP is independent in a form as may be specified by the competent authority.

BECS Environmental was appointed as an independent consultant (EAP) to meet the requirements as set out in regulation 13 of the EIA Regulations. Refer to Table 2 below for a description of the EAP and refer to Addendum 2 for a detailed CV of the EAP, which includes the expertise including qualifications and experience.

Table 2: Description of the EAP

Name of company	BECS Environmental
Postal address	PO Box 72960, Lynnwood Ridge, 0040
Telephone number	012 361 9970
Cell phone number	072 191 6074
Facsimile number	012 361 0645
E-mail address	salome@becsenv.co.za
Name of EAP (report reviewer)	Salome Beeslaar
Expertise of EAP	B.Sc Environmental Science (UP[1]), B.Sc Honours Geography (UP), M.Sc Geography (UP), Registered EAP with EAPASA[2] number 2020/846, Professional Scientist (Environmental Science) with SACNASP[3] number 400385/14, member of the IAIAsa[4] with membership number: 5853
Name of EAP (report compilation)	Christopher Delport
Expertise of EAP	B. Sc Environmental Science (UP), B. Sc Honours Geography & Environmental Science (UP), member of the IAIAsa with membership number: 6643

I, Christopher Delport (9507265046081), hereby declare that I have no conflict of interest related to the work of this report. Specially, I declare that I have no business, personal, or financial interests in the property and/or environmental authorisation being assessed in this report and that I have no personal or financial connections to the relevant property owners or farm. I declare that the opinions expressed

[1] University of Pretoria
[2] Environmental Assessment Practitioners Association of South Africa
[3] South African Council for Natural Scientific Professions
[4] International Association for Impact Assessment South Africa

in this report are my own and a true reflection of my professional expertise and that there are no circumstances that may compromise my objectivity in performing such work.

_____

Christopher Delport

BSc Hons– Geography and Environmental Science

November 2021

b) The location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report

Refer to Table 3 below for a description of the property. A locality map of the farm is provided below.

Table 3: Farm names, 21-Digit Surveyor General codes, and coordinates

	Portion 3 of the farm Kameelzynkraal 547 JR
Title deed number	T68664/2020
Deeds office	Pretoria
Property owner	Eggspert Kameelzynkraal (Pty) Ltd
21-digit Surveyor General Code and extent for each farm portion	Portion 3 of the farm Kameelzynkraal 547 JR T0JR00000000054700003 97 ha
Coordinates[5]	Portion 3 of the farm Kameelzynkraal 547 JR 25°54'53.26"S, 28°31'23.90"E 25°54'59.28"S, 28°31'36.23"E 25°56'30.32"S, 28°30'0.57"E 25°56'24.88"S, 28°29'52.70"E

Please note: The environmental authorisation is being applied for on a portion of portion 3 of the farm Kameelzynkraal. The coordinates below indicate the area to be considered for authorisation of the development. Figure 1 represents the area to be excluded from the development footprint and excluded from authorisation.

Table 4: Coordinates of area to be considered for environmental authorisation

	A portion of portion 3 of the farm Kameelzynkraal 547 JR
Extent	71 ha
Coordinates	25°54'53.26"S, 28°31'23.90"E 25°54'59.28"S, 28°31'36.23"E 25°55'57.88"S, 28°30'28.99"E 25°55'53.10"S, 28°30'24.90"E

[5] **NOTE**: The coordinates have been updated to a more accurate representation of the corners of the property.

c) Locality map

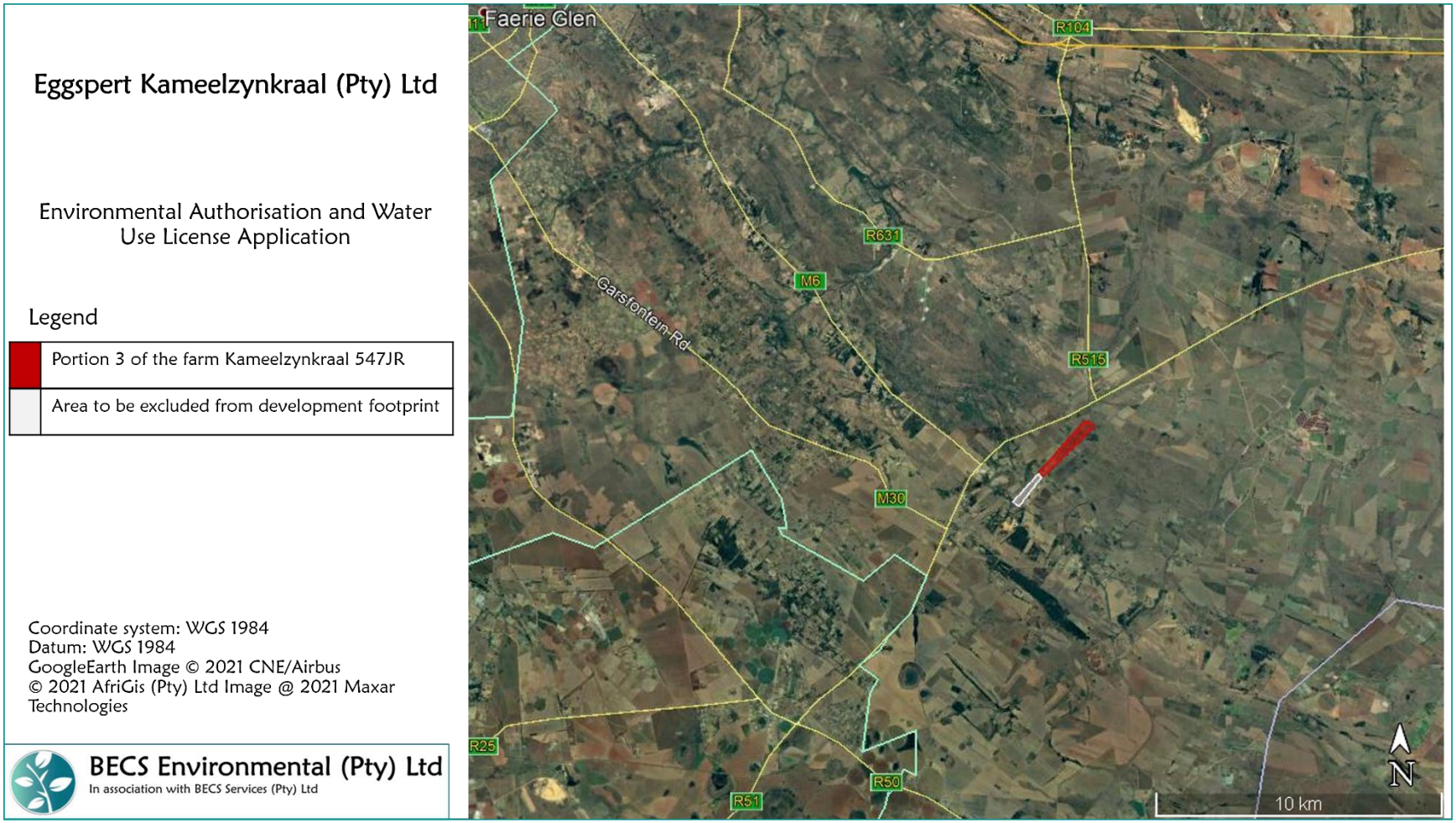


Figure 1: Locality map of Portion 3 of the farm Kameelzynkraal 547 JR (Grey area to be excluded from development footprint)

d) Description of the scope of the proposed overall activity

This application is for an environmental authorisation application in terms of NEMA. According to Section 24(2) and 24(5) of the National Environmental Management Act No 107 of 1998 (as amended) (NEMA):

'The Minister, or an MEC with the concurrence of the Minister, may identify (a) activities which may not commence without environmental authorisation(EA) from the competent authority; (b) geographical areas based on environmental attributes, and as specified in spatial development tools adopted in the prescribed manner by the Minister or MEC, with the concurrence of the Minister, in which specified activities may not commence without EA from the competent authority.

The Minister, or an MEC with the concurrence of the Minister, may make regulations consistent with subsection (4) laying down the procedure to be followed in applying for, the issuing of and monitoring compliance with EAs.'

This EA application is for activities that trigger a full EIA; therefore a full EIA process is undertaken. Refer to Part A, section (d)(i) for all listed activities. GDARD gave confirmation of receipt of the application for environmental authorisation on the 11th of June 2021. The application has been assigned the following reference number Gaut: 002/21-22/E2900. The environmental scoping report was received on the 26th of July and was acknowledged with a letter sent from GDARD on the 30th of July 2021. A letter of acceptance of the environmental scoping report was received on the 19th of August 2021. Refer to Addendum 5B for the acknowledgement of receipt of the ESR and Addendum 5C for proof of acceptance of the ESR.

In addition to this application, the farm will also apply for a Water Use License (WUL) with the Department of Water and Sanitation (DWS) for a Section 21a, b, c, e, g and i in terms of the National Water Act, 1998 (Act No 36 of 1998) (as amended). Refer to Addendum 5E for correspondence with DWS regarding the WULA.

(i) Listed and specified activities triggered and being applied for

Refer to Table 5 below for all listed activities being applied for.

Table 5: All listed activities for this application

Name of Activity	Listed Activity	Applicable Listing Notice
The development and related operation of facilities or infrastructure for the concentration of more than 5,000 poultry per facility situated outside an urban area, excluding chicks younger than 20 days and more than 25,000 chicks younger than 20 days per facility situated outside an urban area	5(ii)(iv)	GNR 983 (GN 327)

Name of Activity	Listed Activity	Applicable Listing Notice
The development and related operation of hatcheries or agri-industrial facilities outside industrial complexes where the development footprint covers an area of 2,000m² or more	8	GN 983 (GN 327)
The clearance of an area of 1ha or more, but less than 20ha of indigenous vegetation	27	GN 983 (GN 327)
Any process or activity identified in terms of section 53(1) of the NEMBA	30	GNR 983(GN 327)
The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.	6	GNR 984 (GN 325)
The development of reservoirs, excluding dams, with a capacity of more than 250m³ in sites identified as CBAs or ESAs in the Gauteng Conservation Plan or in bioregional plans; or sites identified within threatened ecosystems	2 (c)(iv)(v)	GNR 985 (GN 324)
The development of a road wider than 4m with a reserve less than 13.5m in sites identified as CBAs or ESAs in the Gauteng Conservation Plan or in bioregional plans; or sites identified within threatened ecosystems	4 (c)(iv)(v)	GNR 985 (GN 324)
The clearance of an area of 300m² or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan within CBAs or ESAs identified in the Gauteng Conservation Plan or bioregional plans	12 (c)(ii)	GNR 985 (GN 324)

The farm will also apply for a Water Use License (WUL) with the Department of Water and Sanitation (DWS) for a Section 21a, b, c, e, g and i in terms of the National Water Act, 1998 (Act No 36 of 1998) (as amended).

(ii) Description of the activities to be undertaken

The proposed development includes the building of chicken rearing houses and associated infrastructure. The development is considered an agri-industrial facility, falling outside industrial complexes and the development footprint covers an area of 2,000m² or more. There will be approximately 32 500 day-old chicks placed in each house, situated outside an urban area. The chicks will be placed in 7 rearing homes of approximately 1000 m². Roads approximately 4 metres wide will also be developed on the site, falling within a terrestrial CBA. The development will require the clearance of more than 1 ha, but less than 20ha of indigenous vegetation.

The activities will include the abstraction of groundwater from 5 boreholes and the storage of water in a reservoir. Abstraction of roughly 20 000 cubic metres of water per year and storage of 360 cubic meters of water in a reservoir on the farm. A Water Use License Application is currently being lodged for dirty water uses which will occur on site.

e) Policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context

This section only includes policy and legislative context directly related to the authorisations of the farm. For a complete description of all legislation, guidelines and policies, a detailed Environmental Legal Compliance Assessment (ELCA) must be done.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Authorisation applications			
NEMA and the Environmental Conservation Act 73 of 1989 as amended (ECA)	The first listed activities which required an EA (referred to as a record of decision (RoD) in the past) commenced in 1998. These activities were published in the EIA Regulations of 1998 (GN1183). In 2006, the ECA activities and EIA Regulations were replaced by the first NEMA EIA Regulations. The second set of NEMA EIA activities replaced the first set of NEMA EIA activities in 2010. The third set of NEMA EIA activities commenced on 8 December 2014. According to these listings, a Basic Assessment should be conducted if an activity on listing notice 1 or 3 is triggered. If an activity on listing notice 2 is triggered, then a full Environmental Impact Assessment (EIA) is required.	Addendum 5A: Acceptance of application and Table 5	This EIA application includes activities that are listed under NEMA.
National Water Act No 36 of 1998, (NWA)	Section 21 of the NWA sets out the water uses for which a IWUL is required. These water uses commenced in 1 October 1998, and include	Addendum 5E: Correspondence from DWS	The client is in the process of applying for a WULA for Section 21a, b, c, e, g and i water uses.

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
	permissible water uses (water uses for which no licencing or registration is necessary), general authorisations (GA) (water uses for which registration only is required), and water use licences (water used for which both registration and licencing is required). An existing lawful water use is any water use that commenced 2 years or more prior to the NWA and authorised under the old Act. These water uses are deemed lawful. In 1999, the GN 704 Regulations i.t.o. NWA were published.		
National Heritage Resources Act no 25 of 1999 (NHRA)	All required permits as per the Act.	Section 2(h)(v)	A specialist conducted a Heritage Impact Assessment (HIA). This report is attached to the EIAR/EMP. All impacts and management measures from the HIA are included in this ESR to ensure that heritage resources are not negatively impacted.
Section 15(1) of the National Forest Act No 84 of 1998 (NFA)	No person may cut, disturb, damage or destroy any protected tree; or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, or any forest product derived from a protected tree, except under a licence granted by the Minister.	Section 2(h)(iv)(5)	The farm is currently applying for an EIA for the clearance of indigenous vegetation within critical biodiversity areas identified in bioregional plans. It is unclear at this stage which species will be removed. However, the farm will not cut, disturb, damage or destroy any protected tree;

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
			or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree without prior approval and licensing. The Fauna and Flora study will indicate whether such permits are necessary.
Biodiversity management			
Protection of threatened or protected species: Sections 56-58 & 87-93 of National Environmental Management Biodiversity Act No 10 of 2004 (as amended) (NEMBA), section 12 of NFA	The Minister may, by notice in the Gazette, publish a list of critical endangered, endangered, vulnerable and/or protected species. No person may (a) cut, disturb, damage, destroy or remove any protected tree; or (b) collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister.	Section 2(h)(iv)(5)	All critically endangered, endangered, vulnerable and/or protected species will be identified, and the correct mitigation measures will be implemented.
Alien and invasive species: GN 1048 of 1984 i.t.o. CARA, GN 507, GN 508 & GN 509 of 2013, & GN 598 & GN 599 of 2014 i.t.o. NEMBA, sections 65-77 of NEMBA	Category 1a Listed Invasive Species must be combatted or eradicated. Category 1b Listed Invasive Species must be controlled. Category 2 Listed Invasive Species require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit. Category 3 Listed Invasive Species are subject to exemption.	Section 2(h)(iv)(5)	All invasive species will be identified, and the correct mitigation measures will be implemented along with environmentally friendly removal processes.
Soil management			

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Contaminated land: Sections 35-41 of NEMWA	The assessment of impacts relating to soil pollution and erosion control, must form part of both the EMP. The acidification, salination and mineralisation of soils through seepage of polluted water must take place as approved in the EMP. The spillage of hazardous chemicals onto soils or its escape or migration into surrounding soils from the approved deposition area, must be prevented. Oils, grease and hydraulic fluids must be disposed of. Oils, grease and hydraulic fluid spills must be cleaned up by removing all contaminated soil and disposing such soil in a waste disposal receptacle or at a licensed facility. The chemical and physical properties of topsoil to be used for the purposes of rehabilitation must not be changed by introducing foreign material, gravel, rock, rubble or mine residue to such soil. An owner of land that is significantly contaminated, or a person who undertakes an activity that caused the land to be significantly contaminated, must notify the department of that contamination as soon as that person becomes aware, of that contamination	EMP	The impacts on groundwater, soil, land capability and land use are included in the EIA/EMP.
Emergency incidents			

Applicable legislation and guidelines used to compile the report	Description of legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Section 30 of NEMA, section 20 of NWA S20, and Section 18 of the National Veld Fires and Forest Act No 101 of 1998 (as amended) (NVFFA)	In the event of an emergency, the farm must: report through the most effective means reasonably available; take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons; undertake clean-up procedures; remedy the effects of the incident; and assess the immediate and long-term effects of the incident on the environment and public health. Any owner who has reason to believe that a fire on his or her land or the land of an adjoining owner may endanger life, property or the environment, must immediately notify the fire protection officer or, any member of the executive committee of the fire protection association, if one exists for the area; and the owners of adjoining land; and do everything in his or her power to stop the spread of the fire.	EMP	The farm will compile an environmental emergency procedure. This procedure will be implemented on the farm.

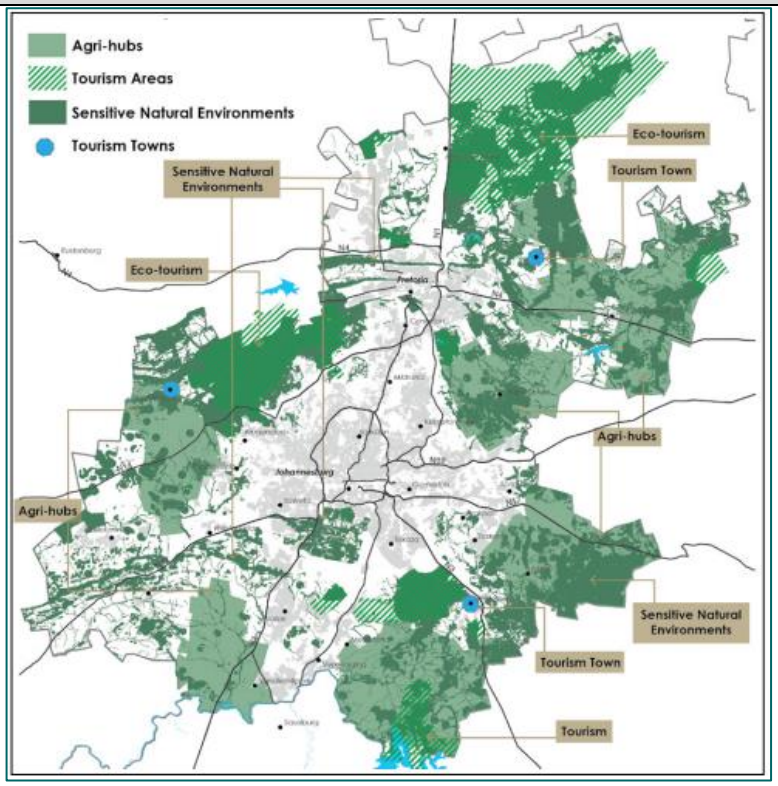
f) Motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report

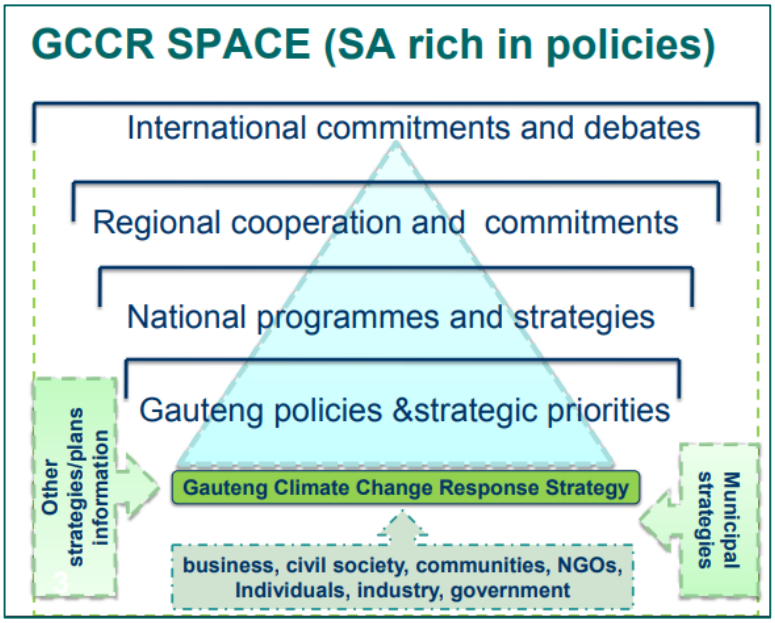
As per the Guideline on Needs and Desirability in terms of the EIA Regulations (published 20 October 2014), the following table has been compiled:

Table 6: Need and desirability of the proposed project

Guideline requirement	Comments on requirement
1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?	
1.1 How were the following ecological integrity considerations taken into account?	
1.1.1 Threatened Ecosystems,	A wetland delineation, terrestrial biodiversity study, flora and fauna assessment has been compiled for the project which investigates the impact on the ecological integrity of the area and puts forward management measures. Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs") are also identified in these studies. A risk assessment methodology will be used to assess the ecological integrity and the impact the development has on the region. Further, specialist studies are undertaken in consideration to all environmental components are compiled as such.
1.1.2 Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure,	
1.1.3 CBAs and Ecological Support Areas (ESAs),	
1.1.4 Conservation targets,	The information below is extracted from the Terrestrial Ecology Assessment (Limnology, 2021): The site is mostly natural with few sections of alien vegetation. Larger sections of the site have been cleared for historical cultivation and is currently utilized for fodder production through the planting of grass. The primary drivers of the ecology on site are the biological, physical, and chemical processes. Biological: The biological process of the site is impacted with degradation of the natural processes of the site. Indigenous species of herbivores and carnivores has been removed from the site by anthropogenic activities. Natural grazing by indigenous species has been completely removed. Vegetation of the site is natural with some alien/ exotic species. Overall, the biological functionality of the site remains albeit most of the drivers has been replaced by domesticated species.
1.1.5 Ecological drivers of the ecosystem,	

Guideline requirement	Comments on requirement
	Chemical: With the exclusion of fire from the site the nutrient recycling of the site is limited to natural decomposition processes in addition to hydrological functionalities. Aspects such as photosynthesis will be degraded as the amount of standing phytomass is cleared and unnaturally altered. The frequency of fire events is of concern- too frequent burning of the site can alter the chemical properties of the soils. Hydrology: The site lies in quaternary catchment B20C. The site lies near the Osspruit system as part of the Bronkhorstspruit drainage system.
1.1.6 Environmental Management Framework,	The Gauteng Department of Agriculture and Rural Development (GDARD) has put together a Gauteng Provincial Environmental Management Framework (GPEMF). https://egis.environment.gov.za/GPEMF (accessed, 24th June 2021). The EMF integrates policies and frameworks and aligns government mandates to streamline decision-making and to improve cooperative governance. The EMF has several specific objectives, which include identifying the status quo, development pressures and trends in the area and development a decision support system for development in the area to ensure that environmental attributes, issues and priorities are taken into account.
1.1.7 Spatial Development Framework, and	*Gauteng Spatial Development Framework, 2030:* The Gauteng Spatial Development Framework (GSDF) was developed to guide the location of physical development throughout Gauteng. In particular, The City of Tshwane's spatial development policy is centred on: • Compaction and densification. • The green economy. • Sustainable human settlements. • Retail development. • Rural management. • Urban design and quality of environment. • The urban edge and growth management boundary.

Guideline requirement	Comments on requirement
	 Environment and Hinterland *(Gauteng Spatial Development Framework, 2030)* As seen in the figure above, the following can be noted; • 36% of the province's high potential agricultural land is located in the City of Tshwane. • The hinterland holds potential for agricultural and tourism development. • Towns such as Magaliesburg, Heidelberg and Cullinan present opportunities for tourism development, in particular in conjunction with surrounding ecotourism opportunities. The proposed project is located outside of urban areas, and as such promotes the containment of cities, and the activity contributes to the economic growth of the province by increasing the GDP.
1.1.8 Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.).	*Implementation of Gauteng Climate Change Response Strategy (GCCRS) (Rina Taviv, 2013).* Gauteng has a Climate Change Response Strategy that is being implemented in line with global and international guidelines. The Gauteng

Guideline requirement	Comments on requirement
	Climate Change Response Strategy and Action Plan lists the following objectives in the water sector in response to climate change: • Gauteng to collaborate with national government to monitor rainfall frequency and evaporation from water bodies and built environment surfaces • Investigate and implement secure water supply interventions. • Monitor water use and promote the implementation of water conservation.  GCCR space (SA rich in policies) *(Rina Taviv, 2013)*
1.2 How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	Refer to impact assessment for the impact of the development on the biological diversity and mitigation measures thereof.
1.3 How will this development pollute and/or degrade the	

Guideline requirement	Comments on requirement
biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	
1.4 What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	The farm may generate manure as a waste product. As a cage system is used, the manure falls onto a conveyor belt. The conveyor belt is pulled out twice a week and loaded onto a truck to be sold to a compost manufacturer. Other wastes such as oil will be managed to ensure that soils and water systems are not polluted. (Refer to Waste Plan – Addendum 3M)
1.5 How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	A Phase 1 Heritage Impact Assessment has been conducted. The study includes mitigation measures to ensure the impact of the development does not disturb any heritage resources. Furthermore, the site layout is chosen as to prevent disturbances to the identified heritage sites.
1.6 How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What	There is no anticipated depletion of renewable or non-renewable resources envisaged as all resources will be sourced off the farm.

Guideline requirement	Comments on requirement
measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	
1.7 How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	
1.7.1 Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate,	

Guideline requirement	Comments on requirement
without compromising their quest to improve their quality of life)	
1.7.2 Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)	
1.7.3 Do the proposed location, type and scale of development promote a reduced dependency on resources?	
1.8 How were a risk-averse and cautious approach applied in terms of ecological impacts?	Specialist studies were undertaken and included in this process. All limits of current knowledge, gaps, uncertainties, and assumptions from both the specialist as well as the EAP, are included in this report.
1.8.1 What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	
1.8.2 What is the level of risk associated with the limits of current knowledge?	<u>Aquatic Ecosystem Delineation:</u> As aquatic systems are directly linked to the frequency and quantity of rain it will influence the systems drastically. If during dry months or dry seasons studies are done, the accuracy of the report's findings could be affected. <u>Avifauna Assessment:</u> The general assessment of species rests mainly on the 1997 SABAP1 atlas data (Harrison et al. 1997) for comparison with the current SABAP2 atlas, so any limitations in either of those studies will by implication also affect this survey and conclusions. <u>Palaeontological Impact Assessment:</u> The accuracy and reliability of the report may be limited by the following constraints:

Guideline requirement	Comments on requirement
	1. Most development areas have never been surveyed by a palaeontologist or geophysicist. 2. Variable accuracy of geological maps and associated information. 3. Poor locality information on sheet explanations for geological maps. 4. Lack of published data. 5. Lack of rocky outcrops. 6. Inaccessibility of site. <u>Archaeological Impact Assessment:</u> Dense vegetation hampered the visibility of archaeological material towards the northern boundary of the study area. Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the construction phase.
1.8.3 Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	All risks identified will be dealt with the suggested mitigation measures as well as suggestions from the various specialist studies. A risk-averse cautious approach will be followed.
1.9 How will the ecological impacts resulting from this development impact on people's environmental right in terms following	Refer to impact assessment for a comprehensive analysis of all potential impacts. Impact identification and prediction includes a stepwise procedure to identify the direct, indirect and cumulative impacts (relating to both positive and negative impacts) for which a proposed activity and its alternatives will have on the environment as well as the community. This is undertaken by determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity aspects of sites and locations as well as the risk of impact of the proposed activity. Refer to part A(h)(iv) for a complete description of these environmental attributes. Sources of data to be used for gathering data on the environmental attributes as well as the impacts include; monitoring / sampling data collected and stored, assumptions and actual measurements, published data available from the departments or other stakeholders in the area as well as specialist studies.
1.9.1 Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	
1.9.2 Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	

Guideline requirement	Comments on requirement
1.10 Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	Likely impacts are described qualitatively and then studied separately in detail. This provides consistent and systematic basis for the comparison and application of judgements.
1.11 Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?	
1.12 Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	There is no alternative to this project. The no-go option is also assessed, which will ultimately have a more significant effect than the preferred alternative because it will hinder the local economy whereas the preferred alternative allows the development to take place.
1.13 Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Refer to the cumulative impact assessment.
2.1 What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?	Refer to Part A (h)(iv) for the socio-economic context of the area. Refer to 1.1.7 and 1.1.8 above for the spatial priorities addressed in the Integrated Development Plan.

Guideline requirement	Comments on requirement
2.1.1 The Integrated Development Plan (IDP) (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area,	
2.1.2 Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	
2.1.3 Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	
2.1.4 Municipal Local Economic Development Strategy (LED Strategy).	
2.2 Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	There will be employment opportunities, which is a positive impact as approximately 50 jobs are provided during construction and about 31 jobs during operation. During the construction phase, skilled contractors specialising in the poultry industry will be required, which may not necessarily include individuals from the local community. However, operational jobs will be from the local community. Those employed by the company may have the opportunity to develop the relevant skills, which will promote skills development. All concerns raised by the registered Interested and affected parties (I&APs) and stakeholders have been included to assess the socio-economic context.
2.2.1 Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	
2.3 How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	

Guideline requirement	Comments on requirement
2.4 Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	The development will create a local economic boost and provide jobs and skills development for community members. The development will provide long term economic sustainability, and should the development expand, this will continue to contribute to the social and economic well-being of the community.
2.5 (Not applicable)	
2.6 How were a risk-averse and cautious approach applied in terms of socio-economic impacts?	IDPs, SDFs, and other published documents are used to determine the socio-economic aspects of the area.
2.6.1 What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Various specialist studies were done, and each specialist study highlights the limitations relevant to each area of inquiry.
2.6.2 What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	
2.6.3 Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	
2.7 How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	This project will not affect these aspects.
2.7.1 Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	

Guideline requirement	Comments on requirement
2.7.2 Positive impacts. What measures were taken to enhance positive impacts?	
2.8 Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	Refer to impact assessment. There is no alternative to the following: • The development and related operation of facilities or infrastructure for the concentration of more than 5,000 poultry per facility situated outside an urban area, excluding chicks younger than 20 days and more than 25,000 chicks younger than 20 days per facility situated outside an urban area, • The development and related operation of hatcheries or agri-industrial facilities outside industrial complexes where the development footprint covers an area of 2,000m² or more, • The clearance of an area of 1ha or more, but less than 20ha of indigenous vegetation, • The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution, or effluent, • The development of reservoirs, excluding dams, with a capacity of more than 250m³ in sites identified as CBAs or ESAs in the Gauteng Conservation Plan or in bioregional plans; or sites identified within threatened ecosystems, • The development of a road approximately 4 metres wide with a reserve less than 13.5m in sites identified as CBAs or ESAs in the Gauteng Conservation Plan or in bioregional plans; or sites identified within threatened ecosystems, and • The clearance of an area of 300m² or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan within CBAs or ESAs identified in the Gauteng Conservation Plan or bioregional plans. The consultation process involves communication with the community and all activities are planned with the aid of specialists.
2.9 What measures were taken to pursue the selection of the "best practicable environmental option"	Refer to the impact assessment which includes the environmental objective to be achieved, the phase applicable to management measure, management tools, management timeframe and schedule, monitoring

Guideline requirement	Comments on requirement
in terms of socio-economic considerations?	programmes, responsibilities for implementation and long-term maintenance and the mitigation hierarchy.
2.10 What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	
2.11 What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	
2.12 What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	
2.13 What measures were taken to:	
2.13.1 ensure the participation of all I&APs,	The process followed adheres to the National Environmental Management Act 107-1998 - National guideline on minimum information

Guideline requirement	Comments on requirement
2.13.2 provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, 2.13.3 ensure participation by vulnerable and disadvantaged persons 2.13.4 promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means 2.13.5 ensure openness and transparency, and access to information in terms of the process 2.13.6 ensure that the interests, needs and values of all I&APs were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge, and 2.13.7 ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were be promoted 2.14 Considering the interests, needs and values of all the I&APs, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs	(20180209-GGN-41432-00086) and the 2012, IEM Guideline Series 7, Public participation, GN 807. Below is a summary of the announcement. Formal announcement of the project: The notices as mentioned below include all requirements as per the EIA Regulations. Advertisement: An advertisement was placed in 'Streeknuus' on the 25th of June 2021. Refer to Addendum 4B for a copy and proof of this advertisement. Site notice: One site notice was placed at the entrance to the farm on the 24th of June 2021. Refer to Addendum 4C for a copy and proof of this site notice as well as Addendum 4D for a map indicating location of the site notice. Letters: Letters were sent to all stakeholders as well as landowners to the site on the 24th of June 2021. Addendum 4E for a copy and proof of these letters sent. Public meeting: As a result of Covid-19, no public meeting was held, however, following a request, two meetings were held with the Ndala Sokhulumi Traditional Authority on Monday the 6th of September at the proposed site and on Thursday the 30th of September at the Eggspert Eggs Elandsfontein site. This EIA was simultaneously sent to GDARD, the registered I&APs and stakeholders. Any further issues raised have been included in this final EIA/EMP for submission to GDARD. All registered I&APs were given the opportunity to comment on the EIA. This included any issues that they had with the proposed activity and that they believed may have been of significance in the consideration of the application.

Guideline requirement	Comments on requirement
of the local area (or that is proportional to the needs of an area)?	
2.15 What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	All contractors, sub-contractors and workers will attend compulsory environmental awareness training and inductions. This training will highlight the dangers associated with the workplace. Procedures relating to environmental risks will also be put in place and will be regularly updated.
2.16 Describe how the development will impact on job creation in terms of, amongst other aspects:	
2.16.1 the number of temporary versus permanent jobs that will be created,	There will be employment opportunities, which is a positive impact as approximately 50 jobs are provided during construction and about 31 jobs during operation. During the construction phase, skilled contractors specialising in the poultry industry will be required, which may not necessarily include individuals from the local community. However, operational jobs will be from the local community. Those employed by the company may have the opportunity to develop the relevant skills, which will promote skills development. All concerns raised by the registered Interested and affected parties (I&APs) and stakeholders will be included to assess the socio-economic context. Further information will only be available once this application has been approved and the community has been consulted.
2.16.2 whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),	
2.16.3 the distance from where labourers will have to travel,	
2.16.4 the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and	
2.16.5 the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	
2.17 What measures were taken to ensure:	
2.17.1 that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and	A summary of various legislation is included in Part A e) of this report. All organs of state will receive this EIA/EMP for review. Any comments from them will be incorporated into the final decision.

Guideline requirement	Comments on requirement
2.17.2 that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	
2.18 What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	
2.19 Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	Refer to impact assessment mitigation measures.
2.20 What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	There are provisions made to ensure that environmental pollution does not occur.
2.21 Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	There is no alternative to this project and the placement of the site was done in consultation with the respective environmental specialists.

Guideline requirement	Comments on requirement
2.22 Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Refer to the cumulative impact assessment.

g) Motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report

Following consultation with the specialists, the site layout plan under Addendum 1A was formulated to ensure that the least possible impact occurs to the sensitive areas.

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h) Full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report

Various specialist studies were conducted as part of the EIA process. This EIA and further documents were made available to the stakeholders and I&APs for comments. The preferred alternative was finalised using information from each of the specialists.

i) Details of the development footprint alternatives considered

The following definition of "alternatives" is given in the EIA Regulations: *"alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to the -*

(a) property on which or location where the activity is proposed to be undertaken;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology to be used in the activity; or

(e) operational aspects of the activity; and

(f) includes the option of not implementing the activity;"

Please note the term preferred alternative is the preferred activity whereby the second alternative is the alternative to the preferred alternative.

1 The property on which or location where it is proposed to undertake the activity

No alternatives are applied for.

2 The type of activity to be undertaken

No alternatives are applied for.

3 The design or layout of the activity

The preferred alternative is to place 5 chicken houses within areas of high sensitivity whilst abiding by all mitigation measures. The second alternative is to remain outside of the sensitive areas, which would result in the loss of five chicken houses. This is not economically viable.

4 The technology to be used in the activity

No alternatives are applied for.

5 The operational aspects of the activity

No alternatives are applied for.

6 The option of not implementing the activity

In the case of the no go option being implemented, the development will not commence. This would mean that a potentially positive socio-economic activity does not occur.

ii) Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs

1 Identification of interested and affected parties

Refer to Table 7 below for all I&APs and stakeholders identified. Refer to Addendum 4G for the entire database of all I&APs as well as stakeholders, and map indicating adjacent properties.

Table 7: I&APs and stakeholders identified

Interested and Affected Parties[6]	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this EIA where issues and or response were incorporated
Affected parties				
Landowner/s				
Portion 3 of the farm Kameelzynkraal 547 JR:	N/A	None	None	N/A

[6] Landowner names removed due to the Protection of Personal Information Act of 2013

Interested and Affected Parties[6]	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this EIA where issues and or response were incorporated
[redacted]				
Lawful occupier/s of the land				
Portion 3 of the farm Kameelzynkraal 547 JR: [redacted]	Refer above			
Landowners or lawful occupiers on adjacent properties				
Portion 13 of the farm Kameelzynkraal 547 JR: [redacted]	N/A	None	None	N/A
RE of the farm Kameelzynkraal 547 JR: [redacted]	Refer below	Refer below	Refer below	Refer below
Portion 32 of the farm Kameelzynkraal 547 JR: [redacted]	N/A	None	None	N/A
Portion 31 of the farm Kameelzynkraal 547 JR: [redacted]	N/A	None	None	N/A
Portion 27 of the farm Kameelzynkraal 547 JR: [redacted]	N/A	None	None	N/A
Portion 9 of the farm Kameelzynkraal 547 JR:	N/A	None	None	N/A

Interested and Affected Parties[6]	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this EIA where issues and or response were incorporated
[redacted]				
Portion 7 of the farm Onbekend 398 JR: [redacted]	N/A	None	None	N/A
Municipal ward councillor – ward 101				
[redacted]	N/A	None	None	N/A
City of Tshwane Metropolitan Municipality				
[redacted]	2021/08/13	Comments on the final ESR: Refer to Addendum 5F	Refer to Addendum 5F	Addendum 5F
	2021/10/13	Comments on the draft EIA: Refer to Addendum 5F	Refer to Addendum 5F	Addendum 5F
City of Tshwane Roads and Transport Department	2021/10/15	The department requested the Stormwater Management Plan for comment	EAP sent the Stormwater Management Plan on 2021/10/29	Addendum 5F
	2021/11/12	The department requested additional information in the Stormwater Management Plan	EAP sent the updated Stormwater Management Plan on 2021/11/29	Addendum 5F
City of Tshwane Municipal Health Services	2021/11/19	Comments were sent on the draft EIA	EAP sent a response letter on 2021/11/30	Addendum 5I
Organs of state				
DWS Bronkhorstspruit	N/A	None	None	N/A
Communities				
None	N/A	None	None	N/A
Traditional Leaders				
None	N/A	None	None	N/A
Department of Forestry, Fisheries and the Environment				
[redacted]	N/A	None	None	N/A
Gauteng Department of Agriculture and Rural Development				

Interested and Affected Parties[6]	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this EIA where issues and or response were incorporated
[redacted]	2021/08/19 2021/11/02	Comments on the ESR and draft EIA: Refer to PART B n) Specific information required by the competent Authority	Refer to PART B n) Specific information required by the competent Authority	PART B n) Specific information required by the competent Authority
Department of Agriculture, Land Reform and Rural Development				
[redacted]	N/A	None	None	N/A
[redacted]	2021/07/16	[redacted] sent an email with a letter attached from Mr. [redacted], Acting Chief Director, Office of the Regional Land Claims Commission. The letter indicates that there are existing land claims against the property.	The EAP emailed [redacted] and attached a letter sent on behalf of the landowner. The letter states that as far as the owner is aware, no notice has been published in the government gazette in respect of the relevant claim/s. The letter further gives written notice of the owner's intention to develop the property. In a response from DALRRD, [redacted] stated that the land claims were lodged between 2014 and 2016 and are not yet published in the government gazette, hence the owner is free to continue with the project.	Addendum 4F
Other Competent Authorities affected				

Interested and Affected Parties[6]	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this EIA where issues and or response were incorporated
South African Heritage Resources Agency (SAHRA)	N/A	None	None	N/A
Other affected parties				
Historical disadvantaged communities				
None identified	N/A	None	None	N/A
Land claimants				
None identified.	N/A	None	None	N/A
Interested parties				
RE of the farm Kameelzynkraal 547 JR:	2021/06/25	sent a completed form to register as an I&AP.	The EAP registered the as an I&AP and forwarded the draft ESR to the I&AP.	Addendum 4F.
Portion 27 of the farm Kameelzynkraal 547 JR:	2021/08/19	The party indicated concern in terms of biosecurity as the existing Metacine poultry facility is situated between 500 metres and 2 kilometres away from the proposed development.	The EAP responded in a formal letter indicating that the applicant will be putting biosecurity measures in place to minimise risks as far as possible. Refer to Addendum 4F for the full correspondence.	Addendum 4F.
Young Farmers Agric Business Pty Ltd:	2021/06/25	sent an email requesting to be included in the public participation process as his project had recently been granted an EA for the construction of broiler houses in close proximity to the client's project. He added that this is of concern for biosecurity purposes as	The EAP requested a copy of the EIA for which the party has been granted approval. The party then forwarded the EAP an EA. The EAP registered the the party as an I&AP and forwarded the draft ESR to the I&AP.	Addendum 4F.

Interested and Affected Parties[6]	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this EIA where issues and or response were incorporated
		his farm is less than 5 kilometres away.		
Ndala Sokhulumi Traditional Authority [redacted]	2021/06/28	[redacted] sent an email requesting to be included in the public participation process.	The EAP registered the party as an I&AP and forwarded the draft ESR to the I&AP.	Addendum 4F.
	2021/08/11	The party requested to have a physical meeting with all necessary Covid-19 protocols in place. Further, the party indicated that consultation would be held with other affected parties as well as the local authorities.	The EAP arranged a physical meeting to be held on the 6th of September 2021. Refer to Addendum 4F for the minutes of the meeting.	Addendum 4F.
	2021/09/30	A second physical meeting was held with the applicant and the registered party at Eggspert Eggs, Elandsfontein. The issue of trespassing that is ongoing at the farm Kameelzynkraal was discussed. The client then allowed the party to observe the current biosecurity measures at the Elandsfontein site and assured Young Farmers Agric Business Pty Ltd (who also attended the meeting) that biosecurity is	The EAP arranged the meeting between the client and the party.	

Interested and Affected Parties[6]	Date comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section reference in this EIA where issues and or response were incorporated
		managed as part of the operations at Eggspert Eggs.		

2 Formal announcement of the project

An advertisement was published in the local newspaper 'Streeknuus' on the 25th of June 2021. Refer to Addendum 4B for a copy and proof of this advertisement. One site notice was placed at the entrance to the site where it was visible from the road on the 24th of June 2021. Refer to Addendum 4C for a copy and proof of the site notice placement, as well as 4D for a map of the placement of the site notice. As a result of the Covid-19 pandemic, no public meeting was held, however following a request, a meeting was held with the Ndala Sokhulumi Traditional Authority on Monday the 6th of September. Letters were sent to all adjacent landowners and stakeholders on the 24th of June 2021. Refer to Addendum 4E for copy and proof of letters sent.

3 Environmental Scoping Report and Environmental Impact Assessment Report and EMP

The ESR was sent to all stakeholders and registered I&APs on 26 July 2021 and accepted by GDARD on 19 August 2021. Refer to Addendum 4H for proof of the ESR sent to all stakeholders and registered I&APs. Refer to Addendum 5B for the Acknowledgement of Receipt of the Environmental Scoping Report and Addendum 5C for Acceptance of the Final ESR.

The draft EIAR/EMP was sent to all stakeholders and registered I&APs for 30 days of comment (Refer to Addendum 4I for proof that it was sent out and Addendum 5D for acknowledgement of the draft EIA from GDARD). All I&APs were allowed to comment on the report if registered. This included any issues that they may have had with the proposed activity and that they believed may have been of significance in the consideration of the application. All comments are included in the final EIA/EMP.

4 Decision making announcement to stakeholders and I&APs

Within 12 days of the date of the decision taken by GDARD, all stakeholders and registered I&APs should be notified. They should also be notified that an appeal may be lodged.

iii) Summary of issues raised by interested and affected parties and an indication of the manner in which the issues were incorporated, or the reasons for not including them

Currently, four I&APs have been registered and one of these parties, namely Young Farmers Agric Business Pty Ltd: [redacted], has commented regarding the close proximity of his farm to the proposed project. [redacted] from the Department of Agriculture, Land Reform and Rural Development sent an email indicating that there are existing land claims against the property. The EAP then gave written notice of intention to develop the property. [redacted] responded and stated that the land claims were lodged between 2014 and 2016 and are not yet published in the government gazette, hence the owner is free to continue with the project. Portion 27 of the farm Kameelzynkraal 547 JR indicated concern in terms of biosecurity as the existing Metacine poultry facility is situated between 500 metres and 2 kilometres away from the proposed development. The EAP responded in a

formal letter indicating that the applicant will be putting biosecurity measures in place to minimise risks as far as possible. (Refer to Addendum 4F for all comments received and responded to.)

iv) The Environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects

1 Geology

Information for this section was extracted from the geohydrological assessment and the Palaeontological study (Geovation (Pty) Ltd, 2021; Fourie, 2021).

Based on the 1:250 000 Geological Series (2528 Pretoria) the property is underlain by the Silverton Formation (Magaliesberg Stage) of the Pretoria Group which forms part of the Transvaal System. Within the property boundaries, the Silverton Formation have been intruded by a number of prominent NW-SE orientated diabase dykes and sills. The Silverton Formation consist of shales (carbonaceous in places) as well as hornfells and chert. The extensive broad valleys that extend from northwest to south east in the area represent the topographic signature of the Silverton Formation that comprises mainly of shales.

Vaalian to post-Mokolian diabase (di) intrusions occur throughout the area in the form of plates, sills and dykes. These plates are common in the Transvaal Supergroup and when present in the Pretoria Group they are referred to as the Transvaal diabase (Kent 1980, Visser 1989). The diabase sills of Bushveld age (Norman and Whitfield 2006) is typically fine-grained, green-grey with plagioclase and pyroxenes (Visser 1989).

The Transvaal Supergroup fills an east-west elongated basin in the south-central part of the old Transvaal (now North – West, Gauteng and Mpumalanga) as far south as Potchefstroom. It is Vaalian in age, approximately 2600 Ma to 2100 Ma. A maximum thickness of the Transvaal Supergroup reaches 2000 m in the north-eastern section. The east-west elongated basin is filled with clastic, volcanic and chemical sedimentary rocks. Three groups based on lithological differences have been established: they are the Rooiberg, Pretoria and Chuniespoort Groups as well as other smaller groups (Kent 1980, Snyman 1996). It is the Bushveld Complex that is responsible for the tilting of the Transvaal sediments and the heat of its intrusion having created andalusite crystals (Norman and Whitfield 2006). This Supergroup is underlain by the Ventersdorp, Witwatersrand and Pongola Supergroups, and the Dominion Group. Three prominent ridges are present from the oldest to the youngest, the Time Ball Hill, Daspoort and Magaliesberg Formations (Norman and Whitfield 2006).

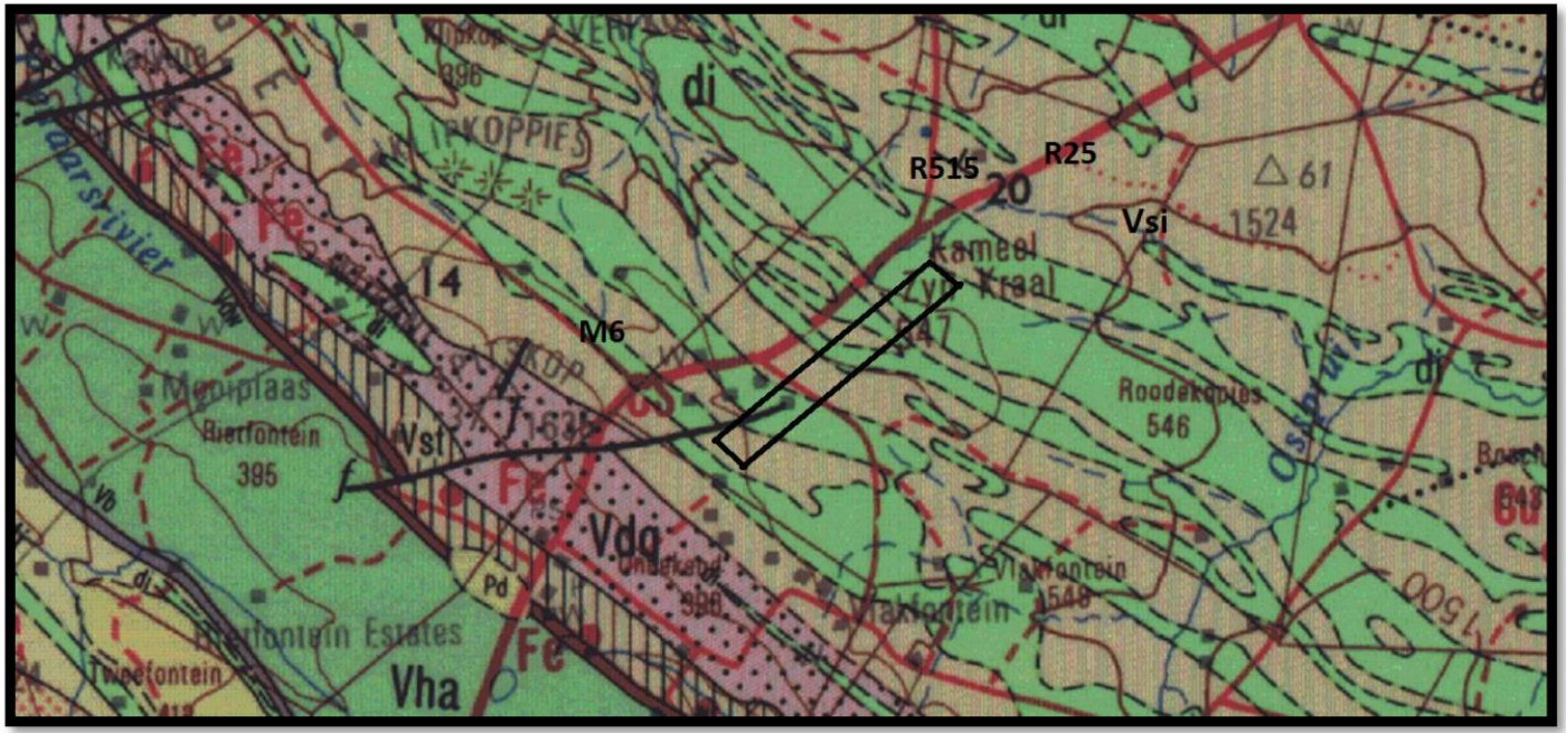

Figure 2: Excerpt of 1:250 000 Geological Map (Fourie, 2021)

Legend to figure and short description

Di - Green, fine- to medium-grained diabase (green). Vaalian to post-Mockolian.

Vsi - Shale, carbonaceous in places; hornfels, chert (light brown). Silverton Formation, Pretoria Group, Transvaal Supergroup. Vaalian.

------ (black) Lineament (Landsat, aeromagnetic).

------ Concealed geological boundary.

⊥20° - Strike and dip of bed.

□ - Proposed development (blocked in black).

Mining Activities on Figure 2: CS – Shale, brickclay Fe - Iron.

The mining past and present has no influence on the development.

Vaalian to post-Mokolian diabase (di) intrusions occur throughout the area in the form of plates, sills and dykes. These plates are common in the Transvaal Supergroup and when present in the Pretoria Group they are referred to as the Transvaal diabase (Kent 1980, Visser 1989). The diabase sills of Bushveld age (Norman and Whitfield 2006) is typically fine-grained, green-grey with plagioclase and pyroxenes (Visser 1989).

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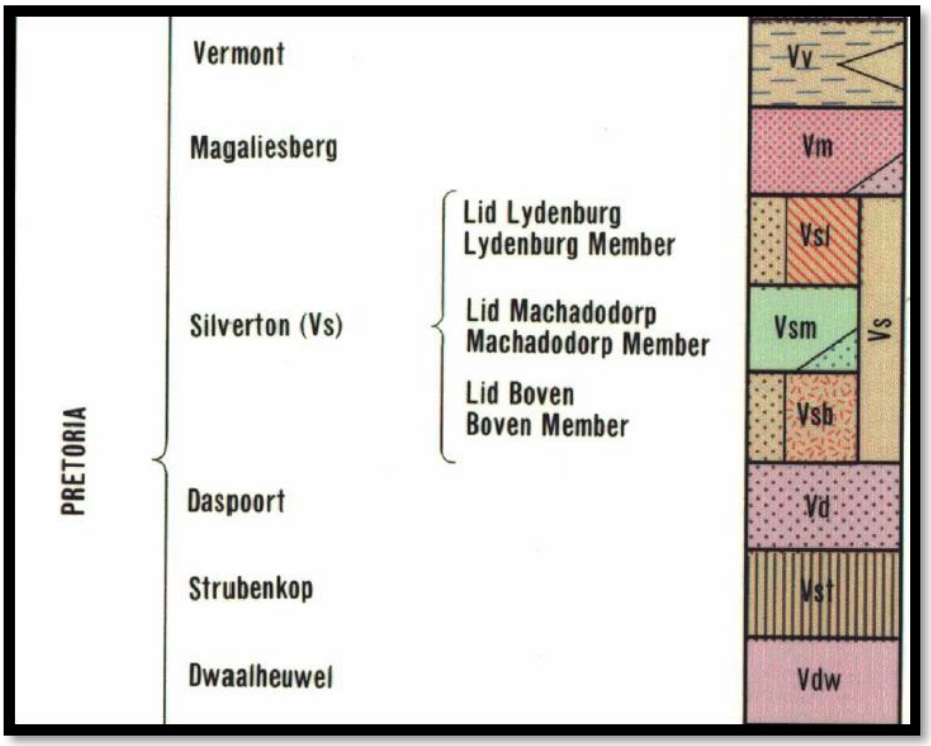


Figure 3: Lithostratigraphy (2430 Pilgrims Rest) (Fourie, 2021).

The Pretoria Group consists predominantly of quartzite and shale, together with a prominent volcanic unit, minor conglomerate, chemical and volcanic members. It comprises the Hekpoort Andesite, Dullstroom Basalt, Time Ball Hill, Silverton, and Magaliesberg Quartzite Formations as well as several smaller formations (in total 15) and overlies the Chuniespoort Group (Kent 1980). Both the shale and quartzite of the Pretoria Group are utilised in the building industry (Snyman 1996). The Rayton Formation (Vr) is present northeast of Pretoria and is approximately 1,200 m thick. It consists of four layers of quartzite alternating with four layers of shale (Visser 1989). In the central part of the basin the quartzite and shale overlying the Magaliesberg Quartzite are combined into the Rayton Formation because intrusion of numerous diabase sills has made it impossible to recognise all the individual formations (Kent 1980). Below the Dullstroom, Houtenbek, Steenkampsberg, Lakenvlei and Vermont Formations is the Magaliesberg Formation which is 300 m thick in the Pretoria region and up to 500 m thick in the Lowveld (Visser 1989).

The hard quartzites form prominent mountain ranges such as the Magaliesberg Mountains (McCarthy and Rubidge 2005). The Magaliesberg is a dominant feature of the Gauteng landscape, and is north-dipping (Norman and Whitfield 2006). It was shaped by glaciation during Dwyka times and then slightly modified by post-glacial erosion (McCarthy and Rubidge 2005). The Silverton Formation shales are rich in carbon and pyrite and show cross-bedding. Brown to khaki-weathering shales is stratigraphically below the Magaliesberg Formation. These shales are visible in road cuttings. The Silverton shale Formation is the thickest of all the shale formations of the Pretoria Group (300-3000 m). It forms wide valleys and when changed to hornfels it can be used for roof coverings (Visser 1989). Here the Silverton Formation is subdivided into three members, the Lydenburg Member (Vsl) at the top, Machadadorp Member (Vsm) and the Boven Member (Vsb) at the base (2430 Pilgrims Rest) (Visser 1989).

The Strubenkop Formation (Vst) is fairly thin (20-80 m) in the east, but thicker towards its central part, up to 130 m thick towards the west. It is enriched with iron in the vicinity of Pretoria. The Boshoek Formation (Vb) is relatively thin (90m) and together with the Dwaalheuwel Formation (Vdw) is present in the eastern former Transvaal only consisting of quartzite. The Hekpoort Andesite Formation (Vha) is usually well developed, except for the Mokopane and Thabazimbi regions (Visser 1989) and can be up to 500 m thick with andesite, basalt and pyroclasts. These sheets are massive with an amygdaloidal crust on top (Snyman 1996). It is rich in green hornblende with an age between 2,224 ± 21 Ma (2626 Wes Rand sheet info). The Dwaalheuwel Formation is only present in the Mokopane area, above the Hekpoort Formation. In the east it is grouped with the Strubenkop Formation and the Daspoort Formation. The Daspoort Formation is between 90 to 190 m thick (Visser 1989).

The Time Ball Hill shale Formation (Vt) is known to contain ‘algal microfossils’ diagenetic in origin. Stromatolites as they are known are preserved in the subordinate carbonate rocks (Kent 1980). The Pretoria Group is clastic sedimentary in nature (Eriksson 1999). The pile of sedimentary rocks, mainly mudstones and quartzites with some basalt can collectively reach a thickness of up to 5 km. The

Rooihoogte Formation sits at the base of the Pretoria Group and is quite thin (10 – 150 m). The chert is present as boulders or a breccia. It is often lumped with the Time Ball Hill Formation (Visser 1989).

2 Climate

Climate data is extracted from Rehab Green Monitoring Consultants CC, 2021. Agro-climatic data is obtained from the Johannesburg-Rand weather station calculated by software named CLIMWAT for CROPWAT, which is a joint publication of the Water Resources, Development and Management Service and the Environment and Natural Resources Service of the Food and Agriculture Organization (FAO) of the UN.

Table 8 provides climate data in terms of:

· Mean daily maximum temperature in °C
· Mean daily minimum temperature in °C
· Mean relative humidity in %
· Mean wind speed in km/day
· Mean sunshine hours per day
· Mean solar radiation in MJ/m^2/day
· Monthly rainfall in mm/month
· Monthly effective rainfall in mm/month
· Reference evapotranspiration calculated with the Penman-Monteith method in mm/day.

Table 8: Climate

Month	Min Temp	Max Temp	Humidity	Wind	Sun	Rad	ETo	Rain	Eff Rain
	°C	°C	%	km/day	hours	MJ/m^2/day	Mm/day	mm	mm
January	14.4	26.1	70	181	7.7	22.9	4.82	153.0	115.5
February	13.9	25.5	74	181	7.6	21.7	4.44	103.0	86.0
March	12.8	24.4	70	164	7.2	19.2	3.91	89.0	76.3
April	10.6	22.2	63	147	7.7	16.9	3.28	67.0	59.8
May	6.7	18.9	51	164	8.1	14.6	2.81	17.0	16.5
June	3.9	16.7	49	199	8.1	13.3	2.55	11.0	10.8
July	3.9	16.7	49	199	8.2	14.0	2.57	4.0	4.0
August	6.7	20.0	44	216	8.6	16.8	3.50	9.0	8.9
September	8.9	22.8	45	259	8.4	19.6	4.58	29.0	27.7
October	11.7	25.0	55	259	8.1	21.7	5.04	81.0	70.5
November	12.8	25.5	65	251	7.7	22.6	4.99	121.0	97.6
December	13.9	26.1	67	216	7.9	22.3	5.04	124.0	99.4
Average	**10.0**	**22.5**	**59**	**203**	**7.9**	**18.9**	**3.96**	**808.0**	**673.0**

3 Topography

Information for this section was extracted from the geohydrological assessment (Geovation (Pty) Ltd, 2021).

The property can be described as a north east – south west orientated flat shaped rectangle with the long axis and short axis having lengths of approximately 3800m and 240m, respectively. Local drainage can be described as follow:

- The highest point (1570 mamsl) is located in the north eastern portion of the site. This point acts as a watershed with local drainage at this point being towards the north east and south west towards the unnamed tributary of the Os Spruit (1540 mamsl).
- Drainage from the south western corner (1553 mamsl) will be in a north easterly direction towards the unnamed tributary of the Os Spruit.

Figure 4: SW-NW Elevation profile (Geovation (Pty) Ltd, 2021)

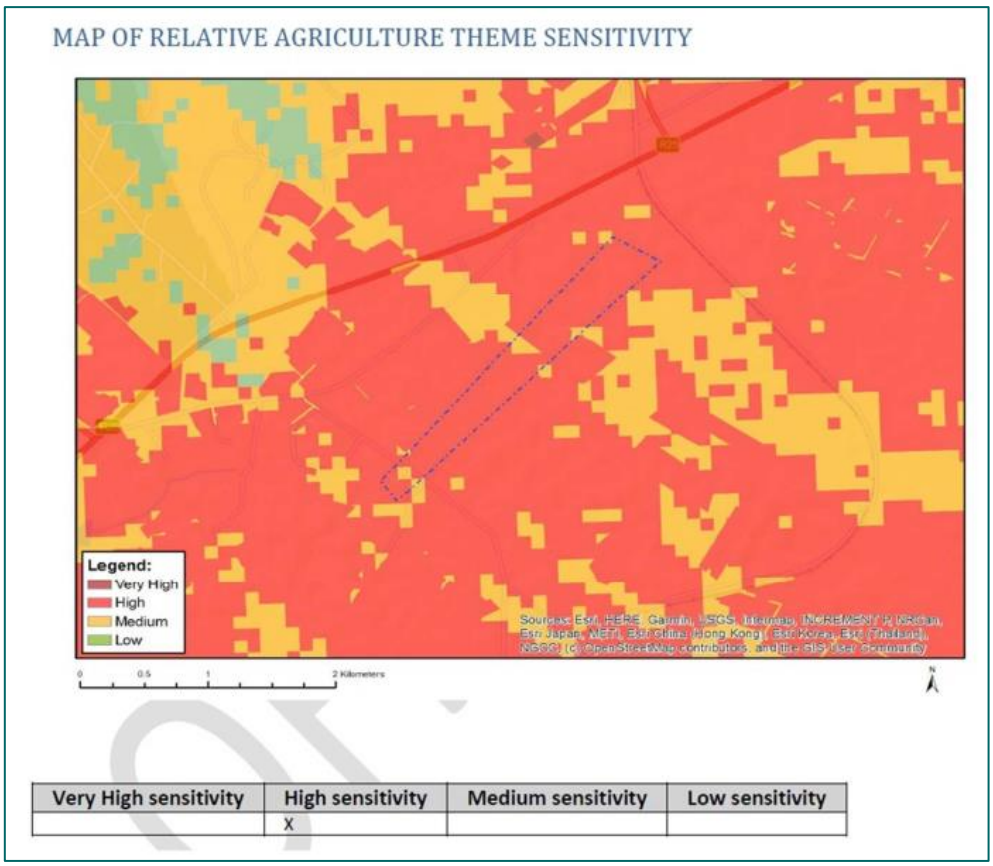
4 Soil

4.1 Site Sensitivity Verification

4.1.1 Agricultural sensitivity as rated by the Screening Tool

Information for this section was extracted from the Agricultural Agro-ecosystem Assessment (Rehab Green Monitoring Consultants CC, 2021):

The agricultural sensitivity of the development site was rated in a report generated by means of the web based Screening Tool dated 25/07/2021 19:49:30. The application category was Transformation of land/Indigenous vegetation. The spatial extent of the 3 agricultural sensitivity classes consisting of high, medium and low, is shown in Figure 5 as extracted from the screening report.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Figure 5: Agricultural sensitivity extracted from the Screening Report (Rehab Green Monitoring Consultants CC, 2021)

The Protocol for Environmental Impacts on Agricultural Resources requires the agricultural sensitivity ratings of the Screening Tool be verified. An intensive baseline field investigation was conducted and detailed soil, land capability and land use data were gathered in order to evaluate the agricultural sensitivity and the anticipated environmental impacts as a result of the proposed development. A detailed soil, land capability and land used map was compiled (Figures 9, 10 and 11 respectively). An agricultural sensitivity dataset was built consisting of a combination of detailed soil, land capability and land use data and a final refined agricultural sensitivity map was compiled (Figure 7) with similar categories than those of the Screening Tool.

Figure 6 and 7 is a comparison of the agricultural sensitivity classes rated by the Screening Tool (Figure 6) and the refined classes as derived from detailed soil, land capability and land use data (Figure 7).

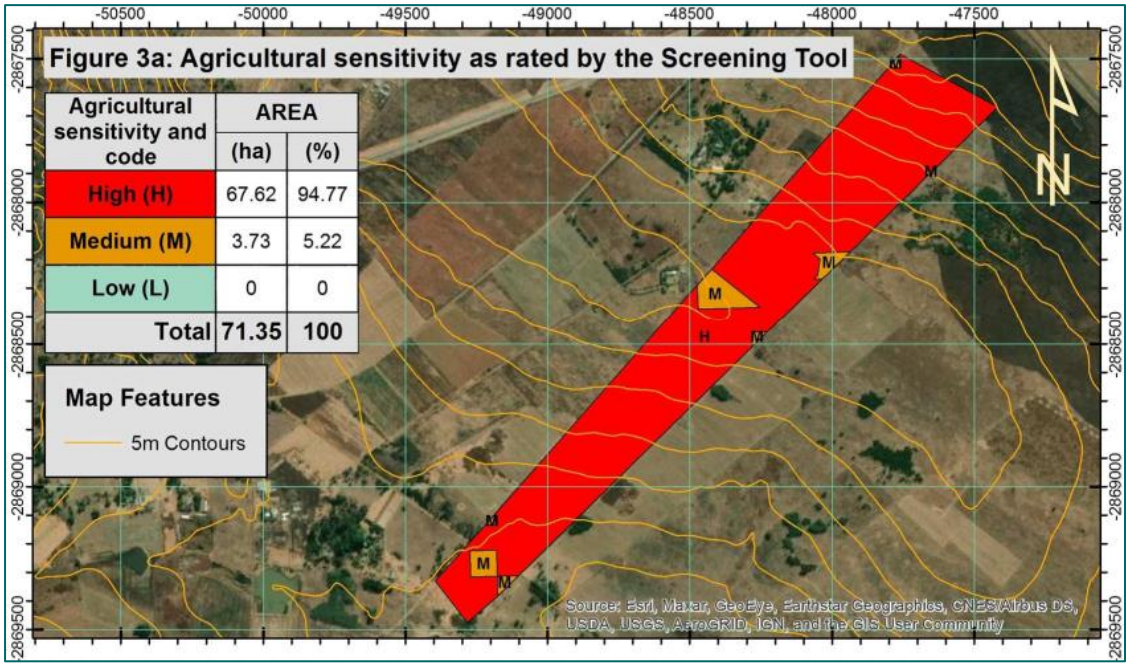


Figure 6: Agricultural sensitivity as rated by the screening tool (Rehab Green Monitoring Consultants CC, 2021)

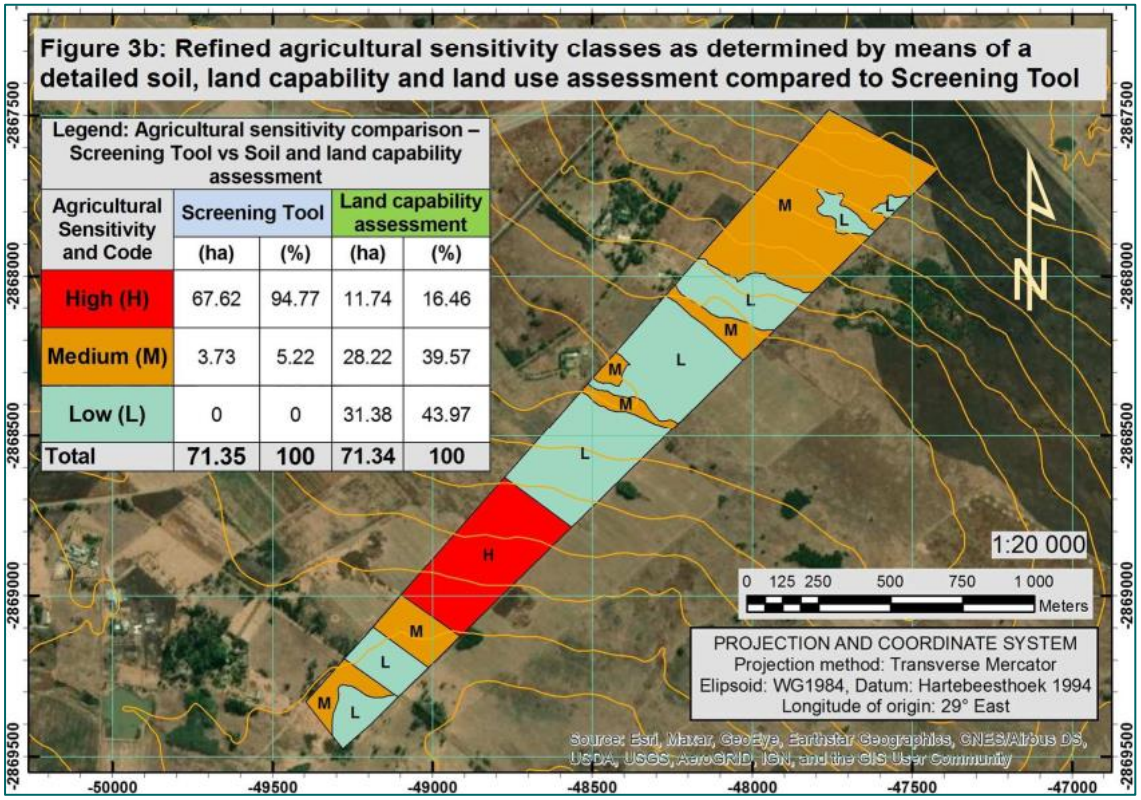


Figure 7: Refined agricultural sensitivity classes as determined by means of a detailed soil, land capability and land use assessment compared to Screening Tool (Rehab Green Monitoring Consultants CC, 2021)

4.1.2 Dispute of the agricultural sensitivity rating of the Screening Tool

Table 9 shows the comparison of the areas and percentages occupied by agricultural sensitivity classes of the Screening Tool and those refined by means of the detailed soil, land capability and land use assessment. The agricultural sensitivity ratings of the Screening Tool were found to vary significantly from those of the detailed soil, land capability and land use assessment.

According to the Screening Tool, 94.77% of the development site is occupied by the high agricultural sensitive class, while only 16.46% was found to have high agricultural sensitivity during the soil and land capability assessment. The main reason for the difference is that a large percentage of the area indicated as high agricultural sensitivity by the Screening Tool is occupied by rocky outcrops or very shallow soils or swelling clay soils with high erosion susceptibility (See detailed soil map, Figure 9). Furthermore, a fair percentage of the high potential soils are occupied by the farmstead and horse stabling and training facility.

Table 9: Comparison of agricultural sensitivity ratings

Legend: Agricultural sensitivity comparison – Screening Tool versus Soil and land capability assessment				
Agricultural Sensitivity Code	**Screening tool**		**Land capability assessment**	
	(ha)	**(%)**	**(ha)**	**(%)**
High (H)	**67.62**	**94.77**	**11.74**	**16.46**
Medium (M)	3.73	5.22	28.22	39.57
Low (L)	0	0	31.38	43.97
Total	**71.35**	**100**	**71.34**	**100**

The Screening Tool indicated no areas with low agricultural sensitivity while all areas with surface rock and very shallow soils that are not utilized for crop farming were rated as medium or low agricultural sensitivity (see methodology in section 2.2.6 of original report). Since the proposed development site occupies land with high agricultural sensitivity, the Protocol requires an Agricultural Agro-Ecosystem Assessment to be done.

4.2 Status quo of the site

Figure 8 shows the development site is a stretched rectangular farm portion of approximately 2500 x 280m covering 71.3 ha. The site stretches across a flat crest in the central part with mild to moderate midslopes (3-5% slopes) to the northeast and southwest. A public road intersects the development site close to the south-western boundary. Existing structures are a farmstead and horse stable and training facility situated adjacent to the public road. Proposed structures consist of 7 chicken houses distributed along the entire length of the development site, indicated by red outlines as well as a reservoir and wash bay, indicated by blue and green outlines respectively.

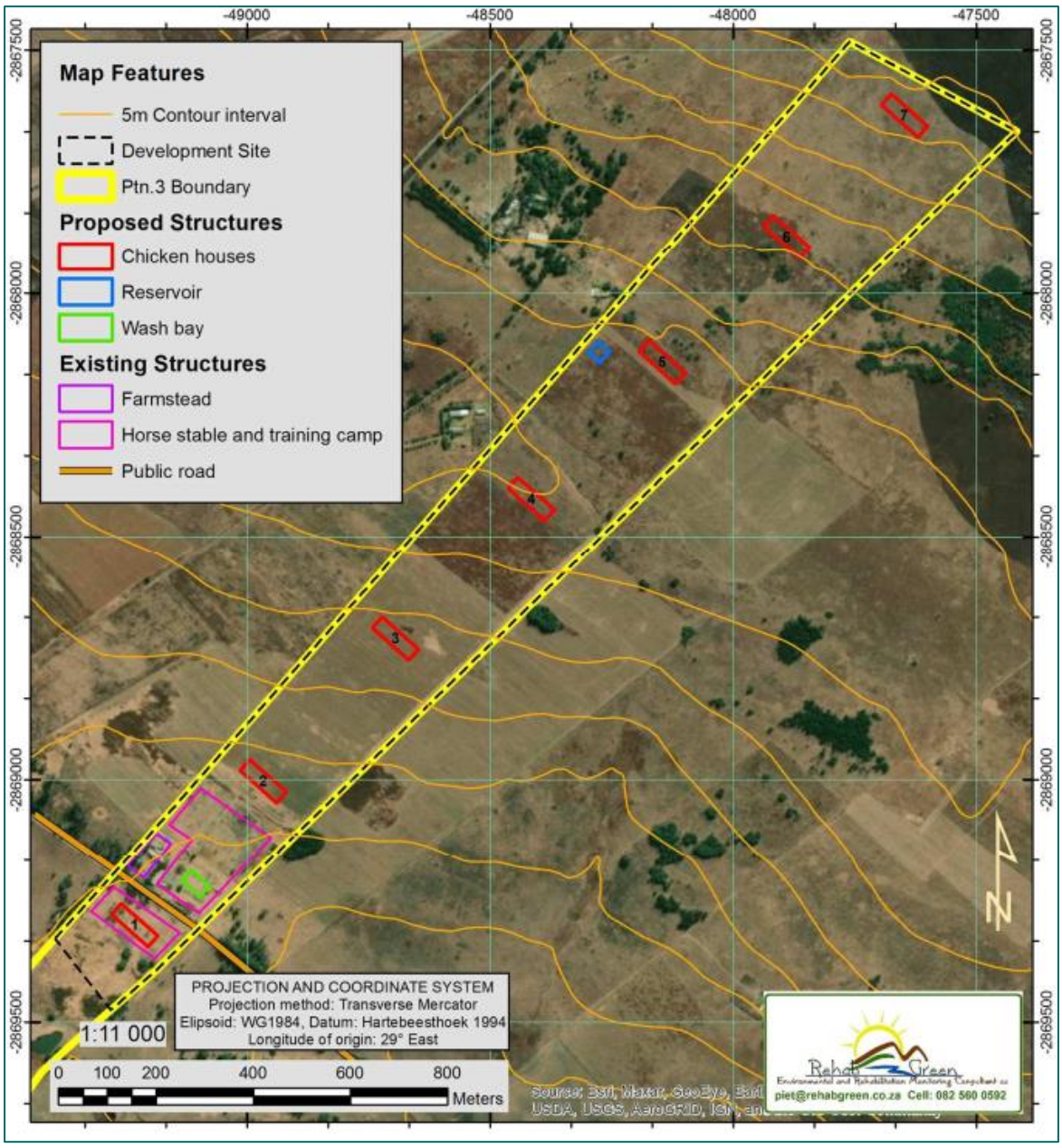


Figure 8: Topography and proposed structures at the development site (Rehab Green Monitoring Consultants CC, 2021)

4.3 Dominant soil types

The detailed soil survey was conducted in the winter season during July 2021. Soil types in the natural state are not subjected to mentionable seasonal variation in physical or chemical properties and follow-up surveys during other seasons are not required. A total of 52 auger observations were made at pre-determined grid points or occasionally in-between, in order to locate and accurately map soil boundaries. During the field assessment a total of 12 units were mapped that are largely homogeneous in terms of dominant soil form, effective soil depth, internal drainage, terrain unit and slope percentage and are shown on the soils map, Figure 9. The mapped units are referred to as soil forms.

The soil legend of Figure 9 is shown as Table10, which described the soils in terms of the following aspects.

· Dominant soil forms and families and subdominant soil forms;

· Terrain unit and slope percentage range;

· A description of the dominant soil form in terms of the effective soil depth, internal drainage, soil colour and soil texture class;

· The agricultural sensitivity classification; and

· The area and percentage comprised by each soil form.

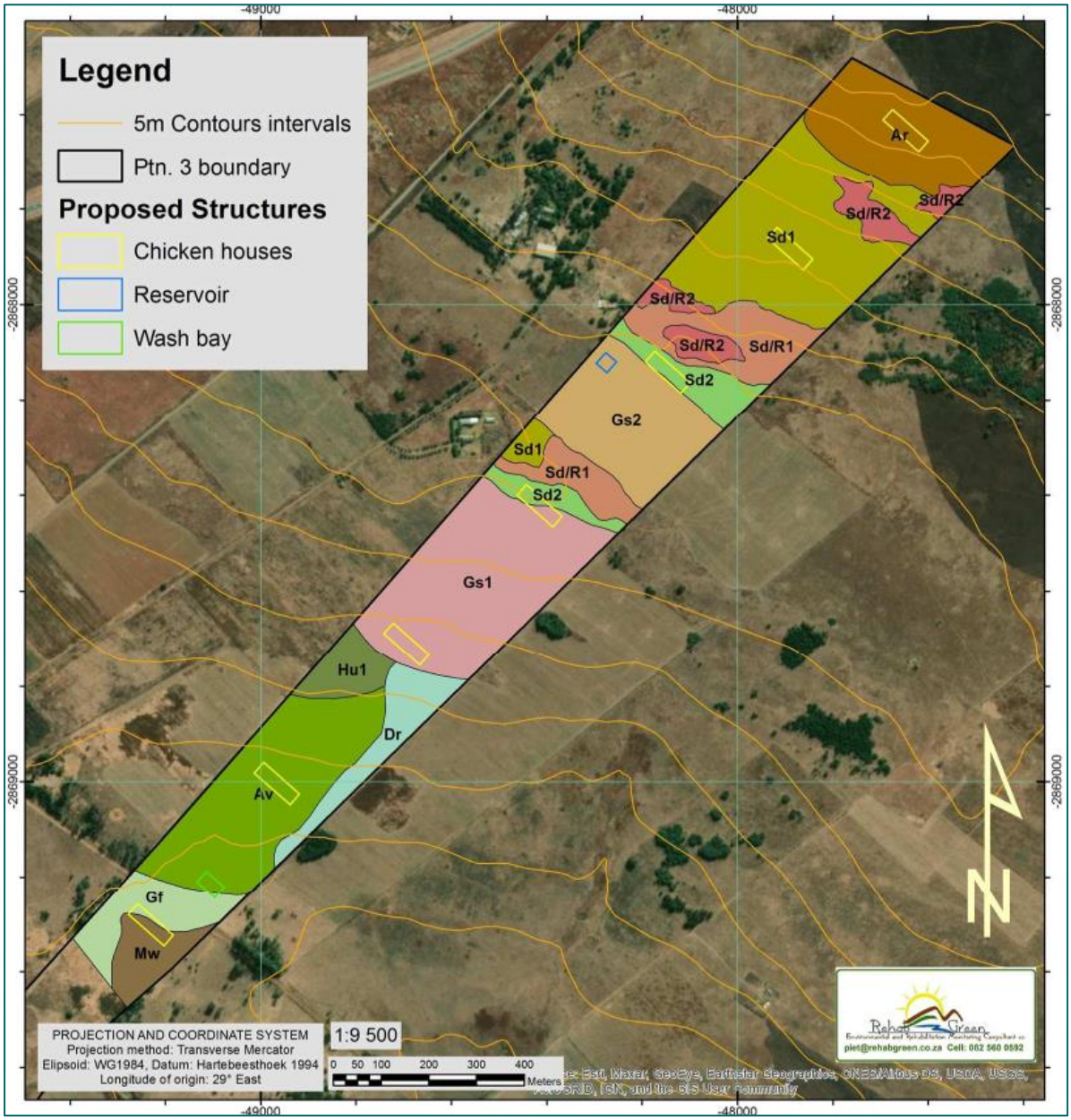


Figure 9: Detailed soil map of a section of portion 3 of the farm Kameel Zyn Kraal 547 JR (Rehab Green Monitoring Consultants CC, 2021)

Table 10: Detailed soil legend of the development site (Rehab Green Monitoring Consultants CC, 2021)

Soil legend						
Soil Type Code	**Dominant & subdominant Soil Form and Family**	**Terrain unit and slope**	**Summarized Description of Dominant Soil Forms in terms of soil depth, colour, internal drainage, and soil texture**	**Agricultural sensitivity**	**Area (ha)**	**Area (%)**
Hu1	*__Hutton 2100__	Gentle midslope (3% slope)	Somewhat shallow to moderately deep (500-800 mm), well-drained, yellowish red soils; Yellowish to reddish brown, sandy clay loam orthic A-horizons underlain by sandy clay loam, yellowish red, apedal B-horizons, underlain by reddish weathered rock.	High	1.84	2.58
Av	***Avalon 2100**; Glencoe	Gentle midslope (2-4% slope)	Moderately deep (600-900 mm), well-drained, brownish yellow soils; Yellowish brown, sandy clay loam orthic A-horizons underlain by sandy clay loam, brownish yellow, apedal B-horizons, underlain by soft plinthite which fade into reddish saprolite.	High	10.37	14.54
Gf	***Griffin 2100**; Avalon, Westhleigh	Flat to gentle footslope with scattered dolerite rock occupying less than 5% of the surface (0-1% slope)	Moderately deep (600-1000 mm), moderately well-drained, brownish yellow soils; Brown, sandy clay loam orthic A-horizons underlain by sandy clay loam, brownish yellow, apedal B-horizons containing <5% concretions, which fade into reddish saprolite.	Medium	3.02	4.23
Sd1	***Shortlands 2110**; Hutton	Gently sloping crest and midslope with sparse, scattered dolerite rock outcrops occupying less than 5% of the surface (3-6% slope)	Somewhat shallow to moderately deep (400-800 mm), well-drained, moderately structured, red soils; Brownish red, sandy clay loam orthic A-horizons underlain by moderately structured, red B-horizons underlain by weathered or hard dolerite rock.	Medium	13.07	18.31
Sd2	***Shortlands 2110**; Hutton	Flat to gently sloping crest with sparse, scattered dolerite rock outcrops occupying less than 5% of the surface (0-1% slope)	Shallow (200-500 mm), well-drained, moderately structured, brownish red soils; Brownish red, sandy clay loam orthic A-horizons underlain by moderately structured, red B-horizons underlain weathered rock or occasionally hard rock.	Medium	3.22	4.52
Ar	***Arcadia 3100**	Gently sloping lower midslope (3-6% slope)	Moderately deep (500-900 mm), well-drained, dark brown vertic soils (swelling clays) with shrink and expand properties; Brown to dark brown, clayey vertic A-horizons with prominent cracks in the dry state, underlain by weathered granite or hard rock.	Medium	6.98	9.78
Sd/R1	***Shortlands 2110**; Hutton, Mispah	Crest and upper midslope with frequent dolerite rock outcrops occupying 10- 50% of the surface (3-6% slope)	Shallow (100-300 mm), well-drained, moderately structured, brownish red soils; Brownish red, sandy clay loam orthic A-horizons directly underlain by rock or via a thin, moderately structured, red B-horizon, underlain weathered rock or hard rock.	Low	5.59	7.82

Soil legend						
Soil Type Code	**Dominant & subdominant Soil Form and Family**	**Terrain unit and slope**	**Summarized Description of Dominant Soil Forms in terms of soil depth, colour, internal drainage, and soil texture**	**Agricultural sensitivity**	**Area (ha)**	**Area (%)**
Sd/R2	***Shortlands 2110;** Mispah, Glenrosa	Midslopes with complex soil-rock associations where dolerite rock occupies 50-90% of the surface (3-12% slope)	Similar soils as in unit Sd/R1 althouth the surface in unit Sd/R2 is mostly dominated by exposed dolerite boulders.	Low	2.94	4.11
Mw	***Milkwood 1000;** Mayo	Flat to gentle footslope with scattered dolerite rock occupying less than 5% of the surface (0-1% slope)	Shallow (200-400 mm), well-drained, brown, moderately structured soils with limited shrink and expand properties; Brown to dark brown, sandy clay, melanic A-horizons directly underlain by hard dolerite rock or via a thin weathered horizon.	Low	2.11	2.95
Gs1	***Glenrosa 1111;** Mispah	Gently sloping crest and upper midslope with continuous fine to medium shale gravel on the surface (1-4% slope)	Shallow (200-300 mm), slight gravelly, well-drained, brown soils; Brown, slight gravelly, sandy loam orthic A-horizons underlain by soft fractured shale.	Low	11.97	16.77
Gs2	***Glenrosa 1111;** Westleigh	Flat to gentle sloping crest and midslope with discontinuous fine gravel on the surface (0-1% slope)	Shallow (200-300 mm), often slight gravelly, well-drained, brown soils; Brown, often slight gravelly, sandy loam orthic A-horizons underlain by soft, weathered dolerite.	Low	7.27	10.18
Dr	***Dresden 1000;** Westleigh	Gentle midslope (3% slope)	Shallow (200-400 mm), well-drained, brown soils; Brown, sandy clay loam orthic A-horizons directly underlain by hard plinthic B1-horizons or via a thin degraded hard plinthic horizon .	Low	2.99	4.19
*** Dominant soil form and family**				**TOTAL**	**71.37**	**100**

4.4 Land Capability classes and wetland delineation

Land capability was assessed in categories of arable land, grazing land, wetlands and wilderness land. Wetland zones were therefore delineated as part of the soil and land capability assessment, based on soil properties.

The location and extent of land capability classes within the development site is shown in Figure 10 and is summarized in Table 11.

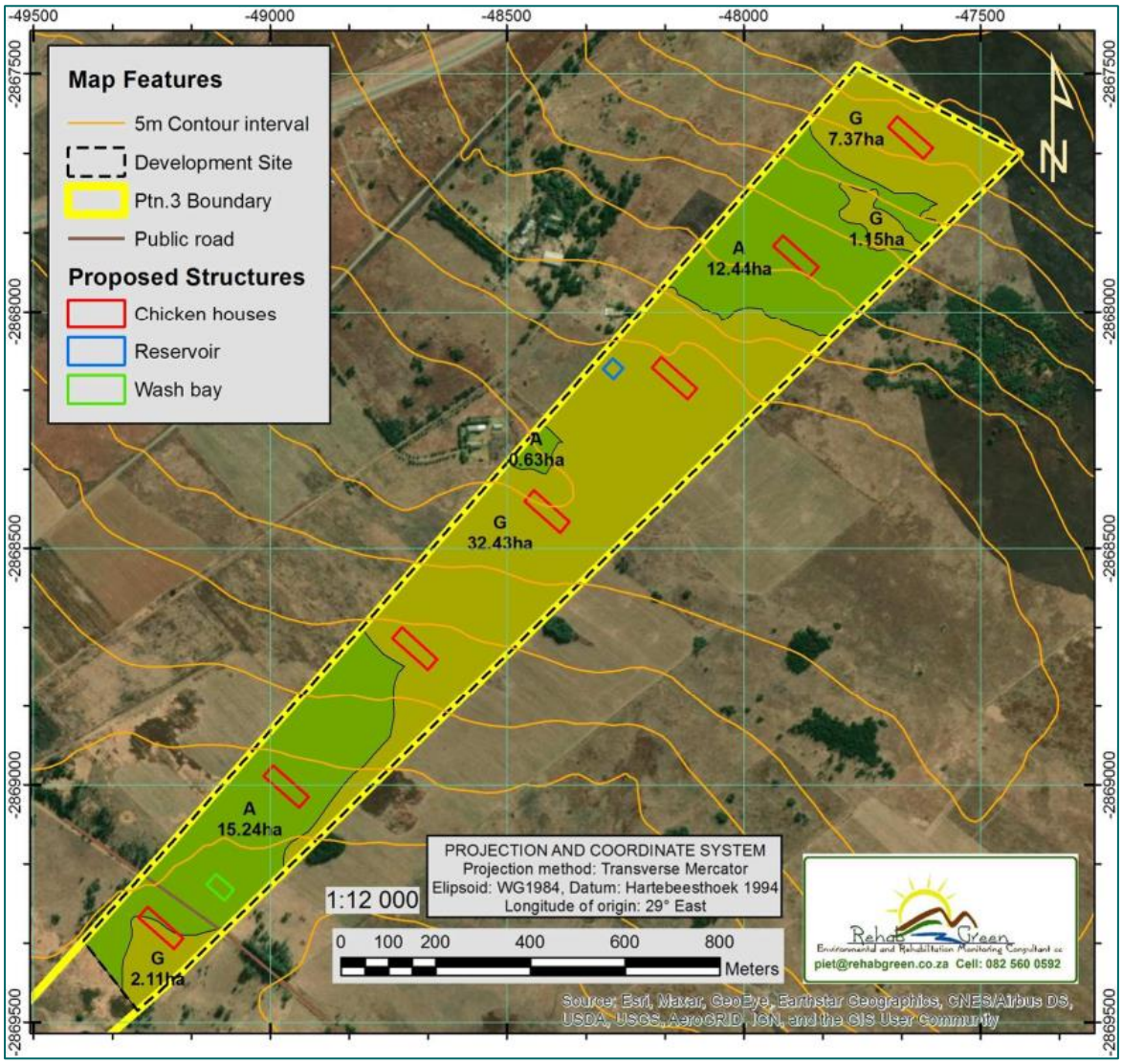


Figure 10: Land capability map of the Development Site (Rehab Green Monitoring Consultants CC, 2021)

Table 11 shows the soil types that are grouped into each land capability class, a broad description of the soil group, the number of units per land capability class and the area and percentage comprised by each land capability or wetland class.

Table 11: Land capability and wetland classes within the development site

LEGEND: LAND CAPABILITY AND WETLAND DELINEATION						
Land Capability Code	**Land Capability Class**	***Soil Types**	**Broad Soil Description**	**Unit Count**	**Area (ha)**	**Area (%)**
A	**Arable**	Hu1, Sd1, Av, Gf	Moderately deep, well-drained, red, structured soils and yellow brown and red apedal soils.	3	28.31	39.66
G	**Grazing**	Sd2, Ar, Sd-R1, Sd-R2, Mw, Gs1, Gs2, Dr	Shallow, red structured soils with exposed surface rock, shallow brown soils and moderately deep structured, swelling clay soils.	4	43.06	60.34
W	**Wetland**	-	-	0	0	0
WDN	**Wilderness**	-	-	0	0	0
***See soil map, Figure 5			**Total**	**7**	**71.37**	**100**

4.5 Agricultural Agro-Ecosystem Assessment

4.5.1 Current land uses

The extent of current land uses within the proposed development site as well as the positions of proposed structures are shown in Figure 11 and are summarized in Table 12.

Table 12: Current land uses within the development site

Land Use Code	Current Land Use	Area (ha)	Area (%)
RL	Rangeland - not utilized	47.38	66.39
CP	Cultivated pasture	16.0	22.43
HT	Horse stable and training camps	6.94	9.73
FS	Farmstead	0.69	0.97
PR	Public road	0.35	0.49
	Total	**71.36**	**100**

Table 12 shows that rangeland and pasture is the dominant land uses although the rangeland was not utilized and the pasture were cut and baled for the horse stable and training facility.

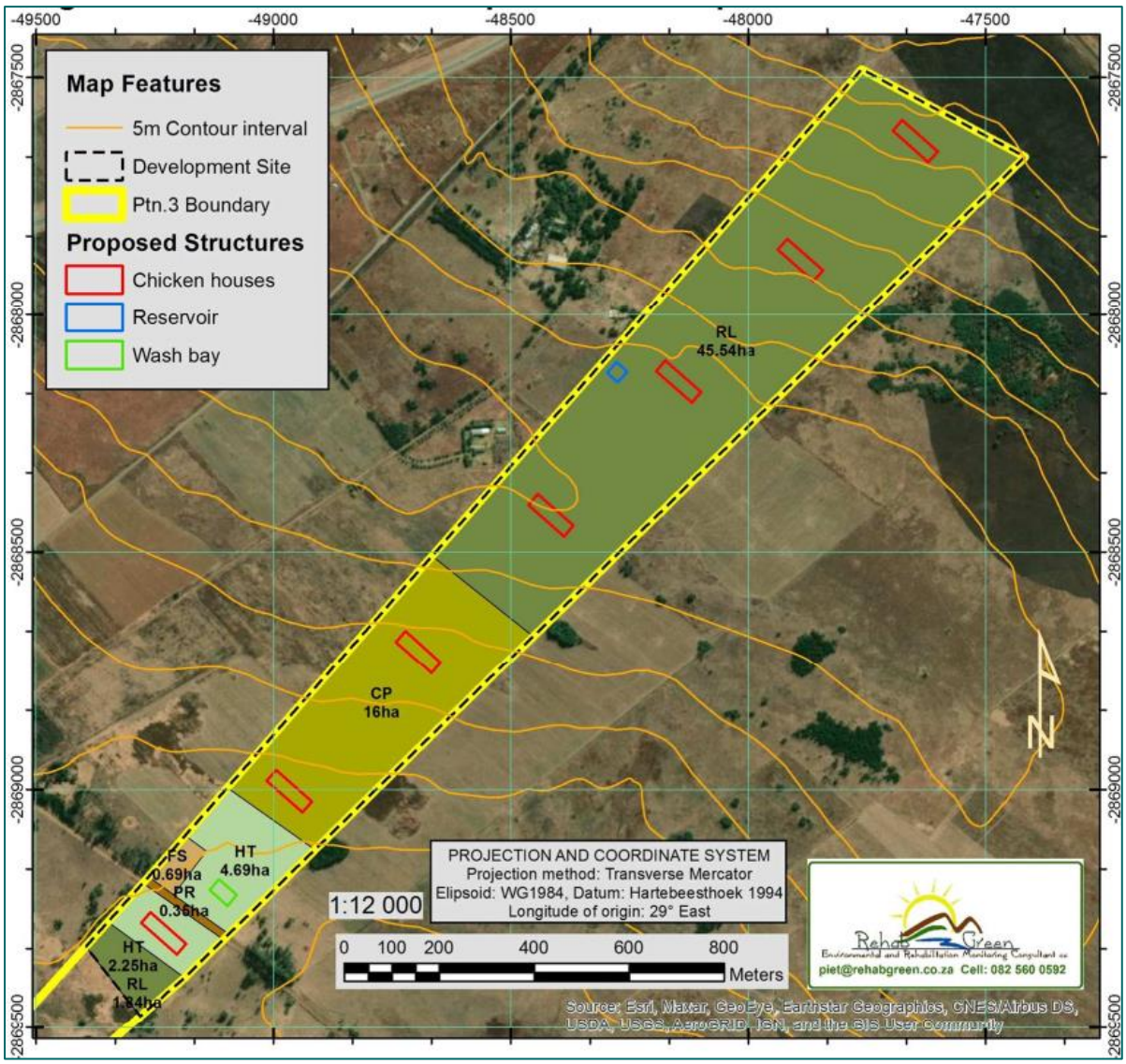


Figure 11: Current land use map of the Development Site (Rehab Green Monitoring Consultants CC, 2021)

4.5.2 Development in 50 meter buffered envelope

The Protocol requires a map that visually shows the current development or land uses in a 50m buffered envelope surrounding the development site, overlain on the agricultural sensitivity map of the Screening Tool Report. However, since the agricultural sensitivity rated by the Screening Tool has a low accuracy (Figure 6), it would make more sense to overlay the land uses in the 50m buffered envelope on the refined agricultural sensitivity maps (Figure 7).

Figure 12 shows the land uses in the 50m buffered envelope surrounding the proposed development site as well the positions of the proposed infrastructure, consisting of 7 chicken houses, a wash bay and reservoir, overlain on the refined agricultural sensitivity classes. Figure 11 and Table 12 indicate that the dominant land uses within the development site are rangeland and pastures, which together

occupies 88.8% of the development site. Table 13 indicates that the dominant land uses within the 50m buffered envelope are also dominated by rangeland and pastures and occupies 89.4% of the buffer zone.

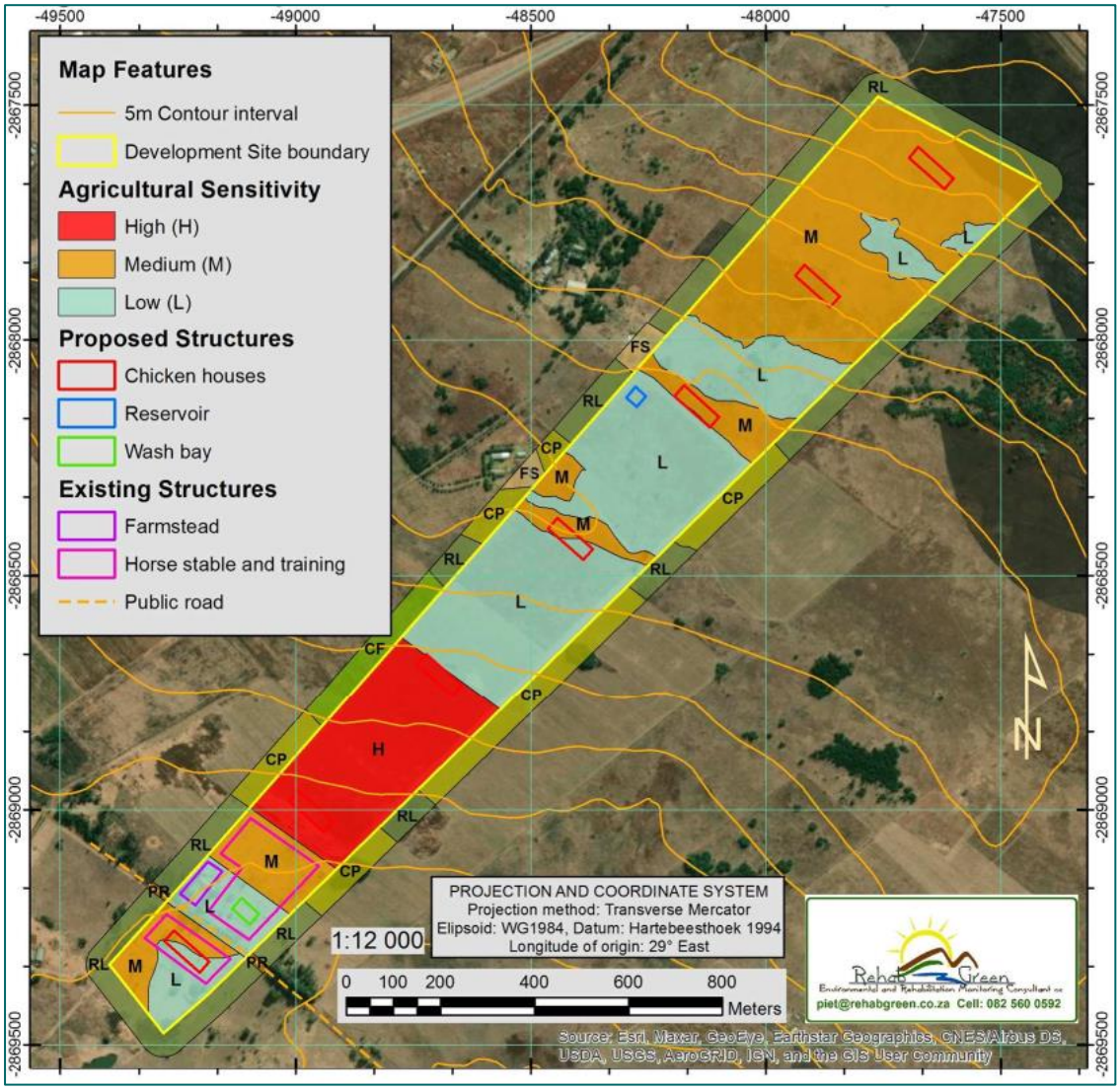


Figure 12: Development/land uses in 50m buffered envelope (Rehab Green Monitoring Consultants CC, 2021)

Table 13: Land uses in 50m buffer zone

Land Use Code	Current Land Use	Area (ha)	Area (%)
CF	Crop farming (maize)	1.98	6.83
RL	Rangeland	17.97	66.39
CP	Cultivated pasture	7.94	27.44
FS	Farmstead and related buildings	0.91	3.13
PR	Public road	0.18	0.61
	Total	**28.98**	**100**

4.5.3 Land uses on adjacent land parcels

Table 14 summarizes the land uses on adjacent land parcels in terms of crop farming, rangeland, pasture, and poultry/chicken farming. The estimates were made based on aerial photo interpretation (Google Earth satellite Imagery) and only larger, identifiable uses were noted. Smaller uses such as farmsteads were ignored.

Table 14: Estimated land uses on adjacent land parcels

Farm name	Portion	Estimate percentage land use				
		Crop farming	Rangeland	Pasture	Chicken farming	Other
Kameel Zyn Kraal 547 JR	**9**	0	50	50	0	0
	13	0	45	45	0	10 (forest)
	27	0	50	40	10	0
	31	0	100	0	0	0
	32	40	30	30	0	0
	Re	0	75	20	0	5 (mining)

It can be derived from Table 14 that rangeland and pastures are by far the dominant land uses on all adjacent land parcels. The majority of adjacent land parcels are fairly small and how effective the rangeland are being utilized is unknown. It is however expected not to be very high. Crop farming occurred rarely and poultry farming was identified on portion 27 only. A small number of chicken farms could be identified within a 10km radius.

5 Vegetation

Information for this section was extracted from the Flora Assessment (Limnology, 2021).

5.1 Vegetation study units

Five vegetation study units were identified on the study site:

- *Searsia discolor* rocky grassland;
- *Combretum – Diospyros* rocky outcrop vegetation;
- Mixed alien and indigenous vegetation;
- Cultivated fields; and
- *Alloteropsis – Hyparrhenia* grassland.

Tables 21 to 25 list the plants found on each of the surveyed areas of the study site.

5.2 Medicinal plants

The names of known medicinal plants are marked with numbers in Tables 21 to 25 and the numbers appear as footnotes at the end of the last table. Of the 115 plant species recorded on the site, 29 species with medicinal properties were found. The distribution of the medicinal species in the study units is as follows:

Table 15: Number of medicinal species in the various study units (Flora Assessment - Limnology, 2021)

Study Unit	Total No. of Species in Study Unit	No. of Medicinal Species in Study Unit
Searsia discolor rocky grassland	76	16
Combretum – Diospyros rocky outcrop vegetation	67	20
Mixed alien and indigenous vegetation	30	3
Cultivated fields	11	0
Alloteropsis – Hyparrhenia grassland	43	6

5.3 Alien plants

Alien plants are not listed separately, but are included in the lists as they form part of each particular study unit. Their names are marked with an asterisk in Tables 21 to 25. Eleven alien plant species, of which four species are Category 1b invasive species and two are Category 2 invasive species were recorded on the site. The number of alien species in each study unit is reflected in table 16.

Table 16: Number of Alien species in each study unit (Flora Assessment - Limnology, 2021)

Study Unit	No. of Alien Species	CAT 1b	CAT 2	Not Invasive
Searsia discolor rocky grassland	5	2	0	3
Combretum – Diospyros rocky outcrop vegetation	4	1	0	3
Mixed alien and indigenous vegetation	10	3	2	5
Cultivated fields	2	0	0	2
Alloteropsis – Hyparrhenia grassland	3	1	0	2

Invasive species are controlled by the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014.

Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form of trade or planting is strictly prohibited.

Category 2: Invasive species, or species deemed to be potentially invasive, in that a permit is required to carry out a restricted activity. Category 2 species include commercially important species such as pine, wattle, and gum trees. Plants in riparian areas become Category 1b invasive species.

5.4 Orange List species on the study site

Four Orange List plant species are known to occur in the 2528DC quarter degree square. The study site has suitable habitat for two species, both of which were found during the present survey. These two species were never before recorded in the 2528DC q.d.s.

Table 17: Red List and Orange List* plants of the 2528DC q.d.s.

Species	Flower time	Priority group*	Conserv status	Presence on site
Argyrolobium campicola	Nov-Feb	A3	Near Threatened[1]	Habitat not suitable
Callilepis leptophylla[3]	Aug-Jan & May	N/A	Declining[2]	**found**
Delosperma leendertziae	Aug-Mar	A2	Near Threatened[1]	Habitat not suitable
Eucomis autumnalis	Nov-Apr	N/A	Declining[2]	Habitat not suitable
Gladiolus pole-evansii	Feb-Mar	A2	Rare[1]	Habitat not suitable
Habenaria bicolor	Jan-Apr	B	Near Threatened[2]	Habitat suitable
Hypoxis hemerocallidea[3]	Sep-Mar	N/A	Declining[2]	**found**
Ilex mitis var. *mitis*	Oct-Dec	N/A	Declining[2]	Habitat not suitable

1) global status
2) national status
3) species never before recorded in the 2528DC q.d.s.
4) species not known to occur in the 2528DC q.d.s.

* Orange listed plants have no priority grouping and are designated 'N/A'

5.5 Red List species on the study site

Six Red List plant species are known to occur in the 2528DC quarter degree square. The study site has suitable habitat for one of these species, but it was not found during the survey. This species was never before recorded in the 2528DC q.d.s. (Annexure A of original report).

GDARD requires biodiversity studies for a Near Threatened orchid species. The study site has suitable habitat for this species, but it was not found during the survey. The survey was done outside the flowering time of this orchid and the relevant study unit has to be examined during summer for the presence of this species.

Table 18: Red List plants for which biodiversity studies are required by GDARD

Species	Flower season	Priority group	Conserv status	PRESENT ON SITE
Habenaria bicolor	Jan-Apr	B	Near Threatened[2]	Habitat suitable

5.6 Protected trees and other protected species

One Protected tree listed in terms of the National Forests Act, 1998 (Act No. 84 of 1998) is known to occur in the 2528DC quarter degree square. However, the study site does not have suitable habitat for this tree (Table 19).

Table 19: Trees of the 2528DC q.d.s. that are protected trees in terms of section 15(1) of the National Forests Act, 1998

Species	Suitable habitat	Presence on site
Pittosporum viridiflorum	In forest margins, bush clumps and bushveld often on rock outcrops.	Habitat not suitable

No Protected plants listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) are known to occur in the 2528DC quarter degree square.

According to the National Screening report two species of conservation concern that are sensitive to illegal harvesting and known or expected to occur on the proposed development footprint are listed for Portion 3 Kameel Zyn Kraal 547-JR. Such species have had their names obscured and are listed as sensitive plant unique numbers 691and 1252 (Table 20).

Table 20: Species of conservation concern that are sensitive to illegal harvesting

Sensitive Species Number	Priority group	Conservation status	Presence on site
1252	B	VU	Habitat not suitable
691	A3	VU	Habitat not suitable

5.7 *Searsia discolor* rocky grassland

5.7.1 Compositional aspects and connectivity

This study unit comprises a dolerite outcrop in natural grassland dominated by *Searsia discolor*. The species diversity of the study unit is high with 66% of all species recorded on the site found in this unit. Connectivity with natural grassland exists to the southeast. A strip of decomposing paddock waste that includes pieces of live Kikuyu grass has been dumped along the centre of the study unit and at the time of the flora survey was being removed, leaving germinating weeds and small to large patches of Kikuyu grass growing where the decomposing material lay. Of the 115 plant species recorded on the site 76 were recorded in the *Searsia discolor* rocky grassland study unit. Of these 71 are indigenous species.

The following number of species in each growth form was noted:

Growth Form	Number of species
Annual & perennial herbaceous species	35
Tree species	2

Growth Form	Number of species
Shrubs and dwarf shrubs	9
Grasses	19
Geophytes	7
Sedges	2
Succulents	2
Total No. of species	76

5.7.2 Red List and Orange List species in the study unit

The *Searsia discolor* rocky grassland study unit does not have suitable habitat for Sensitive species 691 and 1252, but has suitable habitat for one Red List species and two Orange List species. The Red List species (for which GDARD also requires biodiversity studies, see Table 18), was not found during the survey, but a few specimens of one of the Orange List species were found in the *Searsia discolor* rocky grassland study unit (Table 17).

5.7.3 Medicinal and alien species

Sixteen of the 29 medicinal species and five of the 11 alien species recorded on the site were found in the *Searsia discolor* rocky grassland study unit. Of the alien species two are Category 1b invasive species.

5.7.4 Sensitivity

Because the *Searsia discolor* rocky grassland study unit comprises natural grassland and is situated in a Critical Biodiversity area (GDARD C-Plan 3.3) it is considered sensitive.

Table 21: Plants recorded in the *Searsia discolor* rocky grassland

Scientific name	INV CAT	Common names
Acalypha caperonioides		
Albuca setosa		Slymbol
Alloteropsis semialata subsp. *semialata*		Blackseed grass / Donkersaadgras
Aloe marlothii subsp. *marlothii*[1,2,4]		Mountain aloe / Bergaalwyn
Aloe zebrina		
Anthospermum rigidum subsp. *pumilum*		
Asparagus suaveolens		Wild asparagus / Katdoring
Aster harveyanus		Bloublommetjie
Athrixia elata		Wild tea / Bostee
Babiana bainesii		Bobbejaanuintjie
Berkheya zeyheri subsp. *zeyheri*		
*Bidens pilosa**		Blackjack / Knapsekêrel

Scientific name	INV CAT	Common names
Brachiaria serrata		Velvet grass / Fluweelgras
Bulbostylis cf *burchellii*		Biesie
Clematis brachiata[2]		Traveler's joy / Klimop
Conyza podocephala		
Crabbaea acaulis		
Cymbopogon excavatus		Broadleaved turpentine grass / Breëblaar terpentyngras
Cymbopogon pospischilii		Turpentine grass / Terpentyngras
Cynodon dactylon		Couch grass / Kweek
Cyperus obtusiflorus var. *obtusiflorus*		Witbiesie
Dicoma anomala subsp. *anomala*[1,2,3]		Maagbitterwortel
Dimorphotheca spectabilis		Blou bietou
Diospyros austro-africana var. *microphylla*		Jackal bush / Jakkalsbos
Diospyros lycioides subsp. *guerkei*		Bloubos
Eragrostis chloromelas		Curly leaf / Krulblaar
Eragrostis curvula		Weeping love grass / Oulandsgras
Eragrostis racemosa		Narrow heart love grass / Smalhartjiesgras
Gladiolus crassifolius		
Helichrysum nudifolium var. *nudifolium*[1,2]		Hottentot's tea / Hottentotstee
Helichrysum rugulosum[2,3]		
Helichrysum setosum		Yellow everlasting / Geelsewejaartjie
Hermannia depressa[2,3]		Creeping red Hermannia / Rooiopslag
Hilliardiella aristata[1,2]		Silver vernonia
Hilliardiella oligocephala[1,2]		Cape vernonia / Blounaaldetee bossie
Hyparrhenia hirta		Common thatching grass / Dekgras
Hyparrhenia tamba		Blue thatching grass / Blou tamboekiegras
Hypoxis hemerocallidea[1,2,3]		Star flower / Gifbol
Hypoxis multiceps		
Hypoxis rigidula var. *rigidula*		Silver-leaved star flower / Wilde tulp
Imperata cylindrica		Cottonwool grass / Donsgras
Indigastrum burkeanum		
Ipomoea bathycolpos		Veldsambreeltjies
Ipomoea oblongata[2]		
Ipomoea ommaneyi[2]		Beespatat
Justicia anagalloides		
Lantana rugosa[2,3]		Bird's brandy / Voëlbrandewyn
Lasiosiphon sericocephala		

Scientific name	INV CAT	Common names
Macledium zeyheri subsp. *argyrophyllum*[2,3]		Doll's protea
Melinis nerviglumis		Bristle leaf red top / Steekblaarblinkgras
Monsonia angustifolia		Crane's bill / Angelbossie
Ocimum obovatum subsp. *obovatum* var. *obovatum*[2,3]		Cat's whiskers / Katsnor
Parinari capensis subsp. *capensis*		Dwarf mobola / Grysappeltjie
*Pennisetum clandestinum**		Kikuyu grass
Pollichia campestris		Waxberry / Teesuikerbossie
Polydora poskeana		
Schistostephium crataegifolium		Golden flat flower / Bergkruie
Schizachyrium sanguineum		Red autumn grass / Rooi herfsgras
Schizocarphus nervosus		Wild squill / Sandlelie
Searsia discolor		Gwarrie
Searsia lancea		Karee / Karee
Senecio affinis		
Senecio coronatus		Sybossie
Senecio erubescens var. *erubescens*		
Seriphium plumosum		Bankrupt bush / Bankrotbos
Setaria sphacelata var. *sphacelata*		Small creeping foxtail / Kleinkruipmannagras
Sida rhombifolia subsp. *rhombifolia*		Arrow leaf Sida / Taaiman
*Solanum sisymbriifolium**	1b	Wild tomato / Doringbitterappel
Sporobolus africanus		Rat's tail dropseed / Taaipol
*Tagetes minuta**		Tall khaki weed / Lang kakiebos
Trachypogon spicatus		Giant spear grass / Bokbaardgras
Triraphis andropogonoides		Broom needle grass / Perdegras
Tristachya leucothrix		Hairy trident grass / Harige drieblomgras
Vachellia karroo[1,2]		Sweet thorn / Soetdoring
*Verbena bonariensis**	1b	Purple top / Blouwaterbossie
Ziziphus zeyheriana[2]		Dwarf buffalothorn / Dwergblinkblaarwag'nbietjie

INV CAT=Invasive species category

5.8 *Combretum – Diospyros* rocky outcrop vegetation

5.8.1 Compositional aspects and Connectivity

This study unit comprises a variety of mature trees and large shrubs dominated by *Combretum molle* and *Diospyros lycioides* subsp. *guerkei* and also *Cussonia paniculata* subsp. *sinuata* with dense *Alloteropsis semialata* grass that had not been burned in a long time on an outcrop of dolerite. The plant species diversity is high: of the 115 plant species recorded on the site 67 were recorded in the

Combretum – Diospyros rocky outcrop vegetation study unit. Of these 63 are indigenous species. The following number of species in each growth form was noted:

Growth Form	Number of species
Annual & perennial herbaceous species	32
Tree species	11
Shrubs and dwarf shrubs	10
Grasses	6
Geophytes	5
Sedges	1
Succulents	2
Total No. of species	67

5.8.2 Red List and Orange List species in the study unit

The *Combretum – Diospyros* rocky outcrop vegetation study unit does not have suitable habitat for Sensitive species 691 and 1252, nor for the Red List species for which GDARD requires biodiversity studies (Table 18) and which is known to occur in the 2528DC q.d.s. (Table 17). A number of specimens of two Orange List species, also known to occur in the 2528DC q.d.s. were found in the *Combretum – Diospyros* rocky outcrop vegetation study unit.

5.8.3 Medicinal and alien species

Twenty of the 29 medicinal species recorded on the site were found in the *Combretum – Diospyros* rocky outcrop vegetation study unit. Four alien species were recorded in this study unit. Of the alien species one is a Category 1b invasive species.

5.8.4 Sensitivity

Because the *Combretum – Diospyros* rocky outcrop vegetation study unit comprises natural vegetation and is situated in a Critical Biodiversity area (GDARD C-Plan 3.3) it is considered sensitive.

Table 22: Plants recorded in the *Combretum – Diospyros* rocky outcrop vegetation

Scientific name	INV CAT	Common names
Acalypha caperonioides		
Afrosciadium magalismontanum[2]		Wild parsley / Wildepietersielie
Alectra sessiliflora var. *sessiliflora*		
Alloteropsis semialata subsp. *semialata*		Blackseed grass / Donkersaadgras
Aloe marlothii subsp. *marlothii*[1,2,4]		Mountain aloe / Bergaalwyn
Aloe zebrina		
Anthospermum rigidum subsp. *pumilum*		
Asparagus laricinus		Wild asparagus / Katbos
Asparagus suaveolens		Wild asparagus / Katdoring

Scientific name	INV CAT	Common names
Aster harveyanus		Bloublommetjie
*Bidens pilosa**		Blackjack / Knapsekêrel
Buddleja salviifolia		Sagewood / Saliehout
Callilepis leptophylla[2]		Wild daisy / Bergbitterbossie
Celtis africana		White stinkwood / Witstinkhout
Chamaecrista comosa var. *capricornia*		
Combretum erythrophyllum		River bushwillow / Riviervaderlandswilg
Combretum molle[4]		Velvet bushwillow / Fluweel boswilg
Conyza podocephala		
Crabbaea hirsuta[2,3]		Prickle head
Cucumis hirsutus		Wild cucumber / Suurkomkommer
Cussonia paniculata subsp. *sinuata*[2]		Highveld cabbage tree / Hoëveld kiepersol
Cyperus obtusiflorus var. *obtusiflorus*		Witbiesie
Dicoma anomala subsp. *anomala*[1,2,3]		Maagbitterwortel
Dimorphotheca spectabilis		Blou bietou
Diospyros lycioides subsp. *guerkei*		Bloubos
*Erigeron canadensis**		Horseweed fleabane / Kanadese skraalhans
Euclea crispa subsp. *crispa*[4]		Blue guarri / Blou ghwarrie
Gladiolus crassifolius		
Gymnosporia buxifolia[2]		Spikethorn / Pendoring
Helichrysum nudifolium var. *nudifolium*[1,2]		Hottentot's tea / Hottentotstee
Helichrysum rugulosum[2,3]		
Hermannia depressa[2,3]		Creeping red Hermannia / Rooiopslag
Heteromorpha arborescens var. *abyssinica*[1,2]		Common parsley tree / Gewone pietersielieboom
Hilliardiella oligocephala[1,2]		Cape vernonia / Blounaaldetee bossie
Hyparrhenia hirta		Common thatching grass / Dekgras
Hypoxis hemerocallidea[1,2,3]		Star flower / Gifbol
Hypoxis multiceps		
Hypoxis rigidula var. *pilosissima*		Silver-leaved star flower / Wilde tulp
Hypoxis rigidula var. *rigidula*		Silver-leaved star flower / Wilde tulp
Indigastrum burkeanum		
Indigofera hedyantha		Aambeibossie
Ipomoea bathycolpos		Veldsambreeltjies
Ipomoea obscura var. *obscura*		Wild petunia / Wilde patat
Kohautia virgata		
Lantana rugosa[2,3]		Bird's brandy / Voëlbrandewyn
Lasiosiphon sericocephala		

Scientific name	INV CAT	Common names
Leobordia foliosa		
*Melia azedarach**	1b	Syringa / Sering
Melinis repens subsp. *repens*		Red top grass
Nidorella anomala		
*Oenothera tetraptera**		White evening primrose / Witaandblom
Pelargonium luridum[1,2]		Stalkflowered polonium / Wildemalva
Polygala sp.		Dwarf polygala
Rhamnus prinoides[4]		Glossy leaf / Blinkblaar
Schistostephium crataegifolium		Golden flat flower / Bergkruie
Searsia discolor		Gwarrie
Searsia lancea		Karee / Karee
Searsia pyroides var. *pyroides*[4]		Common wild currant / Taaibos
Searsia zeyheri[2]		Blue currant / Blou taaibos
Senegalia caffra		Common hook thorn / Gewone haakdoring
Teucrium trifidum		Koorsbossie
Themeda triandra		Red grass / Rooigras
Triraphis andropogonoides		Broom needle grass / Perdegras
Urelytrum agropyroides		Quinine grass / Varkstertgras
Vachellia karroo[1,2]		Sweet thorn / Soetdoring
Vachellia sieberiana var. *woodii*		Paper-bark thorn / Papierbasdoring
Vigna vexillata var. *vexillata*[3]		Narrow-leaved wild pea / Wilde-ertjie

INV CAT=Invasive species category

5.9 Mixed alien and indigenous vegetation

5.9.1 Compositional aspects and Connectivity

The Mixed alien and indigenous vegetation study unit comprises a variety of mostly alien species. The southernmost part of the site consists of ornamental garden vegetation and pasture contained in paddocks dominated by Kikuyu grass. Small areas of Mixed alien and indigenous vegetation are scattered across the site and comprise mostly alien trees. A recreation area bordering on the *Combretum – Diospyros* rocky outcrop vegetation study unit contains mostly indigenous shade trees surrounding a circular picnic area. Of the 115 plant species recorded on the site 32 were recorded in the Mixed alien and indigenous vegetation study unit. Of these 22 are indigenous species. The following number of species in each growth form was noted:

Growth Form	Number of species
Annual & perennial herbaceous species	13
Tree species	7
Shrubs and dwarf shrubs	3
Grasses	9

Growth Form	Number of species
Total No. of species	32

6.9.2. Red List and Orange List species in the study unit

The Mixed alien and indigenous vegetation study unit does not have suitable habitat for any of the Red List or Orange List plant species known to occur in the 2528DC quarter degree square.

5.9.3 Medicinal and alien species

Four medicinal species were found in this study unit. Ten of the 11 alien species recorded on the site were found in this study unit. Of the alien species three are Category 1b invasive species and two are Category 2 invasive species.

5.9.5 Sensitivity

The Mixed alien and indigenous vegetation study unit is not deemed sensitive.

Table 23: Plants recorded in the Mixed alien and indigenous vegetation

Scientific name	INV CAT	Common names
*Acacia dealbata**	2	Silver wattle / Silwerwattel
*Acacia decurrens**	2	Green wattle / Groenwattel
Asparagus suaveolens		Wild asparagus / Katdoring
*Bidens pilosa**		Blackjack / Knapsekêrel
Celtis africana		White stinkwood / Witstinkhout
Conyza podocephala		
Cymbopogon pospischilii		Turpentine grass / Terpentyngras
Cynodon dactylon		Couch grass / Kweek
Diospyros lycioides subsp. *guerkei*		Bloubos
Eragrostis curvula		Weeping love grass / Oulandsgras
*Erigeron canadensis**		Horseweed fleabane / Kanadese skraalhans
Helichrysum nudifolium var. *nudifolium*[1,2]		Hottentot's tea / Hottentotstee
Hyparrhenia tamba		Blue thatching grass / Blou tamboekiegras
Indigastrum burkeanum		
Ipomoea obscura var. *obscura*		Wild petunia / Wilde patat
Lantana rugosa[2,3]		Bird's brandy / Voëlbrandewyn
*Melia azedarach**	1b	Syringa / Sering
Melinis repens subsp. *repens*		Red top grass
Nidorella anomala		
*Oenothera tetraptera**		White evening primrose / Witaandblom
*Pennisetum clandestinum**		Kikuyu grass

Scientific name	INV CAT	Common names
*Salvia tiliifolia**	1b	Linden leaf sage
Schizachyrium sanguineum		Red autumn grass / Rooi herfsgras
Searsia pyroides var. *pyroides*[4]		Common wild currant / Taaibos
Sida rhombifolia subsp. *rhombifolia*		Arrow leaf Sida / Taaiman
Sporobolus africanus		Rat's tail dropseed / Taaipol
*Tagetes minuta**		Tall khaki weed / Lang kakiebos
Teucrium trifidum		Koorsbossie
Urelytrum agropyroides		Quinine grass / Varkstertgras
Vachellia karroo[1,2]		Sweet thorn / Soetdoring
Vachellia sieberiana var. *woodii*		Paper-bark thorn / Papierbasdoring
*Verbena bonariensis**	1b	Purple top / Blouwaterbossie

INV CAT=Invasive species category

5.10 Cultivated fields

5.10.1 Compositional aspects

The Cultivated fields study unit comprises mostly grasses dominated by Hyparrhenia hirta and Eragrostis species. Of the 115 plant species recorded on the site 11 were recorded in the Cultivated fields study unit. Of these nine are grasses and two are herbaceous species.

5.10.2 Red List and Orange List species in the study unit

The Cultivated fields study unit does not have suitable habitat for the Red List or Orange List plant species known to occur in the 2528DC quarter degree square.

5.10.3 Medicinal alien species

No medicinal species were recorded and two alien species, none of them declared alien invasive species, were found in this study unit.

5.10.4 Sensitivity

The Cultivated fields study unit is not deemed sensitive.

Table 24: Plants recorded in the Cultivated fields

Scientific name	Common names
Conyza podocephala	
Cymbopogon pospischilii	Turpentine grass / Terpentyngras
Cynodon dactylon	Couch grass / Kweek
Eragrostis chloromelas	Curly leaf / Krulblaar
Eragrostis curvula	Weeping love grass / Oulandsgras

Scientific name	Common names
Hyparrhenia hirta	Common thatching grass / Dekgras
Imperata cylindrica	Cottonwool grass / Donsgras
Melinis repens subsp. *repens*	Red top grass
*Pennisetum clandestinum**	Kikuyu grass
Sporobolus africanus	Rat's tail dropseed / Taaipol
*Tagetes minuta**	Tall khaki weed / Lang kakiebos

INV CAT=Invasive species category

5.11 *Alloteropsis – Hyparrhenia* grassland

5.11.1 Compositional aspects and Connectivity

This study unit comprises a large area of natural grassland dominated by *Alloteropsis semialata* and *Hyparrhenia hirta* that has not been burned for a long time, forming a dense mat that impedes entrance into the area and hides smaller herbaceous species and geophytes. Connectivity exists to the southeast. Of the 115 plant species recorded on the site 43 were recorded in the *Alloteropsis – Hyparrhenia* grassland study unit. Of these 40 are indigenous species. The following number of species in each growth form was noted:

Growth Form	Number of species
Annual & perennial herbaceous species	21
Shrubs and dwarf shrubs	2
Grasses	16
Geophytes	2
Sedges	1
Succulents	1
Total No. of species	43

5.11.2 Red List and Orange List species in the study unit

The *Alloteropsis – Hyparrhenia* grassland study unit does not have suitable habitat for Sensitive species 691 and 1252, nor for the Red List species for which GDARD requires biodiversity studies (Table 18) and which is known to occur in the 2528DC q.d.s. (Table 17). The study unit has suitable habitat for two Orange List species, also known to occur in the 2528DC q.d.s., but none was seen during the survey owing to the dense grass cover.

5.11.3 Medicinal and alien species

Six medicinal species and three alien species were recorded in this study unit. Of the alien species one is a Category 1b invasive species.

5.11.4 Sensitivity

Because the *Alloteropsis – Hyparrhenia* grassland study unit comprises natural vegetation and is situated in a Critical Biodiversity area (GDARD C-Plan 3.3) it is considered sensitive.

Table 25: Plants recorded in the *Alloteropsis – Hyparrhenia* grassland

Scientific Name	INV CAT	Common Names
Acalypha caperonioides		
Afrosciadium magalismontanum[2]		Wild parsley / Wildepietersielie
Albuca setosa		Slymbol
Alloteropsis semialata subsp. *semialata*		Blackseed grass / Donkersaadgras
Aloe zebrina		
Asparagus suaveolens		Wild asparagus / Katdoring
*Bidens pilosa**		Blackjack / Knapsekêrel
Brachiaria serrata		Velvet grass / Fluweelgras
Bulbostylis cf *burchellii*		Biesie
Chamaecrista comosa var. *capricornia*		
Conyza podocephala		
Crabbaea hirsuta[2,3]		Prickle head
Cymbopogon excavatus		Broadleaved turpentine grass / Breëblaar terpentyngras
Cymbopogon pospischilii		Turpentine grass / Terpentyngras
Cynodon dactylon		Couch grass / Kweek
Dicoma anomala subsp. *anomala*[1,2,3]		Maagbitterwortel
Dimorphotheca spectabilis		Blou bietou
Eragrostis chloromelas		Curly leaf / Krulblaar
Eragrostis curvula		Weeping love grass / Oulandsgras
Helichrysum nudifolium var. *nudifolium*[1,2]		Hottentot's tea / Hottentotstee
Helichrysum rugulosum[2,3]		
Hilliardiella oligocephala[1,2]		Cape vernonia / Blounaaldetee bossie
Hyparrhenia hirta		Common thatching grass / Dekgras
Hyparrhenia tamba		Blue thatching grass / Blou tamboekiegras
Hypoxis rigidula var. *rigidula*		Silver-leaved star flower / Wilde tulp
Ipomoea obscura var. *obscura*		Wild petunia / Wilde patat
Lasiosiphon sericocephala		
Melinis repens subsp. *repens*		Red top grass
Monsonia angustifolia		Crane's bill / Angelbossie
Nidorella anomala		
Polydora poskeana		
Polygala sp.		Dwarf polygala
Schistostephium crataegifolium		Golden flat flower / Bergkruie
Schizachyrium sanguineum		Red autumn grass / Rooi herfsgras

Scientific Name	INV CAT	Common Names
Seriphium plumosum		Bankrupt bush / Bankrotbos
Setaria sphacelata var. *sphacelata*		Small creeping foxtail / Kleinkruipmannagras
Sida rhombifolia subsp. *rhombifolia*		Arrow leaf Sida / Taaiman
Sporobolus africanus		Rat's tail dropseed / Taaipol
*Tagetes minuta**		Tall khaki weed / Lang kakiebos
Themeda triandra		Red grass / Rooigras
Trachypogon spicatus		Giant spear grass / Bokbaardgras
Triraphis andropogonoides		Broom needle grass / Perdegras
*Verbena bonariensis**	1b	Purple top / Blouwaterbossie

INV CAT = Invasive species category

1) Van Wyk, B-E., Van Oudtshoorn, B. & Gericke, N. 2002.

2) Watt, J.M. & Breyer-Brandwijk, M.G. 1962.

3) Pooley, E. 1998.

4) Van Wyk, B. & Van Wyk P. 1997.

6 Animal life

Information for this section was extracted from the Vertebrate Fauna Habitat Assessment (Limnology, 2021) as well as the Avifauna Assessment (Limnology, 2021).

6.1 Mammal Habitat Assessment

The local occurrences of mammals are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges.

From a mammal habitat perspective, it was established that mainly one of the four major habitats is naturally present on the study site, namely terrestrial habitat. Most of the study site consists of transformed grassland. The site was first transformed for agricultural purposes like grazing and later by anthropogenic influences such as buildings, pastures, horse pens, invasive plants, gravel roads, building ruins, rock dumping, diggings, fences, dumping of horse manure. The study site is thus ecologically disturbed in many parts.

No moribund termitaria were recorded on the study site. These structures are good indicators of the occurrence of small mammals. Accordingly, it is estimated that the mammal population density for the study site is somewhat lower. At the time of the site visit the basal cover was poor in most places due to grass cutting and grazing and would not provide adequate nourishment or cover for small terrestrial mammals. However, there were also areas with good basal cover.

A few indigenous and exotic trees grow on the site, but they would not provide arboreal habitat for arboreal mammal species. Due to the absence of natural arboreal habitat, most arboreal species like vervet monkeys, South African galago, woodland thicket rat, acacia rat, black-tailed tree rat and woodland dormouse were omitted from the species list in Table 26. It is possible that individual vervet monkeys may occur on the study site from time to time. There are a few dead logs, which would provide shelter and food for some mammals.

No wetlands were found on the study site/development area. Due to the absence of wetlands or associated vegetation on the site, most aquatic species like the marsh mongoose, Cape otter, spotted-necked otter, African marsh rat, swamp shrew, cane rats and rough hair golden moles would be absent from the site. However, near some of the houses on the property is a fishpond, but it would not provide habitat for above mention species.

There is a small rocky ridge of natural rupicolous habitat on the study site. There are also manmade rupicolous habitat in the form of buildings, building ruins, dumped boulders and rocks. Due to the absence of large natural rupicolous habitat, some species like Jameson's red rock rabbit, klipspringer, mountain reedbuck, grey rhebok and dassie (rock hyrax) were omitted from the species list in Table 26. However small rupicolous mammals such as elephant rock shrew and Namaqua rock mouse should occur on the site.

The site has no caves suitable for cave-dwelling bats, although some of the buildings may act as substitute daytime roosts. It is likely that common bats commute from roosting sites elsewhere to hawk for insects over the wetlands near the study site.

Most of the surrounding properties are used for farming practices and connectivity with the site is good.

Sight records were also used to compile this mammal report.

6.1.1. Expected and Observed Mammal Species Richness

Many large mammals (such as African buffalo, blue wildebeest, red hartebeest, plain zebra, eland, white rhino, lion, wild dog, cheetah and spotted hyena) have long since been extirpated for sport and later to favour livestock farming. However, at least one leopard occurs in the nearby Bronberg area and the possibility exists that it may move onto or near the site on the odd occasion (Anon 2020). A few medium-sized mammals such as aardwolf, aardvark, black-backed jackal, common duiker and steenbok may still occur on the site from time to time.

The species richness is poor to fair due to the disturbed nature of most parts of the site. Most of the species on the study site are common and widespread (viz. steenbok, scrub hare, multimammate mouse, pygmy mouse, genet species, yellow mongoose and Highveld gerbil).

Of 59 mammal species expected to occur on the study site (Table 26), eleven were confirmed during the site visit. It should be noted that potential occurrences are interpreted as being possible over a period of time as a result of environmentally induced expansions and contractions of population densities and ranges, which stimulate migration.

Table 26 lists the mammals which are deemed as probable residents on the study site and the 500 metres extended study area. All feral or domesticated mammal species expected to occur on the study site (e.g. house mice, house rats, cattle, sheep, dogs and cats) were omitted from Table 26 since these species are normally associated with human settlements.

The bats listed are mostly common in the area wherever they can find daytime roosts in manmade structures. Many bat species commute over considerable distances in search of rich feeding patches, such as insects that are swarming (or may eventually swarm) over wetlands at dusk. Except for a fishpond, no wetlands were observed on the study site.

6.1.2 Threatened and Red Listed Mammal Species

All Red Data species listed in Table 26 as Critically Endangered, Vulnerable, Near Threatened or Data Deficient are discerning species and became endangered as a result of the deterioration of their preferred habitats. Due to the absence of especially wetland-associated vegetation cover on the property, the possibility of Red Listed mammal species occurring decreases dramatically.

The study site falls outside the natural range of the white-tailed rat and Maquassie musk shrew. These species should not occur on the study site.

Due to their ability to fly and cover large distances, the distribution information on some bat species is insufficient. This has resulted in Red Data species such as the Blasius's (Peak-saddle) horseshoe bat and short-eared trident bat being included as a precautionary measure.

Due to the absence of wetlands certain Red Data mammals should not occur on the study site. There are no suitable wetlands on the study site for either the Cape clawless otter or the spotted-necked otter, and these two species should not occur on the study site. The African marsh rat and swamp musk shrew should also not occur on the study site due to the absence of wetlands.

Due to the absence of large rupicolous habitat certain Red Data mammals should be absent from the site, which include mountain reedbuck and grey rhebok.

There is a very small possibility that the serval, brown hyena and African striped weasel may occur on the site from time to time.

At least one leopard occurs in the nearby Bronberg area and there is a possibility that it may move onto or near the site on the odd occasion.

The oribi would have occurred on the site in the past, but due to different anthropogenic factors like hunting, overgrazing, grass cutting, regular veld burning and the relatively small size of the site, this species should not currently occur on the site.

Taking into account the Screening report for the site, the possible occurrence of the rough-haired golden mole (*Chrysospalax villosus*) should be investigated. Rough-haired golden moles prefer dry, sandy ground on the fringes of marshes or vleis (Skinner & Chimimba, 2005), however no suitable habitat is present on the site. This species should not occur on the site due to the absence of wetlands.

No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s). The species richness is poor to fair due to the relative small size of the site, only one habitat type occurring on the site and the fact that the site is disturbed.

Table 26: Mammal species richness. The species observed or deduced to occupy the site. (Systematics and taxonomy as proposed by Skinner & Chimimba [2005], Apps [2012] Stuart & Stuart [2015], and Child. et.al. 2016).

	Scientific Name	English Name
	Order: MACROSCELIDIDAE	
	Family: Macroscelididae	Elephant-shrews
*	***Elephantulus myurus***	Eastern rock elephant-shrew
	Order: ORYCTEROPODIDAE	
	Family: Orycteropodidae	Aardvark
√	*Orycteropus afer*	Aardvark
	Family: Orycteropodidae	
	Order: LAGOMORPHA	
	Family: Leporidae	**Hares, rabbits and rock rabbits**
√	*Lepus saxatilis*	Scrub hare
	Order : RODENTIA	
	Family: Bathyergidae	**Mole rats**
√	*Cryptomys hottentotus*	African mole rat
	Family: Hystricidae	**Porcupines**
√	*Hystrix afriaeaustralis*	Cape porcupine
	Family: Pedetidae	
?	*Pedetes capensis*	Springhare
	Family: Myoxidae	**Dormice**
?	*Graphiurus platyops*	**Rock dormouse**

	Scientific Name	English Name
	Family: Muridae	**Rats and mice**
*	*Lemniscomys rosalia*	Single-striped grass mouse
√	*Rhabdomys pumelo*	Four-striped grass mouse
√	*Mus indutus*	Desert pygmy mouse
√	*Mastomys coucha*	Southern multimammate mouse
√	*Aethomys ineptus*	Tete veld rat
√	*Micaelamys namaquensis*	Namaqua rock mouse
?	*Otomys angoniensis*	Angoni vlei rat
√	*Otomys irroratus*	Vlei rat
√	*Tatera brantsii*	Highveld gerbil
?	*Tatera leucogaster*	Bushveld gerbil
?	*Saccostomus campestris*	Pouched mouse
√	*Dendromus melanotis*	Grey pygmy climbing mouse
?	*Dendromus mesomelas*	Brants' climbing mouse
?	*Dendromus mystacalis*	Chestnut climbing mouse
?	*Steatomys pratensis*	Fat mouse
	Order: PRIMATES	
	Family: Cercopithecidae	Baboons and monkeys
?	*Cercopithecus pygerythrus*	Vervet monkey
	Order: EULIPOTYPHA	
	Family Soricidae	**Shrews**
*	*Crocidura cyanea*	Reddish-grey musk shrew
?	*Crocidura silacea*	Lesser grey-brown musk shrew
?	*Crocidura flavescens*	Greater red musk shrew
√	*Crocidura hirta*	Lesser red musk shrew
	Family: Erinaceidae	**Hedgehog**
***NT**	*Atelerix frontalis*	Southern African hedgehog
	Order: CHIROPTERA	**Bats**
	Family: PTEROPIDAE	**Epauletted fruit bats**
?	*Epomophorus wahlbergi*	Wahlberg's epauletted fruit bat
?	*Eidolon helvum*	Straw-coloured fruit bat
	Family: Embalonuridae	**Sheath-tailed bats**
?	*Taphozous mauritianus*	Mauritian tomb bat
	Family: Molossidae	**Free-tailed bats**
√	*Tadarida aegyptiaca*	Egyptian free-tailed bat
	Family: Vespertilionidae	**Vesper bats**
?	*Miniopterus natalensis*	Natal Long-fingered bat
√	*Neoromicia capensis*	Cape serotine bat
?	*Myotis tricolor*	Temminck's hairy bat
	Family: Nycteridae	**Slit-faced bats**

	Scientific Name	English Name
?	*Nysteris thebaica*	Egyptian slit-faced bat
	Family: Rhinolophidae	**Horseshoe bats**
?	*Rhinolophus clivosus*	Geoffroy's horseshoe bat
?	*Rhinolophus darling*	Darling's horseshoe bat
?NT	*Rhinolophus blasii*	Blasius's horseshoe bat
?	*Rhinolophus simulator*	Bushveld horseshoe bat
	Family: Hipposideridae	Trident bats and leaf-nosed bats
?EN	*Cloeotis percivali*	Short-eared trident bat
	Order: CARNIVORA	
	Family: Hyaenidae	Hyaenas
?	*Proteles cristatus*	Aardwolf
?NT	*Parahyaena brunnea*	Brown hyaena
	Family: Felidae	**Cats**
?Vu	*Panthera pardus*	Leopard
*	*Caracal caracal*	Caracal
√	*Felis silvestris*	African wild cat
?NT	*Leptailurus serval*	Serval
	Family: Viverridae	**Civets and genets**
√	*Genetta genetta*	Small-spotted genet
?	*Genetta tigrina*	South African large-spotted genet
	Family: Herpestidae	**Suricates and mongooses**
√	*Cynictis penicillata*	Yellow mongoose
√	*Galerella sanguinea*	Slender mongoose
*	*Ichneumia albicauda*	White-tailed mongoose
√	*Suricata suricatta*	Suricate
	Family: Canidae	**Foxes, wild dogs and jackals**
√	*Canis mesomelas*	Black-backed jackal
?	*Vulpes chama*	Cape fox
	Family: Mustelidae	**Otters, honey badger, weasel and polecat**
?NT	*Poecilogale albinucha*	African striped weasel
√	*Idonyx striatus*	Striped polecat
	Order: RUMINANTIA	
	Family: Bovidae	**Antelopes and buffalo**
√	*Sylvicapra grimmia*	Common duiker
√	*Raphicerus campestris*	Steenbok

√ Definitely present or have a high probability to occur;

* Medium probability to occur based on ecological and distributional parameters;

? Low probability to occur based on ecological and distributional parameters.

Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004) are indicated in the first column: CR= Critically Endangered, En =

Endangered, Vu = Vulnerable, NT = Near Threatened, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 27: Mammal species positively confirmed on the study site, observed indicators and habitat.

Scientific Name	English Name	Observation Indicator	Habitat
Tatera brantsii	Highveld gerbil	Burrows	Terrestrial
Cynictis penicillata	Yellow mongoose	Sight record	Terrestrial
Suricata suricatta	Suricate	Sight record	Terrestrial
Lepus saxatilis	Scrub hare	Sight record	Terrestrial
Raphicerus campestris	Steenbok	Sight record	Terrestrial
Sylvicapra grimmia	Common duiker	Scat	Terrestrial
Canis mesomelas	Black-backed jackal	Scat	Terrestrial
Crocidura hirta	Lesser red musk shrew	Sight record from trap	Terrestrial /rupicolous
Mastomys coucha	Southern multimammate mouse	Sight record from trap	Terrestrial /rupicolous
Otomys irroratus	Vlei rat	Sight record from trap	Terrestrial
Rhabdomys pumelo	Four-striped grass mouse	Sight record from trap	Terrestrial/rupicolous

The Highveld gerbil, yellow mongoose, suricate, scrub hare, steenbok, common duiker, black-backed jackal, vlei rat, four-striped grass mouse, southern multimammate mouse and lesser red musk shrew listed above, should be common on the study site and elsewhere in its range.

Table 28: Summary of the Small Rodents and shrews caught in Sherman Traps at the Study Site.

Date	2 July 2021	3 July 2021	4 July 2021
Number of Traps	11	11	11
Number of Specie Caught	1	2	3
Number Of Individuals Caught	1	3	5

Of a total potential of 33 traps, 9 were successful (27%). The nine animals included of four species, vlei rat (one specimen), southern multimammate mouse, (four specimen), four-striped grass mouse (two specimen) and lesser red musk shrew (two specimens).

6.2. Herpetofaunal Habitat Assessment

The local occurrences of reptiles and amphibians are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of reptile and amphibian species by evaluating the habitat types within the context of global distribution ranges. From a herpetological

habitat perspective, it was established that mainly one of the four major habitats are naturally present on the study site, namely terrestrial. Small area of natural rupicolous habitat and a few indigenous trees are also present.

Most of the study site consists of transformed grassland. The site was first transformed for agricultural purposes like grazing and later by anthropogenic influences such as buildings, horse pens, pastures, invasive plants, gravel roads, building ruins, rock dumping, diggings, fences dumping of horse manure. The study site is thus ecologically disturbed in many parts.

No moribund termitaria were recorded on the study site. These structures are good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the herpetofauna population density for the study site is somewhat lower. At the time of the site visit the basal cover was poor in many places and would not provide adequate cover for small terrestrial herpetofauna. However, some areas had good basal cover.

There is one important natural rupicolous habitat in the form of a small ridge on the study site. There is also manmade rupicolous habitat in the form of building ruins and building rubble. Both natural and man-made habitats offer nooks and crannies as refuge for common rupicolous herpetofauna. Due to the presence of natural rupicolous habitat, some species like speckled rock skink, variable skink, common girdled lizard and rock agama were added to the species list in Table 4. However, the rock monitor was omitted from the list.

A few indigenous trees occur on the site. Due to the absence of large natural arboreal habitat, some arboreal species like tree agama were omitted from the species list in Table 29, but other species such as the flap-neck chameleon were added to the list. There are several dead logs, which would provide shelter and food for some herpetofauna.

No wetlands were found on the property. Due to the absence of wetlands or associated vegetation on the site, many aquatic species like the marsh terrapin and Nile monitor were omitted from Table 29. Near some of the houses on the property there is a fishpond, which could provide habitat for a few common frog species.

Sight records were also used to compile this herpetofauna report.

6.2.1. Threatened and Red listed Reptile and Amphibian Species

The study site falls outside the natural range or has no suitable habitat for the Nile crocodile or the Southern African python. These species should not occur on the study site.

Neither the coppery grass lizard nor the striped harlequin snake has not been recorded in the quarter degree square of the site. The study site is disturbed and due to different anthropogenic factors like overgrazing, grass cutting and regular burning of the veld, these two species should not occur on the site. There are also no moribund termitaria on the site, the most likely place where the striped harlequin snake could be found.

There are no temporary pans/dams on the site which could provide breeding habitat for the giant bullfrog. Giant bullfrogs need temporary dams in order to avoid predation from fish.

It is important to note that in the latest literature (Mersey (ed.) 2011 and Carruthers & Du Preez 2011); the giant bullfrog's status has changed officially from Near Threatened (Minter et al, 2004) to Least Concern in South Africa. In Gauteng, South Africa, the decline in numbers has led to the species being regarded as a conservation concern (Du Preez & Carruthers, 2017).

The study site forms part of the distribution range of Species 7 distribution range. Species 7 prefers rocky hillsides and rocky outcrops (Boycott & Bourquin, 2000). There is limited rupicolous habitat on the site, but this species could occur on the study site.

6.2.2. Expected and Observed Herpetofauna Species Richness

Of the 54 reptile species which may occur on the study site (Table 29), two were confirmed during the site visit (Table 30) and of the 24 amphibian species which may possibly occur on the study site (Table 29), none were confirmed during the site visit (Table 30). Table 29 lists the reptiles & amphibians which were observed on or deduced to occupy the site.

The American red-eared terrapin (*Trachemys scripta elegans*) and the Brahminy blind snake (*Ramphotyphlops braminus*) are the only two feral reptile or amphibian species known to occur in South Africa (De Moor and Bruton, 1988; Picker and Griffiths, 2011), but with only a few populations, they are not expected to occur on this particular site.

The species assemblage is typical of what can be expected of habitat that is severely disturbed, but with sufficient habitat to sustain populations. Most of the species of the resident diversity (Table 29) are fairly common and widespread (viz. Peters' thread snake, rhombic night adder, common house snake, mole snake, Cape gecko, speckled rock skink, variable skink, guttural toad, red toad and Boettger's caco).

The species richness is poor to fair due to the fairly small size and the disturbed nature of the site.

Table 29: Reptile and Amphibian diversity. The species observed or deduced to occupy the site. Systematic arrangement and nomenclature according to Branch (1998), Minter, et.al (2004), Alexander & Marais (2007), Bates et.al (2014) and Du Preez & Carruthers (2017). The Reptile and Amphibian species observed on or deduced to occupy the site.

	Scientific Name	**English Name**
	CLASS: REPTILIA	**REPTILES**
	Order: TESTUDINES	**TORTOISES & TERRAPINS**
	Family: Testudinidae	Tortoises
?**Vu**	*Kinixys lobatsiana*	Lobatse Hinged-Back Tortoise
	Order: SQUAMATA	**SCALE-BEARING REPTILES**
	Suborder:LACERTILIA	**LIZARDS**
	Family: Gekkonidae	**Geckos**
?	*Hemidactylus mabouia*	Common Tropical House Gecko
?	*Lygodactylus capensis capensis*	Common Dwarf Gecko
*	*Pachydactylus affinis*	Transvaal Gecko
√	*Pachydactylus capensis*	Cape Gecko
	Family:Lacertidae	**Old World Lizards or Lacertids**
*	*Ichnotropis capensis*	Ornate Rough-Scaled Lizard
?	*Nucras holubi*	Holun's Sandveld Lizard
?	*Nucras intertexta*	Spotted Sandveld Lizard
?	*Nucras lalandii*	Delalande's Sandveld Lizard
?	*Nucras ornata*	Ornate Sandveld Lizard
?	*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Lizard
	Family: Cordylidae	
*	*Cordylus vittifer*	Common Girdled Lizard
	Family: Gerrhosauridae	**Plated Lizards**
√	*Gerhosaurus flavigularis*	Yellow-throated Plated Lizard
	Family: Scincidae	**Skinks**
?	*Acontias gracilicauda*	Thin-Tailed Legless Skink
√	*Afroablepharus wahlbergii*	Wahlberg's Snake-Eyed Skink
?	*Mochlus sundevallii sundevallii*	Sundevall's Writhing Skink
√	*Trachylepis capensis*	Cape Skink
√	*Trachylepis punctatissima*	Speckled Rock Skink
?	*Trachylepis varia*	Variable Skink
	Family: Chamaeleonidae	**Chameleons**
?	*Chamaeleo dilepis dilepis*	Common Flap-Neck Chameleon
	Family: Agamidae	**Agamas**
√	*Agama aculeate distanti*	Eastern Ground Agama
*	*Agama atra*	Southern Rock Agama

	Scientific Name	English Name
	Suborder: SERPENTES	**SNAKES**
	Family: Typhlopidae	**Blind Snakes**
*	*Afrotyphlops bibronii*	Bibron's Blind Snake
	Family: Leptotyphlopidae	**Thread Snakes**
√	*Leptotyphlops scutifrons scutifrons*	Peter's Thread Snake
	Family: Pythonidae	**Pythons**
?	*Python natalensis*	Southern African Python
	Family: Viperidae	**Adders**
√	*Bitis arietans*	Puff Adder
√	*Causus rhombeatus*	Rhombic Night Adder
	Family: Lamprophiidae	
*	*Aparallactus capensis*	Black-headed Centipede Eater
?	*Atractapis bibronii*	Bibron's Stiletto Snake
√	*Boaedon capensis*	Common House Snake
?	*Lamprophis aurora*	Aurora Snake
√	*Lycophidion capensis capensis*	Cape Wolf Snake
√	*Psammophis brevirostris*	Short-snouted Grass
?	*Psammophis crucifer*	Cross-Marked Grass Sake
?	*Psammophis trinasalis*	Fork-Marked Sand Snake
√	*Psammophylax rhombeatus rhombeatus*	Spotted Grass Snake
?	*Psammophylax tritaeniatus*	Striped Grass Snake
√	*Prosymna sundevallii*	Sundevall's Shovel-Snout
√	*Pseudaspis cana*	Mole Snake
	Family: Elapidae	**Cobras, Mambas and Others**
√	*Hemachatus heamachatus*	Rinkhals
?	*Naja mossambica*	Mozambique Spitting Cobra
	Family: Colubridae	
*	*Crotaphopeltis hotamboeia*	Red-Lipped Snake
√	*Dasypeltis inornata*	Southern Brown Egg-Eater
√	*Dasypeltis scabra*	Rhombic Egg Eater
	CLASS: AMPHIBIA	**AMPHIBIANS**
	Order: ANURA	**FROGS**
	Family: Pipidae	**Clawed Frogs**
?	*Xenopus laevis*	Common Platanna
	Family: Bufonidae	**Toads**
√	*Sclerophrys gutturalis*	Guttural Toad
?	*Sclerophrys capensis*	Raucous Toad
*	*Schismaderma carens*	Red Toad
	Family: Hyperoliidae	**Reed Frogs**

	Scientific Name	English Name
?	*Kassina senegalesis*	Bubbling Kassina
	Family: Phrynobatrachidae	**Puddle Frog**
?	*Phrynobatrachus natalensis*	Snoring Puddle Frog
	Family: Pyxicephalidae	
?	*Amietia delalandii*	Common River Frog
√	*Cocosternum boettgeri*	Boettger's Caco
?	*Tomopterna cryptotis*	Tremolo Sand Frog
?	*Tomopterna natalensis*	Natal Sand Frog

Systematic arrangement and nomenclature according to Branch (1998), Alexander & Marais (2007), Minter, et.al (2004), Bates, et.al 2014 and Du Preez & Carruthers (2017).

Red Data species rankings as defined in Branch, The Conservation Status of South Africa's threatened Reptiles': 89 – 103. In:- G.H.Verdoorn & J. le Roux (editors), 'The State of Southern Africa's Species (2002) and Minter, et.al, Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, NT = Near Threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 30: Reptile and Amphibian species positively confirmed on the study site, observed indicators and habitat.

Scientific Name	English Name	Observation Indicator	Habitat
Trachylepis punctatissima	Speckled Rock Skink	Sight record	Man-made rupicolous habitat and exotic trees
Trachylepis varia	Variable Skink	Sight record	Natural rupicolous habitat

The speckled rock skink and variable skink should be abundant or common on the study site and elsewhere in its range.

6.3 Avifaunal Habitat Assessment

One of the primary reasons for conserving avifaunal species is that they are environmental indicators. Being a very mobile fauna, they move from less favourable environments to more favourable ones and are the first to respond to any environmental change, whether positive or negative. One of the difficulties with human-induced environmental change is that it can often be many years before the full, long-term effects of a particular action become apparent. However, avifaunal species are quick to colonize optimal environments and to leave poor or degraded ones.

Some avifaunal species are habitat-specific or have very definite biological or ecological requirements, such as specific breeding, roosting or foraging habitat systems. These avifaunal species may not be able to move on and so often become threatened species, especially if their preferred habitat continues to shrink or degrade due to various impacts, which could include change in land-use or water regimes,

altered weather patterns, and impacts such as overgrazing, bush encroachment, afforestation, desertification, human development and the general transformation of natural vegetation due to urbanisation, mining and industrialisation. The number of threatened species in an area is therefore an indication of its general environmental health. Avifaunal species are very sensitive to environmental change and when deciding on whether a habitat is suitable, avifaunal species consider things such as the arrangement of vegetation, spaces between the foliage in trees and so on. Because of this sensitivity to their surroundings, avifaunal species can also be used as indicators to determine the health of existing areas. The presence or absence of certain avifaunal species (not only threatened species but also the more common grassland or wetland species) can give an immediate indication of the quality of the habitat system, such as water quality, depending on particular species individual requirements. This is however a long-term process and the presence of these avifaunal species in a certain area can only be determined over a period of time and during different seasons. The availability of suitable habitat is just as important due to the rate that these habitats are being transformed not only for threatened avifaunal species but also species that are habitat specific such as endemic and near-endemic avifaunal species.

Some avifaunal species will favour a specific habitat type such as river and riparian vegetation or open grassland while other bird species will make use of more than one habitat system such as riparian vegetation and other woodland vegetation. Some avifaunal species are able to adapt to areas change by man while other are very sensitive to human disturbance and areas transformed by man.

Five major avifaunal habitat systems were identified within the study area (Figure 13). A short description of each habitat type follows, ranked from most to least important. These habitat systems are as follows:

- Wetlands, drainage lines and dams
- Open grassland
- Cultivated fields, disturbed grassland, fallow fields, and pastures
- Mixed alien and indigenous vegetation
- Disturbed and transformed area

Table 31 indicates the extent of habitat systems within the study area in terms of surface area and percentage.

Table 31: Avifaunal habitat composition of the study area

Avifaunal Habitat Systems	Area (ha)	%
Wetlands, drainage lines and dams	±6.8004	2
Open Grassland	±141.5981	36
Cultivated fields, disturbed grassland, fallow fields, and pastures	±173.5391	43

Mixed alien and indigenous vegetation	±57.3302	14
Disturbed and transformed areas	±21.3256	5
Total surface Area:	±400.5934	

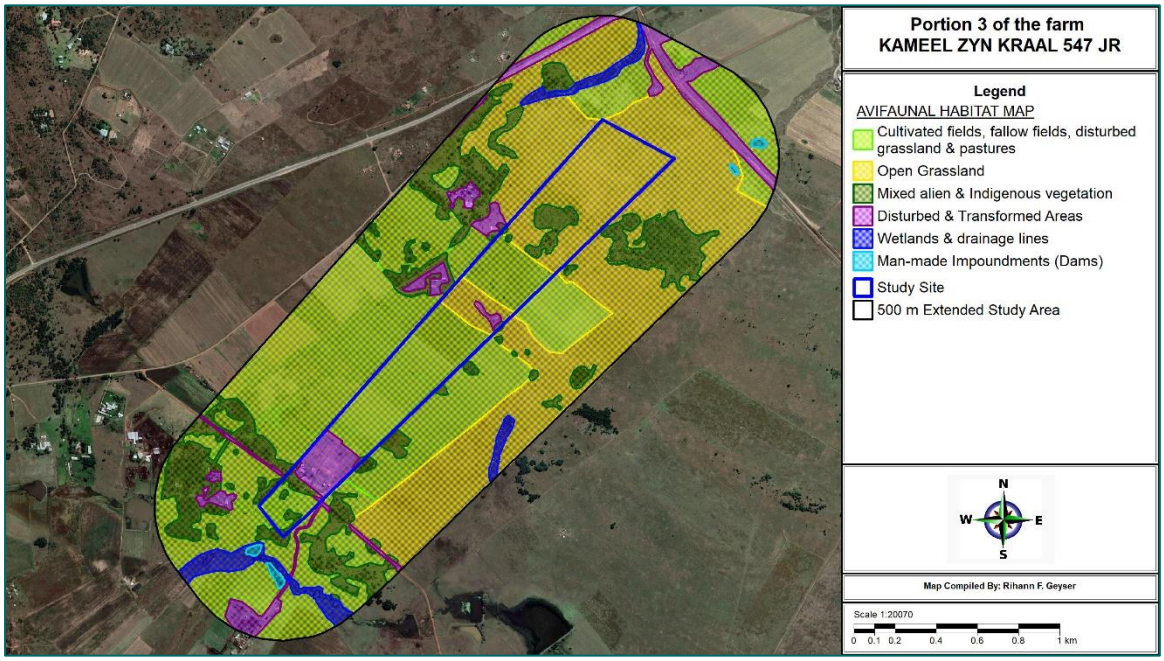


Figure 13: Avifaunal species habitat systems identified on the study site and within the study area.

A short description of each habitat system follows, ranked from most to least important.

6.3.1. Wetlands, drainage lines and man-made impoundments (dams)

Approximately 2% of the total surface area of the study area consists of small seasonal wetlands, drainage lines and dams or man-made impoundment (artificial wetlands). None of these wetland systems are present within the footprint area of the study site and are situated within the 500 m e.s.a. to the north, east and south of the study site.

The drainage line to the north and east of the study site were “dry” during the time of the habitat site survey. These wetlands are non-perennial wetland systems and only become water filled during the high rain season in summer and are too small to support populations of species on conservation concerns during optimal wet conditions. Except for taller grass and weeds that grow within the drainage lines within the dry season, the vegetation within the drainage line does not differ significantly from the surrounding grassland in terms of avifaunal habitat and the avifaunal species diversity will not differ significantly from each other. A wetland system runs past the southern border of the 500 m e.s.a. to the south of the study site but most of this wetland system is situated outside the 500 m e.s.a.

The wetland system bordering the study site does not offer optimal habitat conditions for any Red Data avifaunal species and only the more common aquatic and semi-aquatic avifaunal species that are able that adapt to areas changed by man are likely to make use of this habitat system.

Sensitivity: All wetlands are considered sensitive. The aquatic systems as delineated by an aquatic specialist and its buffers should be regarded as of high sensitivity.

6.3.2. Open grassland

Approximately 36% of the surface area of the study area consists of open highveld grassland on the slopes of low rocky outcrop. These areas form part of the Rand Highveld Grassland vegetation unit and extends to the north and east of the study area. Rocky ridge gives a typical impression of rocky highveld grassland, and they also protect some low woody plants from fire.

Open grassland is the most important habitat type for South Africa's threatened bird species in the region with a proportional importance of 27%. The highest diversity of threatened bird species occurs within this grassland habitat, many of which are under the highest categories of threat (Barnes 2000).

The presence and abundance of bird species in this habitat will vary from season to season - lush and green in summer after summer rains and dry, brown, frosted or burnt during winter. The habitat favours ground-living bird species, such as lapwings, francolins, pipits, longclaws, larks and chats. These birds hunt for insects and/or breed on the ground, in burrows in the ground, or between the grasses. Weavers and widowbirds make use of such habitat for feeding on ripe seeds during late summer and early winter when the grass is not burnt, and widowbirds and cisticolas will also breed in the tall grass during summer. Species such as weavers and bishops that breed in the wetland habitat during summer will also make use of the open grassland habitat for feeding during winter after the grasses have seeded. Aerial feeding birds such as martins, swifts and swallows will also hunt for insects over the grasslands.

Sensitivity: This habitat system form part of the Rand Highveld Grassland vegetation unit (Mucina and Rutherford, 2006) which is considered as an endangered vegetation unit. In terms of avifaunal biodiversity this habitat will support a variety of typical highveld grassland bird species. This area is undergoing rapid transformation due to human related disturbances and land transformation. This open grassland in combination with bordering fallow fields and pastures to the north and east of the study site will favour species of conservation concern especially Secretary bird (*Sagittarius serpentarius*). This grassland area form part of the western boundary of suitable open grassland habitat for this species that stretched from here to the north and east towards the Bronkhorstspruit Dam to the east of the study area. The open grassland to the north and east of the study site should be regarded as of very high sensitivity.

6.3.3. Cultivated fields, disturbed grassland, fallow fields and pastures

Approximately 43% of the surface area of the study area consists of agricultural croplands, disturbed grassland, fallow fields and pastures (secondary grassland).

Agriculture is a major environmental problem for threatened and habitat specific avifaunal species, especially for species that depend on grassland for survival. The tilling of soil for cultivated fields is one of the most drastic and irrevocable alternations wrought on natural systems, destroying the structure and species composition of the natural vegetation (Barnes, 1998). This disturbance is mainly permanent and thereby has a massive impact on the taxa that are dependent on that vegetation. Bird species that are able to exploit monoculture and cultivated crops or by-product of cultivation such as bare ground may benefit temporarily.

The conversion of grassland into cultivated fields has a negative impact on natural grasslands. Seed-eating bird species (granivorous species), such as queleas, doves and bishops, largely benefit from maize, wheat and other cereals as their seeds supply food in large quantities. Many of these species flock in large numbers on to these fields and become pests to farmers, and weeds that grow on cropped and/or fallow fields also supply abundant seeds. The birds least likely to be affected by this transformation of grassland to cultivated fields are smaller species that are able to persist in small fragmented remnants of the undisturbed grassland habitat. The larger species with larger home ranges are most likely to show disrupted patterns of distribution (Barnes, 1998). The only species that will benefit from the current state of this disturbed habitat are bishops, widowbirds, waxbills, cisticolas and prinias, that forage and breed within the grass but feed among the plants that have been established on these cultivated fields. Aerial feeding birds such as martins, swifts and swallows will hunt for insects over these cultivated fields, and some Red Data species such as the Blue Crane, and White-bellied and Blue Korhaan, have been observed to forage and breed on or adjacent to agricultural land and fields (Barnes, 2000).

As with the open grassland habitat system mentioned above, the presence and abundance of bird species in this habitat will vary from season to season - lush and green in summer after summer rains and dry, brown, frosted or burnt during winter. The habitat favours ground-living bird species, such as lapwings, francolins, pipits, longclaws, larks and chats. These birds hunt for insects and/or breed on the ground, in burrows in the ground, or between the grasses. Weavers and widowbirds make use of such habitat for feeding on ripe seeds during late summer and early winter when the grass is not burnt, and widowbirds and cisticolas will also breed in the tall grass during summer. Species such as weavers and bishops that breed in the wetland habitat during summer will also make use of the open grassland habitat for feeding during winter after the grasses have seeded. Aerial feeding birds such as martins, swifts and swallows will also hunt for insects over the grasslands.

Sensitivity: Only the more common grassland avifaunal species are likely to make use of this habitat system. The species are species that are able to utilize fragmented disturbed or secondary grassland patches between disturbed and transformed areas and are not sensitive to the surrounding human disturbances. However, some species of conservation concern are known to foraging within agricultural cropland patches within and surrounding open grassland areas. Some of the areas should be regarded as of medium sensitivity to act as a buffer area between the disturbed and transformed areas and the sensitive open grassland habitat system.

6.3.4. Mixed alien and Indigenous Vegetation

Approximately 14% of the surface area of the study area consists of mixed alien and indigenous vegetation. Most area within this habitat system are dominated by alien an exotic trees such as *Acacia mearnsii (*Wattle), *Eucalyptus* spp and other invasive vegetation. Apart from agricultural practices, alien vegetation has invaded large areas of natural grassland vegetation.

This habitat system will favour avifaunal species that have adapted to alien vegetation such as species typically associated with alien woodland habitat. This area generally includes a variety of arboreal passerines such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and weavers and arboreal non-passerines such as doves, cuckoos, woodpeckers.

Sensitivity: Many indigenous avifaunal species has adapted to alien and exotic vegetation and as a result has increased their distribution range due the presence of these trees. Bush encroachment is previous open grassland areas has changed the species composition from grassland avifaunal species to woodland dominant species. This habitat system is constantly changing. This habitat can be regarded as of low sensitivity.

6.4. Disturbed and Transformed Areas

The rest of the study area ±5% is disturbed and consists of development and human related infrastructure as well as areas that has been transformed by past and present human activities. In general, these areas include built-up areas, graded area, roads, railways, areas with severe dumping and areas that are overgrown by alien vegetation.

Sensitivity: Only the more common avifaunal species that are able to adapt to areas changed by man will make use of this habitat system. None of these species that occur within this habitat system are threatened. This habitat can be regarded as of low sensitivity.

6.5. Red Data Avifaunal Species

The following Red Data avifaunal species were recorded for the 2528DC q.d.g.c. according to the SABAP1 data (Harrison et al. 1997) and the current SABAP2 data more specifically the 2555_2830 pentad in which the study area is situated (sabap2.adu.org.za August 2021). These species include

species that were assessed as threatened during the 2000 assessment (Barnes, 2000) but are now assessed as least concern (LC) according to the 2015 assessment (Taylor et al, 2015).

Table 32: Red Data avifaunal species recorded during the SABAP1 and SABAP2 periods for the 2528DC q.d.g.c.

Scientific Names	English Names*	Reporting Rate (%)**		
		SABAP1	SABAP2	Pentad
Oxyura maccoa	Maccoa Duck (LC/NT)	1	1(n=7)	0
Coracias garrulus	European Roller (LC/NT)	0	1(n=7)	4(n=2)
Alcedo semitorquata	Half-collared Kingfisher (NT/NT)	0	3(n=21)	2(n=1)
Tyto capensis	African Grass Owl (VU/VU)	1	1(n=4)	0
Eupodotis caerulescens	Blue Korhaan (NT/LC)	2	11(n=89)	0
Eupodotis senegalensis	White-bellied Korhaan (VU/VU)	14	0	0
Anthropoides paradiseus	Blue Crane (VU/NT)	19	1(n=5)	0
Bugeranus carunculatus	Wattled Crane (CR/CR)	1	0	0
Rostratula benghalensis	Greater Painted-snipe (NT/VU)	1	0	0
Glareola nordmanni	Black-winged Pratincole (NT/NT)	0	3(n=24)	0
Sterna caspia	Caspian Tern (NT/VU)	4	10(n=82)	0
Circus ranivorus	African Marsh Harrier (VU/EN)	1	2(n=15)	0
Circus macrourus	Pallid Harrier (NT/NT)	0	1(n=11)	8(n=4)
Aquila verreauxii	Verreaux's Eagle (LC/VU)	7	2(n=14)	0
Polemaetus bellicosus	Martial Eagle (VU/EN)	0	<1(n=2)	0
Sagittarius serpentarius	Secretarybird (NT/VU)	9	3(n=21)	2(n=1)
Falco naumanni	Lesser Kestrel (VU/LC)	11	1(n=6)	0
Falco vespertinus	Red-footed Falcon (LC/NT)	1	2(n=15)	0
Falco biarmicus	Lanner Falcon (NT/VU)	0	1(n=5)	0
Falco peregrinus	Peregrine Falcon (NT/LC)	0	1(n=4)	0
Phoenicopterus ruber	Greater Flamingo (NT/NT)	1	7(n=57)	0
Phoenicopterus minor	Lesser Flamingo (NT/NT)	1	3(n=25)	0
Mycteria ibis	Yellow-billed Stork (NT/EN)	0	6(n=49)	0
Ciconia nigra	Black Stork (NT/VU)	1	<1(n=1)	2(n=1)
Ciconia abdimii	Abdim's Stork (LC/NT)	2	1(n=6)	0
Mirafra cheniana	Melodious Lark (NT/LC)	0	6(n=48)	16(n=8)
	TOTAL:	17	23	6

*Red data status according to Barnes (2000)/Red Data status according to Taylor *et al* (2015)

Latest bird names according to BirdLife South Africa Checklist of Birds in South Africa (2017)

**The reporting rate of SABAP1 and SABAP2 is calculated as follows: Total number of cards on which a species was reported X 100 ÷ total number of cards for a particular quarter degree grid cell.

The reporting rate for each species is the percentage for the q.d.g.c. according to the SABAP 1 atlas (Harrison *et al.* 1997) (and the current SABAP2) data and is represented by colour codes as follows: Yellow = Very Low, Light Orange = Low, Dark Orange

= Medium and Red = High. The colour codes of the SABAP2 reporting rate indicate the following; Red = decrease in reporting rate, Green = increase in reporting rate and Blue= stable reporting rate compared to the SABAP1 data.
Red Data avifaunal species categories: EX= Extinct (regionally), **CR** = Critically Endangered **EN** = Endangered, **VU =** Vulnerable, **NT =** Near-threatened, **LC =** Least Concern. (Taylor *et al* 2015).
Adhoc or **ind** = species seen incidentally while passing through the pentad. **"n"** = the number of times a certain species was recorded within a pentad since 1 July 2007.

A total of 26 Red Data avifaunal species have been recorded within the 2528DC q.d.g.c. during the SABAP1 period (Harrison et al. 1997) and the current SABAP2 period combined, 17 species during the SABAP1 period, 23 species during the current SABAP2 period and 6 species for the pentad (SABAP2) in which the study area is situated (sabap2.adu.org.za August 2021).

A total of 36% (n=9) of the Red Data avifaunal species or SCC recorded for the 2528DC q.d.g.c. indicate a decrease in reporting rate, 56% (n=14) species an increase in reporting rate and 8% (n=2) species remains stable.

6.5.1. Summary of the Red Data avifaunal species

Table 33 provides a list of the Red Data avifaunal species recorded for the 2528DC q.d.g.c. according to the SABAP1 data (Harrison et al. 1997) and the current SABAP2 data and an indication of their likelihood of occurrence within the study area based on actual sightings and habitat and food availability.

Table 33: Red Data avifaunal species assessment for the study site and study area according to the SABAP1 and SABAP2 data for the 2528DC q.d.g.c.

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
Oxyura maccoa (Maccoa Duck) (**LC/NT**)	**NONE** Prefers permanent wetlands in open grassland and semi-arid country (including fynbos, succulent Karoo, Nama Karoo) that support rich concentrations of benthic invertebrates (Hockey et al, 2005). Breeding habitat usually contains stands of young, emergent vegetation, mainly rushes and sedges (Hockey et al, 2005) and prefers small, shallow and nutrient-rich inland freshwater water bodies and will also take advantage of farm dams and man-made artificial impoundments and wetlands such settling ponds at sewer farms (Johnsgard and Carbonell, 1996). Maccoa Ducks will make use of larger water bodies with deeper water (Berruti et al. 2005). In KwaZulu-Natal, breeding recorded only at farm dams (Hockey *et al*, 2005).	Highly unlikely Due to a lack of suitable breeding, roosting and foraging habitat.
Coracias garrulus (European Roller) (**LC/NT**)	**NONE** Closed to very open savanna. Most common in open, broadleaved and *Acacia* woodlands with grassy clearings; least	Unlikely Might only pass through the area on rare

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	common in areas with less-developed woody cover (Hockey *et al*, 2005).	occasions to and from more suitable habitat surrounding the study site.
*Alcedo semitorquata** (Half-collared Kingfisher) (**NT/NT**)	**NONE** Half-collared Kingfishers are strictly water-associated kingfishers, requiring fast-flowing perennial streams and rivers and estuaries, usually offering secluded conditions and dense marginal overhanging vegetation (Maclean, 1993 & Turpie, 2005) They also frequents well-vegetated banks of lakes, dams, estuaries and coastal lagoons (Fry *et al*. 1988) and occasionally forages in salt water in the Eastern Cape Province (Maclean, 1993). They occur from sea-level to 2 000 m a.s.l. and are most frequent in broken escarpment terrain (Clancey and Herremans, 1997). This species is timid and inconspicuous, remains motionless for long periods, and is easily overlooked and is usually encountered single or in pairs (Taylor *et al*., 2015) and usually perches low down on the banks of rivers and streams, often on exposed roots, fallen trees over the river, as well as exposed rock and low overhanging tree branches. Despite its reported shyness it also occurs along small dams and wooded streams and canals in urban and suburban areas Taylor *et al*., 2015). Nests are constructed in vertical sand/earth banks usually 1.0 – 1.5 m (0.3 – 4.5 m) high, facing the water and with overhanging vegetation or tree roots to provide concealment (Tarboton *et al*. 1987, Tarboton, 2011, Taylor *et al*. 2015 & Harrison *et al.* 1997) Half-collared Kingfishers requires at least 1 km up and down stream of undisturbed river and riparian vegetation while breeding. Nesting tunnels may be used for successive broods and in successive years and egg-laying takes place from September to October, and occasionally in other months (Tarboton, 2011) if conditions are suitable. This species is largely sedentary but probably undergoes local movements off the central plateau with the decline of river run-off in the dry winter months (Clancey and Herremans, 1997). Their diet mainly consists of small fish (30-70 mm) as well as crabs, amphibians and aquatic invertebrates (Fry *et al.* 1988).	Highly unlikely Due to a lack of suitable breeding, roosting and foraging habitat.
*Tyto capensis** (African Grass Owl) (**VU/VU**)	**NONE** African Grass Owl are more concentrated in areas with rainfall between 700 and 800 mm per year (Tarboton and Erasmus,	Highly unlikely No suitable breeding, roosting and foraging

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	1998) and have been recorded at altitudes from sea-level to 1 900 m a.s.l. Occurs predominately in tall, rank grass or sedges associated with damp substrates such as permanent and non-perennial wetlands and streams (Tarboton et al., 1987 & Kemp 2005). Breeds mainly in permanent and seasonal vleis, which it vacates while hunting or during post-breeding although it will sometimes breed in any area of long grass, sedges or even weeds (Van Rooyen, pers comm.) and not necessarily associated with wetlands (Tarboton *et al*. 1987) although this is more the exception than the rule. It constructs a series of tunnels, caves and landing platforms around the nest and roost, and therefore requires tall grass that offers concealment from above, and has relatively rigid but pliable blades, such as the grass species *Imperata cylindrica* (Taylor *et al*., 2015). Along wetland edges, African Grass Owls may roost in close proximity to Marsh Owls, but are often outnumbered 10:1 by that species. The peak breeding season is from February to April which coincides with maximum grass cover (Taylor *et al*., 2015). Foraging mainly confined to tall grassland next to their wetland vegetation and rarely hunts in short grassland, wetlands or croplands nearby (Barnes, 2000). Mainly restricted to wet areas (marshes and vleis) where tall dense grass and/or sedges occur. Prefers permanent or seasonal vleis and vacates the latter when these dried up or are burnt. Roosts and breeds in vleis but often hunt elsewhere e.g. old lands and disturbed grassland although this is suboptimal habitat conditions (Tarboton *et al*. 1987). Being opportunistic hunters responsive to rodent outbreaks, African Grass Owls may hunt or even breed in sub-optimal habitats in years of high rodent abundance which include such habitats as sparse woodland (Mendelsohn, 1989), scattered thorn scrub with dense ground cover, old fields (Tarboton et al., 1987 & Kemp 2005) and planted pastures (CA Whittington-Jones pers obs in Taylor *et al*., 2015). In the Western Cape populations are found in low fynbos or renosterveld usually close to water and among thick stands of grass (*Stenotaphrum* sp) and sedge (*Juncus* sp)(Hockey et al, 2005). African Grass Owls in atypical habitats may represent wandering non-breeding adults or dispersing immature birds (Taylor *et al*., 2015).	habitat were identified on and surrounding the study site

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
Eupodotis caerulescens (Blue Korhaan) (VU/LC)	**YES** Occurs in flat undulating terrain in grassland and Nama Karoo, where rainfall 300-1 000 mm /a. Often on damp ground; sometimes attracted to burnt areas. Favours short vegetation; 61 % of 141 groups where vegetation ≤ belly height. At Wakkerstroom, Mpumalanga, abundance positively correlated with altitude, flat topography and burnt grassland. In Nama Karoo, 96% of 88 groups in natural vegetation, 2% in fallow fields, 1% in cultivated grass and pastures and 1% in lucerne pastures. At De Aar, Northern Cape, near western edge of range, only found close to large lucerne fields. Remains < 1 km from water (Hockey *et al*., 2005).	Likely This species was assessed as regionally Near Threatened in the 2000 (Barnes, 2000) assessment, but is now assessed as regionally Least Concern in the absence of data that indicate significant reduction in its range and numbers (Taylor *et al*., 2015).
*Eupodotis senegalensis** (White-bellied Korhaan) (VU/VU)	**YES** Occurs in fairly tall, dense grassland, especially sour and mixed grassland, in open or lightly wooded, undulating to hilly country. In winter, occasionally on modified pastures and burnt ground (Harrison *et al.* 1997a).	Likely The open grassland area to the north and east of the study site offers suitable habitat conditions for this species. This species was only recorded during the SABAP1 period and these are no current SABAP2 record for this species for the q.d.g.c in which study site is situated. Given the reporting rated for this species they are only likely to move through the area on rare conditions. Scarce in Gauteng and secretive resident; widespread (Marais & Peacock, 2008)
Grus paradisea * (Blue Crane) (VU/NT)	**SUBOPTIMAL** Blue Crane occurs in open dry-grassland in the midlands and highland of Kwazulu-Natal and in the ecotones between the Grassland and Nama Karoo, biomes (Hockey *et al*., 2005).	Unlikely The open grassland habitat offers suboptimal habitat conditions for

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	They are also regularly found in cultivated lands and edges of vleis (Maclean, 1993) especially in the Western Cape Province where they use a matrix of pastures and cereal croplands for mainly foraging purposes and moving between these biomes and habitat systems as food availability and breeding conditions changes during the progressing seasons (Allan, 1995). Nests in both moist situations in vleis which have short grass cover and in dry sites far from water, usually exposed places such as on hillsides; forages in grassland and cultivated and fallow lands; roosts communally in the shallow water of pans and dams (Tarboton *et al*. 1987). Short dry grassland, being more abundant and evenly disturbed in the eastern "sour" grassland, where natural grazing of livestock is the predominant land use. Prefers to nest in areas of open grassland (Barnes, 2000) In the fynbos biome it inhabit cereal croplands and cultivated pastures and avoids natural vegetation. By contrast, it is found in natural vegetation in the Karoo and grassland biomes, but it also feeds in crop fields (Harrison *et al*. 1997a).	this species but in combination with the open grassland areas to the north and east of the study site it could potentially offer suitable foraging habitat for this species. With a reporting rate of 1% (n=5) for the q.d.g.c. and 0% for the pentad, they are only likely to move through the area on rare occasions. Localised but common in the south-eastern Gauteng (Marais & Peacock, 2008)
Grus carunculata Wattled Crane (**CR/CR**)	**NONE** Fairly shallow wetlands with extensive short, emergent vegetation, especially sedges. Breeding populations in Zimbabwe and S Africa mostly in small, permanent, wetlands (S Africa > 1 000 m, Zimbabwe > 1 500 m) surrounded by grassland (S Africa, e Zimbabwe) or miombo (*Brachystegia*) woodland (c Zimbabwe) in high-rainfall areas with plateau topography. In Namibia, Botswana and Mozambique, on large, low-lying, tropical, seasonal flood plains. In Zimbabwe, 19 pairs bred at man-made dams, 9 in marshes, 8 in pans and 3 along streams. In KwaZulu-Natal, winter 2001, 59% of birds in natural wetlands, 16% in grasslands, 13% in harvested maize and winter pastures, and 12% at dams In S African survey 1985-1986, 44% at farm dams, 34% at vleis, 17% in natural dryland habitats and 5% in cultivated fields. Okavango Delta population concentrated on seasonal wetlands, moving to recently burnt ground in dry season.	Highly unlikely Due to a lack of suitable breeding and foraging habitat. This species is a rare winter visitor in the Devon area to the south–east of the study site and highly unlikely to make use of the habitat systems within the study areas.
Rostratula benghalensis (Greater Painted-snipe) (**NT/VU**)	**NONE** Dams, pans and marshy river flood plains. Favours waterside habitat with substantial cover and receding water levels with exposed mud among vegetation, departing when water recedes	Highly unlikely Due to a lack of suitable foraging habitat

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	beyond the fringes of vegetation. Rare in seasonally flooded grassland and palm savanna (Hockey *et al*. 2005).	Uncommon visitor and resident (Marais & Peacock, 2008)
Glareola nordmanni (Black-winged Pratincole) (**NT/NT**)	**SUBOPTIMAL** A non-breeding overland migrant to southern Africa. In southern Africa winter quarters, prefers open grassland, edges of pans and cultivated fields, but most common in seasonally wet grasslands and pan systems. Attracted to damp ground after rains, also to agricultural activities, including mowing and ploughing, and to newly flooded grassland (Hockey *et al*. 2005).	Highly unlikely With a reporting rate of 3% (n=24) and 0% for the pentad they are only likely to pass through the area on rare occasions such as during migration. Erratic summer migrant sometimes in large flocks (Marais & Peacock, 2008).
Sterna caspia (Caspian Tern) (**NT/VU**)	**NONE** Occurs along coast, mostly in sheltered bays and estuaries. Inland, at large water bodies, both natural and man-made, with preference for saline pans and large impoundments. Coastal breeding habitat primarily offshore islands, but with increasing use of sandy beaches and islands in salt works, where protection is offered. Inland, breeds on small, low islets in pans and dams (Hockey *et al*. 2005).	Highly unlikely Due to a lack of suitable foraging and breeding habitat. Non-breeding winter visitor to large water bodies in Gauteng (Marais & Peacock, 2008)
*Circus ranivorus** (African Marsh Harrier) (**VU/EN**)	**NONE** This species is dependant almost exclusively dependent on permanent wetlands both inland and coastal wetlands for breeding, feeding and roosting. It also hunts over drier floodplains, grassland, croplands and Fynbos where it preys mainly on small rodents as well as birds, reptiles, frogs and insects (Simmons in Hockey *et al*. 2005). Most highveld wetlands > 100 ha support a breeding pair (Tarboton & Allan 1984). Nests are usually placed in extensive reed beds often high above water although breeding has been recorded in adjacent sedges, Fynbos, scrub and agricultural field, but these are considered to be rare occurrences (Kemp and Kemp, 2006). Forages over reeds, lake margins, floodplains and occasionally even woodland. Almost entirely absent from areas below 300 mm of rainfall (Harrison et al., 1997a). Marsh, vleis, grassland (usually near water); may hunt over grassland, cultivated lands	Highly unlikely There are no suitable foraging, breeding or roosting habitat for this species on the study site. Declining resident of large vleis, occurs mainly in south-eastern Gauteng (Marais & Peacock, 2008)

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	and open savanna (Maclean, 1993). May utilise small wetlands 1-2 ha in extent for foraging, but larger wetlands are required for breeding (Barnes, 2000). Breeding adults are largely sedentary (Simmons in Hockey *et al*. 2005) with pairs often retaining the same territory year after year (Simmons, 1990) while juveniles disperse widely.	
Circus macrourus Pallid Harrier (**NT/NT**)	**SUBOPTIMAL** Grasslands associated with open pans or flood plains; also cropland	Unlikely The open grassland and bordering agricultural croplands and fallow fields could offers suitable foraging habitat for this species during their none-breeding range in summer. This species is only likely to move through the area ons occasions during their summer migration to the south.
Aquila verreauxii (Verreaux's Eagle) (**LC/VU**)	**NONE** Verreaux's Eagles prefer mountains and rocky areas with cliffs (Hockey *et al*. 2005). They are solitary nesters and build a massive stick structure on rocky outcrops or cliffs and more rarely in trees or on power pylons (Taylor *et al*., 2015) or tall telecommunication towers on top of mountains such as the Magaliesberg, Wonderboom, Gauteng (pers obs). Juveniles disperse from breeding areas, while adults show a strong fidelity to their breeding territories and the availability of prey seems to play a large role in breeding timing of and breeding density (Gargett & Mundy, 1990). They mainly breed from April with a single nestling fledging in October/November (Davies & Allan, 1997). Verreaux's Eagles feeds mainly on Rock Hyrax (*Procavia capensis*) although it is an opportunistic predator that will also prey on medium-sized mammals, large birds and carrion (Simmons in Hockey *et al*. 2005). Predation of hyrax varied from 70-180 hyraxes per pair per year and has been estimated to exceed 350 elsewhere (Gargett & Mundy, 1990). Paradoxically, the breeding performance of Verreaux's Eagle shows an inverse relationship with rainfall (Allan, 1988), as	Highly unlikely Due to a lack of suitable foraging habitat and the lack of the availability of their prime prey items. Only likely to move through the area on very rare occasions such as during dispersal or to and from more suitable habitat surrounding the study site.

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	more hyraxes become available to eagles when they are forced to move further from their refuges to find food during drought (Davies, 1994) and probably also during the winter season. Populations do not show good correlation with fluctuation in hyrax numbers because the eagles are able to switch to alternative prey items when hyraxes are scarce. Birds in the Strandveld on the West Coast rely heavily on Augulate Tortoises (*Chersina angulata*) and Molerats (*Cryptomus & Bathyergus* spp)(M Murgatryd unpubl. data). Mammals consists of between 81-99% of the prey remains found at 73 nests in western South Africa, with Rock Hyrax (*Procavia capensis*) being more important in Karoo (89%, n = 3 623) than in the Eastern Cape grassland-savanna (62%, n = 1 370) or fynbos (49%, n = 755). Other mammalian prey include Vervet Monkey (*Cercopithecus aethiops*), Chacma Baboon (*Papio ursinus*), canerats (*Thryonomys* spp), Dune Mole Rat (*Bathyergus suillus*) bushbabies (*Galago* spp), bush squirrels (*Paraxerus* spp), hares (*Lepus* spp), rabbits (*Pronolagus* spp), African Porcupine (*Hystrix africaeaustralis*), African Wild Cat (*Felis lybica*), Grey Duiker (*Sylvicapra grimmia*), Klipspringer (*Oreotragus oreotragus*), Mountain Reedbuck (*Redunca fulvorfula*) and Springbok (*Antidorcas marsupialis*). Avian prey mostly consists of guineafowl, francolins and bustards, but also Egyptian Goose, Cape Vulture chicks, herons, Southern Bald Ibis chicks, Western Cattle Egret, Kelp Gull, doves (taken in flight) and (rarely) chickens. One juvenile repeatedly took fledgling Cape Cormorants from nest ledges at Cape Point, Western Cape. Occasionally takes snakes and lizards, especially monitor lizards (*Varanus* spp); also tortoises, broken open by dropping them from air onto rocks (Hockey *et al*. 2005).	
Polemaetus bellicosus (Martial Eagle) (**VU/EN**)	**NONE** Martial Eagles tolerates a wide range of vegetation types but seem to favour arid and mesic savannah but are also regularly found at forest edges and in open shrubland (Simmons in Hockey *et al*. 2005). They will occupy most habitats provided there are adequate tall trees or pylons for nesting and perching (Machange *et al*., 2005). They rarely occur in mountainous areas. Martial Eagles are known to nest on human-made structures, such as pylons and wind-pumps, and in alien trees (Tarboton & Allan, 1984). The ability to nest on such structures	Highly unlikely Due to a lack of suitable habitat and disturbance cause by the large scale development surrounding the study site. With a reporting rate of <1% (n=2) for the q.d.g.c. and 0% for the

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	may have increased densities in natural treeless parts of the Karoo, Namaqualand and Kalahari (Machange *et al*., 2005). In extensive areas of good natural habitat, such as the Kruger National Park (Kemp & Kemp, 1974), immatures are uncommon while adults and juveniles are seen regularly (Kemp & Begg, 2001), suggesting that breeding pairs dominate the best habitat and immatures have to disperse elsewhere to mature. Declining sightings in the Kruger National Park suggests that adult recruitment may be falling because dispersal areas for immatures have become population sinks with reduced survival and therefore falling recruitment (Taylor *et al*., 2015). They are found in open grassland, scrub, Karoo, agricultural lands and woodland, It relies on large trees (or electricity pylons) to provide nest sites (Barnes, 2000) as well as windmills and even cliffs in treeless areas. It occurs mainly in flat country and is rarer in mountains, and it also avoids extreme desert, and densely wooded and forested areas (Harrison *et al*. 1997a & Barnes, 2000).	pentad, this species is only likely to move through the area on rare occasions. Uncommon local resident (Marais & Peacock, 2008)
*Sagittarius serpentarius** (Secretarybird) (**NT/VU**)	**YES** Secretarybirds prefers open grassland and scrub, with ground cover shorter than 50 cm and with scattered trees as roosting or nesting sites, shrubland, open *Acacia* and *Combretum* savannah (Hockey *et al*. 2005). They avoid forests, densely wooded areas, Mountain Fynbos, very rocky, hilly and mountainous woodland areas (Hockey *et al*. 2005 & Barnes, 2000). They can found from sea-level to montane grassland over 2 000 m a.sl. They normally occur single or in pairs, although groups of up to 50 have been recorded at waterholes in arid areas (Herholdt & Anderson, 2006). Nests are large, stick platforms usually built on top of isolated small to medium-sized flat-crowned *Vachellias* (*Acacia*) trees and will also make use of alien pines or wattles where indigenous thorny trees are not available (Tarboton, 2011) and such adaptive trails indicate that they may have the potential to exploit marginal conditions and therefor recover rapidly from population decline (Barnes, 2000) Nesting density only about 150 km^2/pair (n = 4, Kemp, 1995). Secretarybirds are indiscriminate predators of a great variety of small animals. The majority of the diet consists of invertebrates particularly Orthoptera (grasshoppers, locusts and crickets but will also prey on small mammals, birds, and their	<u>Unlikely</u> The open grassland to the north and east of the study area offers suitable foraging habitat for this species With a reporting rate of 3% (n=21) and 2% (n=1) for the pentad this species is only likely to move through the area on occasions to and from more suitable habitat to the north and east of the study site.

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	eggs, reptiles (including tortoises), amphibians and rodents (Taylor *et al*., 2015). Small prey items, include small tortoises, that is swallowed whole and larger items are held down with their feet and torn up with bill. They are attracted to recently burnt areas to feed on animals killed by fire, but does not eat carrion.	
*Falco naumanni** (Lesser Kestrel) (**VU/LC**)	**SUBOPTIMAL** Non-breeding Palaearctic migrant. Forages preferentially in pristine open grassland but also hunts in converted grassland such as small scale pastures provided the conversion is not as total as in plantation forestry or in areas of consolidated agricultural monoculture (Barnes, 2000; Hockey *et al*. 2005) such as maize, sorghum, peanuts, wheat, beans and other crops (Tarboton & Allan 1984) where they hunt for large insects and small rodents, but avoid wooded areas except on migration. They roost communally in tall trees, mainly *Eucalyptus*, in urban areas (Barnes, 2000), often in towns or villages, but also in farm lands (pers. obs). Favour a warm, dry, open or lightly wooded environment, and are concentrated in the grassy Karoo, western fringes of the grassland biome and southeast Kalahari. Generally avoids foraging in transformed habitats but occurs in some agricultural areas, including croplands, in fynbos and renosterveld of the Western Cape (Hockey *et al*. 2005). Large numbers congregate in sweet and mixed grasslands of the highveld regions.	Unlikely This species was assessed as regionally Vulnerable in the 2000 (Barnes, 2000) assessment, but it is now assessed as regionally Least Concern because it no longer approaches any of the thresholds for Vulnerable (Taylor *et al*., 2015)
Falco vespertinus (Red-footed Falcon) (**LC/NT**)	**SUBOPTIMAL** Gregarious; on non-breeding grounds (southern Africa), spends much of day in air, often at high altitude, but lower in mornings and evenings when hawking emergent insects. Frequently perches on dead trees, telephone poles and wires, and fence lines. Aggregates in late evening at communal roosts, sometimes containing 1 000+ birds. Settles at dusk, dispersing to foraging area at first light. In east of region, small numbers associate with large flocks of Amur Falcons and/or Lesser Kestrels. Flight graceful, with much gliding and soaring. European breeding population reduced by habitat loss and pesticide spraying.	Unlikely Due to a lack of suitable breeding habitat. Only likely to move through the area on rare occasions to and from more suitable foraging habitat surrounding the study site or during migration.
*Falco biarmicus** (Lanner Falcon) (**NT/VU**)	**SUBOPTIMAL** Most frequent in open grassland, open or cleared woodland, and agricultural areas. Breeding pairs generally favour habitats	Highly unlikely Due to a lack of suitable breeding and foraging

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	where cliffs are available as nest and roost sites, but will use alternative sites such as trees, electricity pylons and building ledges if cliffs are absent (Hockey *et al*. 2005). Mountains or open country, from semi desert to woodland and agricultural land, also cities (Maclean, 1993), even on forest-grassland ecotones. Generally a cliff nesting species and its wider distribution is closely associated with mountains with suitable cliffs. Able to breed on lower rock faces than Peregrine Falcon *Falco peregrinus* and also utilises the disused nests of other species, such as crows, other raptors and storks, on cliffs, in trees and on power pylons, and also quarry walls (Tarboton *et al*. 1987). Generally prefers open habitats e.g. alpine grassland and the Kalahari, but exploits a wide range of habitats – grassland, open savanna, agricultural lands, suburban and urban areas, rural settlements – in both flat and hilly or mountainous country. Also breeds in wooded and forested areas where cliffs occur (Harrison *et al*. 1997a).	habitat on and surrounding the study area. Only likely to move through the area on rare occasions to and from more suitable foraging habitat surrounding the study area. Uncommon resident in open areas in Gauteng (Marais & Peacock, 2008)
Falco peregrinus (Peregrine Falcon) (**NT/LC**)	**SUBOPTIMAL** Resident *F. p. minor* mostly restricted to mountainous riparian or coastal habitats, where high cliffs provides breeding and roosting sites. Breeding pairs prefer habitats that favour specialised, high speed, aerial hunting, e.g. high cliffs overhanging vegetation with raised and/or discontinuous canopy (e.g. forest, fynbos, woodland), or expanses of open water. Also uses quarries and dam walls, and frequents city centres, e.g. Cape Town, where tall buildings substitute for rock faces. Migrant *F. p. calidus* in more open country, often coastal, even roosting on ground on almost unvegetated salt flats.	Unlikely This species was assessed as regionally Near Threatened in the 2000 (Barnes, 2000) assessment, but given its vast global range, adaptability to urban environments and inaccessible breeding sites it is now considered as regionally Least Concern (Taylor *et al*., 2015)
*Phoenicopterus roseus** (Greater Flamingo) (**NT/NT**)	**NONE** Greater Flamingos occur in large flocks of up to tens of thousands, often with Lesser Flamingos. Movements take place at mostly at night and in response to inundation of ephemeral pans (Simmons in Hockey *et al*. 2005). Little is known regarding regional movements but apparent large influxes from East Africa occur during the breeding season, particularly to Sue Pan in Botswana (McCulloch & Borello, 1998). They feed on brine shrimps, brine flies, molluscs and diatoms by wading in water,	Highly unlikely Due to a lack of suitable foraging and breeding habitat,

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	bill upside down, filtering food from mud (Simmons in Hockey *et al*. 2005). Their main breeding sites in southern Africa are Etosha Pan and Sue Pan, but occasionally breeds at number of smaller wetlands in South Africa (Anderson, 2000) although these breeding attempts are often unsuccessful (Simmons in Hockey *et al*. 2005). Most of the recruitment to the South African population originates from Sua Pan. Breeding has been successful in South Africa at Lake St Lucia, De Hoop Vlei, Bredasdorp and several wetlands in the Northern Cape (Taylor *et al*., 2015). The species is a colonial nester, with hundreds to thousands of nests per colony and breeds in summer, after breeding areas are flooded (Taylor *et al*., 2015). Breeds at recently flooded, large, eutrophic wetlands (favoured foraging habitat), shallow salt pans; at other times, at coastal mudflats, inland dams, sewage treatments works, small ephemeral pans and river mouths (Hockey *et al*. 2005). Usually breeds colonially on mudflats in large pans (Harrison *et al*. 1997). Also in shallow pans, especially saline pans when they have water; also occasionally on other bodies of shallow water such as dams and vleis (Tarboton *et al.* 1987). Large bodies of shallow water, both inland and coastal; prefers saline and brackish water (Maclean 1993). Occasionally forages along sandy coasts.	
*Phoenicopterus minor** (Lesser Flamingo) (**NT/NT**)	**NONE** Primarily open, shallow eutrophic, wetlands and coastal lagoons and may occur on water bodies which are more saline and more alkaline than those used by *Phoenicopterus ruber* (Greater Flamingo). Breeds on saline lakes, salt pans and mudflats far out in pans and lakes (Harrison *et al*. 1997a). Non-breeding birds aggregate at coastal mudflats, salt works and sewage treatment works where salinities are high. Small, ephemeral freshwater wetlands very important for birds dispersing from breeding grounds (Hockey *et al*., 2005). Shallow pans, especially saline pans when they contain water (Tarboton *et al.*, 1987). Large brackish or saline inland and coastal waters (Maclean, 1993).	Highly unlikely Due to a lack of suitable foraging and breeding habitat. Mainly restricted to the south-western and south-eastern Gauteng (Marais & Peacock, 2008)
Mycteria ibis (Yellow-billed Stork) (**NT/EN**)	**NONE** Utilises diverse wetlands and permanent and seasonal habitats, including alkaline and freshwater lakes, river, dams, pans, flood plains, large marshes, swamps, estuaries, margins of lakes or rivers, flooded grassland and small pools or streams where	Highly unlikely Due to a lack of suitable habitat Common at large wetlands within

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	there are areas of shallow water free of emergent vegetation (Tarboton *et al.,* 1987); less often marine mudflats and estuaries (Hockey *et al*., 2005). Nests colonially on large trees adjacent to productive wetlands, but only locally and erratically during ideal conditions.	Gauteng; erratic elsewhere (Marais & Peacock, 2008)
*Ciconia nigra** (Black Stork) (**NT/VU**)	**NONE** The Black Stork is a solitary and associated with mountainous areas and build nests on suitable cliffs (Hancock *et al*., 2010) during winter which is an adaptation to take advantage of an abundance of prey in waterbodies with receding water levels (Siegfried, 1967). This species is mainly piscivorous which constitute 91% of their diet (Chevallier *et al*., 2008). Their piscivorous diet recoded consists of such species as Sharptooth Catfish (*Clarias gariepinus*), other catfish (*Clarias* spp), mud-fishes (*Labeo* spp), and Tigerfish (*Hydrocynus vittatus*). In Kuiseb River, Namibia, inferred to eat Mozambique Tilapia (*Oreochromis mossambicus*), Carp (*Cyprinus carpio*) and Chubbyhead Barb (*Barbus anoplus*) (all alien to the river system). They are absent or uncommon from seasonal pans that lack fish (Allan in Hockey *et al*., 2005). There is no correlation between the abundance of fish and site selected by Black Storks and suggests that selection of fishing areas are influenced by other factors such as human activities (Chevallier *et al*., 2008). The diet of nestlings differs from adult birds and mainly consists of amphibians and insects (Hampl *et al*., 2005). Amphibian prey species include Common Platanna (*Xenopus laevis*), Southern Pygmy Toad (*Bufo vertebralis*) and Cape Sand Frog (*Tomopterna* delalandi). Other diet include tadpoles, small mammals, nestling birds, small reptiles, including tortoises, large insects, larvae of Armyworms (*Spodoptera exempta*), and freshwater snails (Hockey *et al*., 2005). Black Storks mainly forages single and occasionally, in pairs or small groups in shallow water where they are readily found at dams, shallow pans and floodplains where they are readily found in their core distribution range and also make use of shallows of streams and rivers, pools in dry riverbeds, coastal estuaries and sometimes on marshland and flooded grassland and they are occasionally found on dry land (Hockey *et al*., 2005). Their nests are being predated by Verreaux's Eagle (*Aquila*	Highly unlikely Due to a lack of suitable breeding and foraging habitat

Species Name**	Presence Of Suitable Habitat and Habitat Requirements	Likelihood Of Occurrence on Study Site
	verreauxii) and Martial Eagle (*Polemaetus bellicosus*) as well as Chacma Baboon (*Papio ursinus*) (Cannell, 1991).	
Ciconia abdimii (Abdim's Stork) (**LC/NT**)	**SUBOPTIMAL** Abdim's Storks are non-breeding inter-African migrants that depart during May to August to their breeding ground in a wide band south of the Sahara from Senegal in the west to Ethiopia and Somalia in the east. Local movements occur throughout summer in response to food availability, especially rain-related insect irruptions. They depart to their breeding grounds from February to early April, exceptionally during the middle to late April. They gather in large flocks at staging areas, including Limpopo Province during mid-March. Occasionally overwinters in southern Africa. Abdim's Storks are mainly found in grassland, sparsely savannah woodland, edges of pans, pastures, cultivated land and suburban areas in groups of up to 100 birds (Anderson in Hockey *et al*., 2005). Prior to migration they occur in large groups of up to 10 000 birds. After good rains and during migration they also occur in semi-desert habitats, including Kalahari. Generally absent from wetlands, but uses rice paddies and marshes near Beira, Mozambique (Hockey *et al*., 2005).	Highly unlikely Only likely to move through the area on rare occasions. May on rare occasions forage on the agricultural cropland, fallow fields and pasture on and surrounding the study area. With a reporting rate of 1% for the q.d.g.c. and 0% for the pentad, this species is only likely to move through the area on rare occasions.
Mirafra cheniana (Melodious Lark) (**NT/LC**)	**YES** Occurs in grassland dominated by *Themeda triandra* grass in South Africa. Occasionally in planted pastures of *Eragrostis curvula* and *E. tef.* Avoids wet lowlands, favouring fairly short grassland (< 0.5 m), with open spaces between tussocks, at 550 – 1 750 m a.s.l. with annual rainfall of between 400 – 800 mm p/a (Hockey *et al*., 2005).	Likely This species was assessed as regionally Near Threatened in the 2000 (Barnes, 2000) assessment, but it is now assessed as regionally Least Concern (Taylor *et al*., 2015).

*Priority Red Data bird species according to GDARD.

**Red data status according to Barnes (2000)/Red Data status according to Taylor *et al* (2015)

Latest bird names according to BirdLife South Africa Checklist of Birds in South Africa (2016)

Red Data avifaunal species Categories: **EX**= Extinct (regionally), **CR** = Critically Endangered **EN** = Endangered, **VU** = Vulnerable, **NT** = Near-threatened, **LC** = Least Concern, **DD** = Data Deficient, **NR** = Not Recognised by BirdLife International, **LC** = Least Concern (Taylor *et al* 2015).

7 Surface water

The following information was extracted from the Aquatic ecosystem delineation (Limnology, 2021).

7.1 Ecoregion description

The site falls within the Highveld Ecoregion as described in the Level 1 Ecoregions by the Department of Water Affairs and Forestry (DWAF, 2005). The ecoregion is described by:

- Plains with a moderate to low relief, as well as various grassland vegetation types (with moist types present towards the east and drier types towards the west and south), define this high lying region.
- Several large rivers have their sources in the region, e.g. Vet, Modder, Riet, Vaal, Olifants, Steelpoort, Marico, Crocodile (west), Crocodile (east) and the Great Usutu. The level 1 description of the Water Management Area, as from DWAF, 2007 lists the system as part of the Crocodile (West) River and is characterized by the following:
- This is generally a low laying, dry to arid, hot region with virtually no perennial streams originating in the area itself. Perennial rivers that traverse this region include the Crocodile (west), Marico, Mokolo, Lephalala, and Mogalakwena.
- Mean annual precipitation: Low to arid.
- Coefficient of variation of annual precipitation: Moderately high to high
- Drainage density: Mostly low but with some areas in the north having a high drainage density.
- Stream frequency: Mostly low to medium, but high in north-eastern areas.
- Slopes <5%: Generally, >80% of the area.
- Median annual simulated runoff: Very low to low.
- Mean annual temperature: High to very high

7.2 Catchment description

The site lies in quaternary catchment B20C. The site lies near the Osspruit system as part of the Bronkhorstspruit drainage system. Figure 14 below for the Google Earth description of the site, as provided by the Department of Water Affair's Resource Quality Services (RQS) department.

7.2.1 DWAF (2014) Inventory

The Department of water and sanitation's inventory for the site was accessed using Google Earth (Figure 15). Reach 1211 of the A21C is listed as follows:

Present Ecological Status (PES): D

Ecological Integrity (EI): High

Ecosystem Services (ES): High

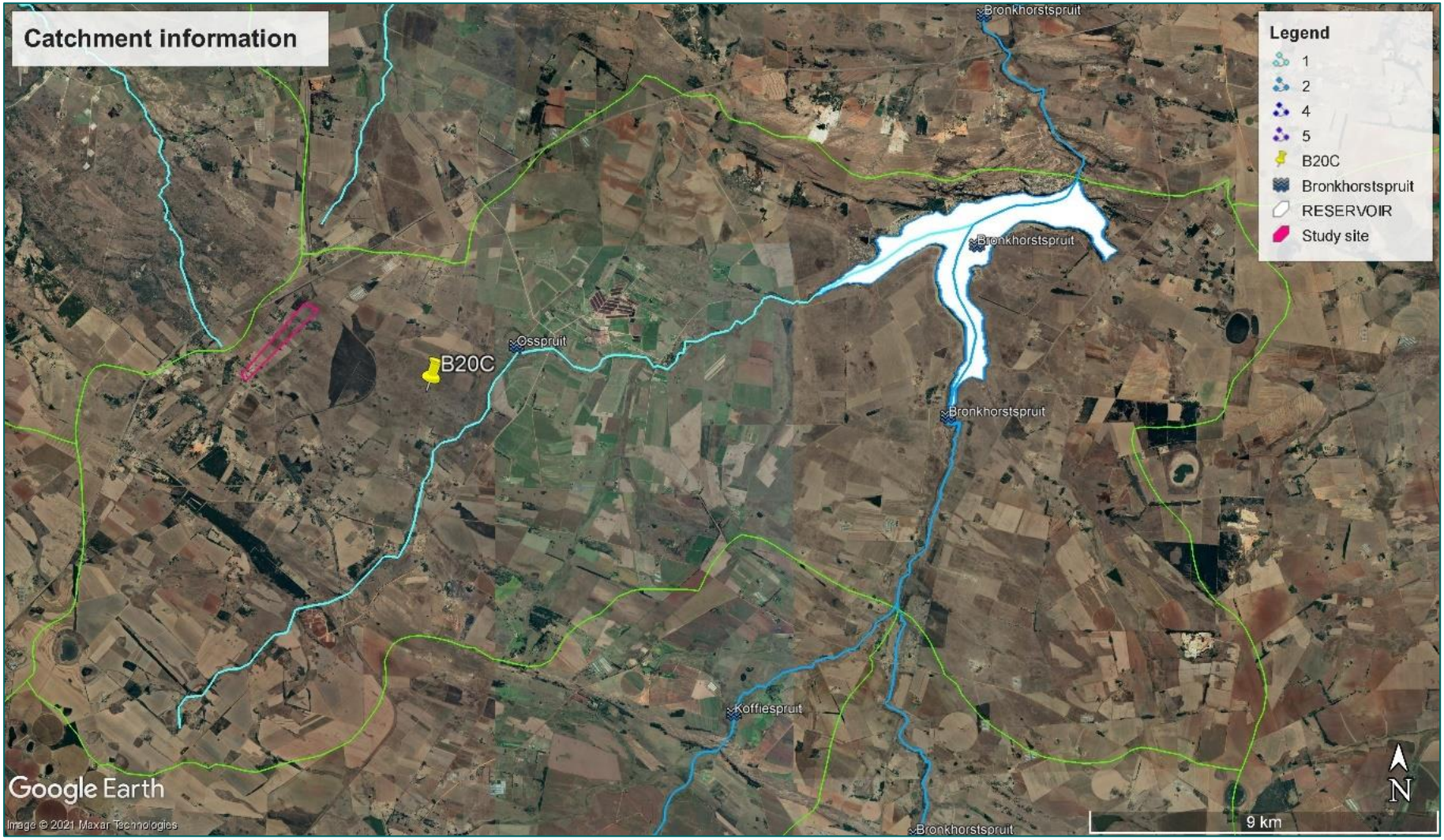


Figure 14: The Catchment and Hydrological Data For The Study Site, As Available From DWA RQS Services (Limnology, 2021)

Figure 15: DWS RQS Catchment Reach Inventory (Limnology, 2021)

7.2.2 Historical Images

Google Earth's Timeline function was used as reference imagery (Accessed June 2021). Google Earth imagery from 2004 (Figure 16) to mid-2020 (Figure 17) is available and was used to determine the historical land use and whether the site was extensively altered in the past or to detect large changes in the land use of the catchment. From these images the catchment of the site and the 500 m ESA remains relatively as in situ.

Figure 16: The Oldest Usable Google Earth Image Of The Site From 2004 (Limnology, 2021)

Figure 17: Google Earth Image From 2020 (Limnology, 2021)

No aquatic ecosystems were observed on site (Figure 19) however systems were observed within the 500 m ESA. These include seepage wetlands and channelled valley bottom wetland including impoundments. These systems will not be addressed in terms of PES and EIS as they are not directly on site. The assessment in this report will however address the issue of activities impacting on the aquatic ecosystems. These findings are consistent with the GN320 of NEMA findings of the site.

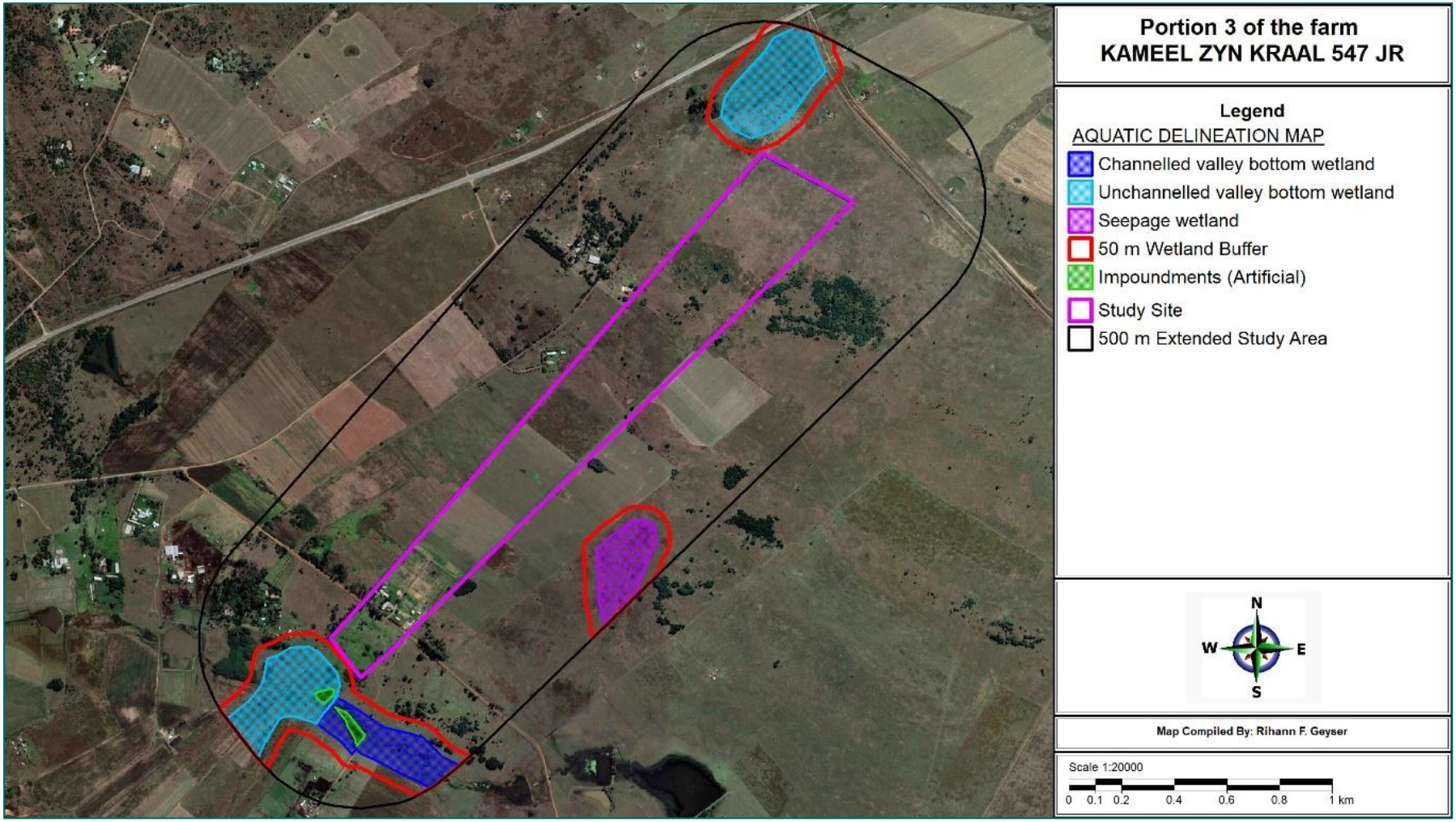


Figure 18: Aquatic Ecosystem Delineation (Limnology, 2021)

8 Groundwater

8.1 Regional geohydrology

Information for this section was extracted from the geohydrological assessment (Geovation (Pty) Ltd, 2021).

8.1.1 Aquifer Types and Borehole Yields

Groundwater occurrence favours weathered shale, brecciated or jointed zones and especially the contact zones between intrusive diabase sheets and shale. Based on the 1:500 000 Hydrogeological Map (2526), the average expected borehole yield range between 0.5-2 l/s. Barnard (2000) further states that the groundwater yield potential is classed as good on the basis that 40% of boreholes on record produce more than 2l/s and 22% produce more than 5l/s. Higher-yielding boreholes occur more often in association with the surface water drainage systems of the broad valley bottoms.

8.1.2 Depth to Groundwater

The static groundwater level generally occurs between 10 and 25m below surface.

8.1.3 Groundwater Recharge & Baseflow

The study area falls within quaternary catchment B20C. The mean annual precipitation and annual recharge figures for the study area is presented in Table 34. Vegter's (1995) recharge and baseflow maps were used to obtain a first estimate of regional recharge groundwater contribution to rivers and streams.

Table 34: Regional Rainfall, Recharge and Baseflow

Mean Annual Precipitation (mm):	718
Annual Recharge (mm):	50 - 75
Percentage Recharge of MAP:	6.9% - 10%
Annual Baseflow (mm):	10 - 25
Percentage Baseflow of MAP:	1.4% - 3.5%

8.1.4 Groundwater Quality

The groundwater quality can be described as good and suitable for any use with an average electrical conductivity (EC) value and pH value of 58 mS/m and 7.6 respectively.

8.1.5 Aquifer Vulnerability

The national scale Groundwater Vulnerability Map, which was developed according to the DRASTIC methodology (DWAF, 2005) and recompiled in 2013 was used to assess the aquifers underlying the site in terms of "Aquifer Vulnerability". Aquifer Vulnerability can be defined as *"the likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer"*.

The DRASTIC method takes into account the following factors:

- D = depth to groundwater (5)
- R = recharge (4)
- A = aquifer media (3)
- S = soil type (2)
- T = topography (1)
- I = impact of the vadose zone (5)
- C = conductivity (hydraulic) (3)

The number indicated in parenthesis at the end of each factor description is the weighting or relative importance of that factor.

Aquifer Vulnerability is rated as follows:

Green represents the least vulnerable region that is only vulnerable to conservative pollutants in the long term when continuously discharged or leached
Yellow represents the moderately vulnerable region, which is vulnerable to some pollutants, but only when continuously discharged or leached.
Red represents the most vulnerable aquifer region, which is vulnerable to many pollutants except those strongly absorbed or readily transformed in many pollution scenarios.

The vulnerability of the aquifers within the project area is rated as “moderately vulnerable to pollutants”.

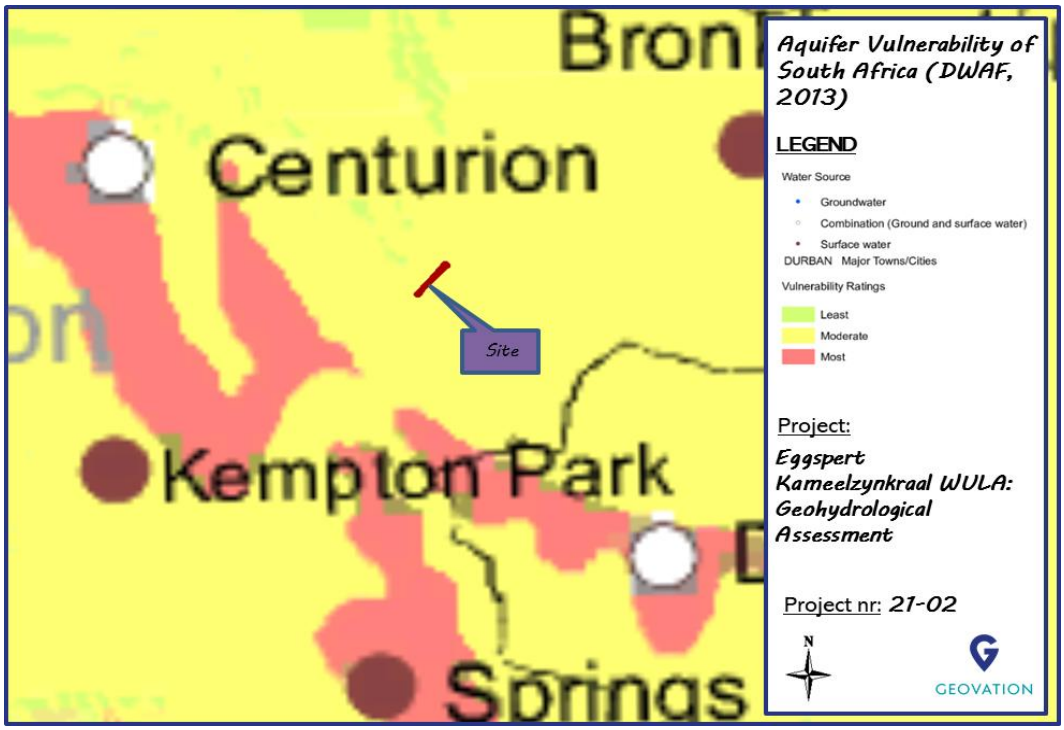


Figure 19: Regional groundwater vulnerability for the study area (DWAF, 2013).

8.2 Delineation of the Groundwater Resource Unit

A “Geohydrological Response Unit” (GRU), also referred to as a “Groundwater Resource Unit”, is defined as a groundwater system that has been delineated or grouped into a single significant water resource based on one or more characteristics that are similar across that unit. Criteria to map a GRU would include:

1. Areas of similar geology;
2. Groundwater elevations generally mimic surface topography, and groundwater flows from higher lying ground towards lower lying springs or valleys (drainage lines), therefore surface water catchment boundaries may be used as surrogate for groundwater divides;
3. Rivers/Streams acting as a constant head boundary;
4. Impermeable dykes/lineaments acting as no-flow boundaries; and lastly
5. Expert judgement and interpretation.

For this study area there are clear drainage features that enable the definition of a more localised aquifer (i.e. a GRU). The GRU for the underlying fractured aquifer has been defined using catchment boundaries and contacts between different geological units as shown in Map 2 in Appendix A of the original report:

- Topographical high to the north east and north west.
- Geological contact between Daspoort quartzite and Silverton shale to the south west.

The mapped GRU covers a total area of 348 ha.

8.3 Site Specific Assessment

8.3.1 Existing Groundwater Information

8.3.1.1 National Groundwater Archive Data

A desktop hydrocensus was carried out within the GMU as a minimum, but it extended to at least a one-kilometre search radius around the site boundaries. This was done to determine groundwater use in the area. A search of the National Groundwater Archive (NGA), which provides data on borehole positions, groundwater chemistry and yield, when available, was carried out to identify proximal boreholes. These sites are then typically verified in the field and provide background information on the area, should they exist.

Under circumstances where the coordinate accuracy of most of the boreholes enumerated in the NGA is not better than 10 000 m, their positions are at least constrained to the boundaries of the topocadastral farms on which they are located. The associated geohydrological data and information therefore provides only a broad overview of groundwater conditions rather than site-specific information.

A search to the NGA produced one borehole within a 1km radius from the site. The search radius was extended to a 5km radius and 11 boreholes were identified. A summary of the data contained in the

data base is presented in Table 35. The regional locations of the boreholes were not plotted due to inaccurate and multiple duplicated coordinates.

Table 35: Summary of data contained in the NGA

BH_ID	Latitude	Longitude	Date Constructed	Depth	Yield (l/s)	SWL (mbgl)
2528CD00119	-25.90202	28.46971	11/22/1973	73	1.8	7.00
2528CD00117	-25.90201	28.46971	1/15/1969	87	0.7	7.92
2528CD00115	-25.90200	28.46971	3/6/1975	132	0.2	15.00
2528CD00116	-25.90200	28.46972	1/8/1968	78	1.6	15.24
2528CD00118	-25.90200	28.46973	3/19/1975	103	0.2	10.00
2528CD00152	-25.90200	28.46974	2/22/1968	72	0.2	24.38
2526CD00001	-25.92001	28.50053	9/24/1986	35		25.44
2528DC00019	-25.91727	28.52471	7/5/1938	78	0.1	6.10
2528DC00013	-25.89506	28.51221	7/17/1933	22	1.2	10.97
2528DC00011	-25.89505	28.51221	8/21/1933	30		
2528DC00012	-25.89505	28.51222	8/9/1933	30	1.2	10.67
			Min	22	0.1	6.10
			Max	132	1.8	25.44
			Median	73	0.7	10.82

The median borehole yield and static water levels is in accordance with published data.

8.3.1.2 Water use Authorization & Registration Management System (WARMS)

WARMS data (updated 15 June 2021) was acquired for the study area to establish the volume of lawful groundwater use within the GRU. No registered groundwater users were listed within the delineated GRU. The search radius was increased to a 2km radius from the boundaries of the GRU and three registered groundwater users were identified (Table 36). The location of the registered groundwater users is presented in Map 3 in Appendix A of the original report.

Table 36: Registered Water Use within a 2km radius from Eggspert Kameelzynkraal.

WARMS nr.	Coordinates Decimal Degrees (WGS84)		Water Use	Registered Water Use (m3/a)
	Latitude	Longitude		
24042974	-25.91720	28.50803	Agriculture: Irrigation	3110
24043517	-25.94060	28.50970	Industry (non-urban)	1825
24057440	-25.94060	28.51970	Agriculture: Watering livestock	7300

8.3.2 Hydrocensus

A hydrocensus was conducted on 11 June 2021 to establish groundwater use within the larger project area. The hydrocensus extended to a maximum distance of ~1km from the site boundaries, except

where a river or a surface water body exist. The hydrocensus did not extend past such a feature as surface water bodies are usually hydraulically connected to an aquifer, act as a constanthead boundary and a groundwater pollution plume or cone of depression would theoretically not extend past a constant head boundary. Any information pertaining to the abstraction, yield and quality of groundwater was sought.

Apart from the five existing boreholes located within the site boundaries, an additional eleven boreholes were identified on neighbouring properties. A summary of the most important data pertaining to the boreholes are summarised in Table 11. The borehole locations are presented in Map 3 in Appendix A of the original report. From the hydrocensus data it can be concluded that that there is groundwater use within the GRU and that water is mainly used for domestic and small scale agricultural purposes (stock watering). An estimated 33.4 m^3/day (12 191 m^3/annum) of water is abstracted from the boreholes visited during the hydrocensus. Apart from limited seasonal fluctuations in groundwater levels (<10%, based on previous experience in similar geology and rainfall), groundwater yields will remain consistent, irrespective of the season. The groundwater information can therefore be gathered indeterminate of the season.

Table 37: Details of boreholes located within the site properties.

BH nr	Coordinates Decimal Degrees (WGS84)	Depth (m)	Yield (l/s)	Static water level (mbgl)	Equipment	Water Use	Property Owner
BH1	S 25.92597 E 28.51344	53.6	0.61	6.35	None	Agriculture	
BH3	S 25.91907 E 28.52226	51.1	0.27	17.10	None	Agriculture	
BH5	S 25.93573 E 28.50284	37.5	2.78	0	None	Agriculture	
BH-Dam	S 25. 92885 E 28.50967	31.8	0.30	4.88	Submersible Pump	Agriculture Domestic	
BH House	S 25.92959 E 28.50927	37.4	0.11	7.08	Submersible Pump	Agriculture Domestic	

Table 38: Details of boreholes located on neighbouring properties

BH nr	Coordinates Decimal Degrees (WGS84)	Depth (m)	Yield (l/s)	Static water level (mbgl)	Equipment	Water Use (Daily Use m^3)	Property Owner
HCBH1	S 25.91902 E 28.51727	96	0.19	11.13	Submersible Pump	Domestic (2.8)	

BH nr	Coordinates Decimal Degrees (WGS84)	Depth (m)	Yield (l/s)	Static water level (mbgl)	Equipment	Water Use (Daily Use m^3)	Property Owner
HCBH2	S 25.92481 E 28.50923	45	0.27	nm	Submersible Pump	Domestic (2.0)	
HCBH3	S 25.91704 E 28.51715	~	0.27	nm	Submersible Pump	Agriculture Domestic (3.0)	
HCBH4	S 25.93902 E 28.49860	~	~	2.12	Submersible Pump	Domestic (2.0)	
HCBH5	S 25.93589 E 28.50659	85	~	4.38	Submersible Pump	Agriculture Domestic (12.6)	
HCBH6	S 25.92801 E 28.50613	63	3	nm	Submersible Pump	Domestic Gardening (3.0)	
HCBH7	S 25.92999 E 28.50447	30	3	nm	Submersible Pump	Domestic Gardening (3.0)	
HCBH8	S 25.92848 E 28.50534	~	~	9.22	None	None	
HCBH9	S 25.93508 E 28.50048	~	3	1.8	None	Domestic (1.0)	
HCBH10	S 25.92905 E 28.50117	~	0.20	10.47	Submersible Pump	Domestic (2.0)	
HCBH11	S 25.92896 E 28.50134	~	0.20	10.41	Submersible Pump	Domestic (2.0)	

NOTE: In accordance with the Protection of Personal Information Act (Act No. 4 of 2013) cell numbers have been omitted from the table above.

8.3.3 Groundwater Flow Direction

Generally, groundwater elevations mimic surface topography, and groundwater flows from higher lying ground towards lower lying springs or valleys (drainage lines). Utilising 7 reliable static water table measurements within the project area, the correlation between surface topography and groundwater elevation (Figure 20) was established. A positive correlation of 86.5% between absolute surface and groundwater table elevations in meters above mean sea level (mamsl) is recognised for the wider project area. Groundwater elevations therefore mimic surface topography, and groundwater will flow from higher lying ground towards lower lying springs or valleys (drainage lines).

The inferred groundwater flow direction is indicated in Map 3 in Appendix A of the original report.

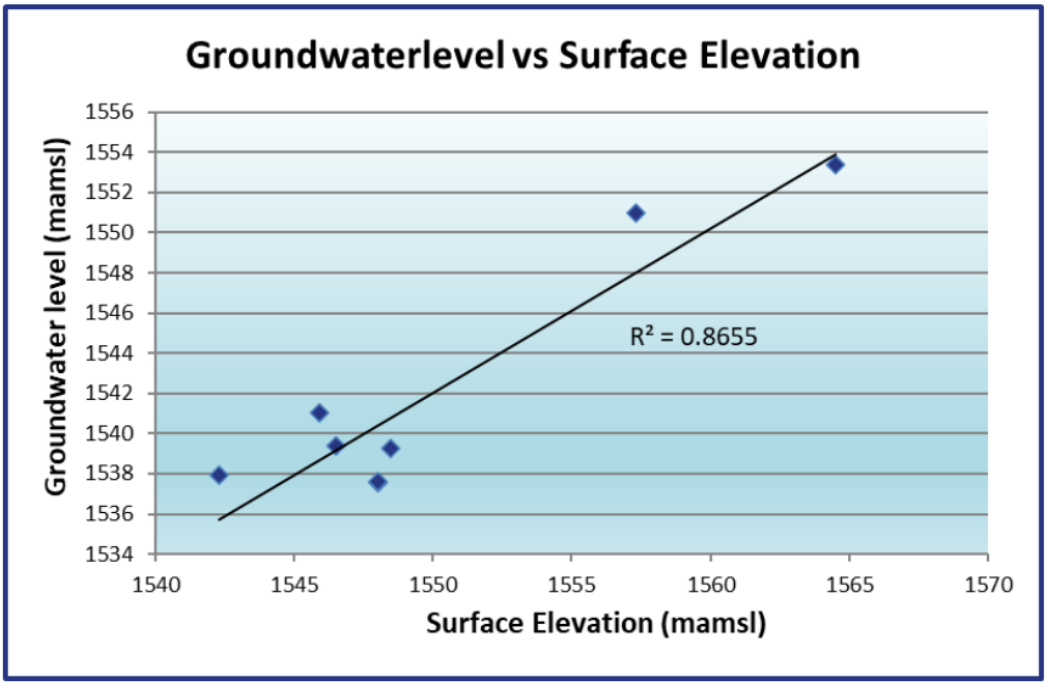


Figure 20: Graph showing correlation between surface elevation and static groundwater level (Geovation, 2021)

8.3.4 Test Pumping

8.3.4.1 Description of a Pumptest

The efficient operation and utilisation of a borehole requires insight into and an awareness of its productivity and that of the groundwater resource from which it draws water. This activity, which is also known as test pumping, provides a means of identifying potential constraints on the performance of a borehole and on the exploitation of the groundwater resource. It also provides data to calculate aquifer parameters such as Transmissivity (T) values.

The five proposed production boreholes were pump tested. The pumping tests were performed as per SANS 10299-4:2003 standards and included the following tests: (1) stepped discharge test followed by a (2) twenty-four-hour constant discharge test (CDT), and (3) recovery monitoring.

Stepped Discharge Test

Also known as a step drawdown test, is performed to assess the productivity of a borehole. It also serves to more clearly define the optimum yield at which the borehole can be subjected to constant discharge testing. The test involves pumping the borehole at three or more sequentially higher pumping rates each maintained for an equal length of time, generally not less than 30 minutes. The magnitude of the water level drawdown in the borehole in response to each of these pumping rates is measured and recorded in accordance with a prescribed time schedule.

Constant Discharge Test

A constant discharge test is performed to assess the productivity of the aquifer according to its response to the abstraction of water. This test entails pumping the borehole at a single pumping rate which is kept constant for an extended period of time. In this instance the boreholes were pumped for twenty four hours.

Recovery Monitoring

This test provides an indication of the ability of a borehole and groundwater system to recover from the stress of abstraction. This ability can again be analysed to provide information with regards to the hydraulic properties of the groundwater system and arrive at an optimum yield for the medium to long term utilisation of the borehole.

8.3.4.2 Results & Data Interpretation

The data acquired during the pump test was analysed and the sustainable yield of the tested borehole was calculated using the Flow Characterization Method (FC-Method) developed by the Institute for Groundwater Studies from the University of the Free State.

The FC-Method calculates the sustainable yield of a borehole by using derivatives, boundary information and error propagation. Data used for input into the software was obtained from the pumping test conducted on the borehole. As described above, a pump test basically entails continues monitoring of the water level over a given time while pumping water from the borehole at a constant pre-determined yield. After the pump has been switched off, continues measuring of the recovering water level takes place. The data was analysed to obtain a sustainable pumping yield.

The pumptesting data for the tested boreholes and FC-Solutions is presented in Appendix D of the original report. The calculated sustainable yield for the borehole together with the necessary information to equip the borehole is presented in Table 39.

Table 39: Management Recommendations for the tested borehole.

Borehole nr.	Coordinates (WGS84)		Depth (m)	Static Water Level (m)	#Dynamic WL (m)	Sustainable Yield (l/h) Pumping 12 hours/day	Proposed depth of pump installation (m)	Volume/day (m3)
	S	E						
BH1	25.92597	28.51344	53.6	6.35	18	2200	30	26.40
BH3	25.91907	28.52226	51.5	17.10	22	1000	28	12.00

Borehole nr.	Coordinates (WGS84)		Depth (m)	Static Water Level (m)	#Dynamic WL (m)	Sustainable Yield (l/h) Pumping 12 hours/day	Proposed depth of pump installation (m)	Volume/day (m3)
	S	E						
BH5	25.93573	28.50284	37.5	0.00	14	10000	30	120.00
BH-Dam	25.92885	28.50967	31.8	4.88	20	1100	25	13.20
BH-House	25.92959	28.50927	37.4	7.08	16	400	25	4.80
					TOTAL VOLUME/DAY (m^3)			**176.40**

 # Dynamic water level - Level at which the water level in the borehole stabilises after continuous pumping. To be used to calculate hydraulic heads when sizing submersible pumps.

A total volume of 0.064 Mm^3/annum of water can be abstracted from the tested boreholes.

8.3.5 Groundwater Quality

Groundwater samples were collected for analysis of the major ions and trace elements, as well as a microbial analysis during pumptesting of the production boreholes. Three water samples were also collected from boreholes visited during the hydrocensus and submitted for analysis of the major ions and trace elements. The laboratory reports are presented in Appendix E of the original report.

8.3.5.1 Water quality compared to SANS Drinking Water Standards

Water quality results were compared with the SABS drinking water standards (SANS 241-1:2015, edition 2) (Table 40). Water is classified unfit for human consumption if the Standard Limits are exceeded.

All of the parameters analysed for in borehole BH1 and the sampled hydrocenus boreholes comply with the SANS241 drinking water limits.

Elevated Turbidity, Fluoride and Total Coliforms exceeding SANS241 drinking water limits were reported in boreholes BH3, BH5, BH-Dam & BH House.

Table 40: Water quality results compared to SANS 241-1:2015 (edition 2) drinking water Standards

Sample nr.	BH1	BH3	BH5	BH-Dam	BH-House	HCBH2	HCBH5	HCBH7	Standard Limits
pH	7.65	7.00	7.87	6.53	7.32	8.22	8.41	8.10	5.0 - 9.7
EC	28	29	21	10	21	18	36	60	170

Sample nr.	BH1	BH3	BH5	BH-Dam	BH-House	HCBH2	HCBH5	HCBH7	Standard Limits
TDS	145	148	118	52	160	107	213	343	1200
T-Alk	136	136	107	40	89	100	190	212	~
Cl	0.6	3.4	0.0	4.2	6.1	1.8	7.4	51.6	300
SO_4	4.9	8.4	5.5	1.9	8.1	1.2	8.6	16.0	250
NO_3-N	1.27	0.45	0.00	1.08	1.66	1.86	0.68	9.16	11
NH_4-N	0.00	0.03	0.05	0.07	0.08	0.01	0.01	0	1.5
F	0.00	0.00	1.62	0.00	0.45	0.00	1.40	0.28	1.5
Ca	25.00	25.00	25.20	5.02	15.30	18.90	42.40	64.20	~
Mg	15.60	18.40	5.13	6.72	9.26	9.90	9.32	30.80	~
Na	9.11	6.32	12.80	4.34	13.40	5.54	23.80	10.20	200
K	1.06	1.24	0.94	0.32	1.09	0.61	0.94	0.38	~
Al	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3
Fe	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.3
Mn	0.00	0.08	0.10	0.04	0.02	0.00	0.04	0.00	0.1
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Cu	0.00	0.00	0.00	0.00	0.00	0.01	0.00	1.60	2
Ni	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Zn	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.17	5
Cd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.003
Pb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
***E.Coli* (cfu/100ml)**	0	0	0	0	0				0
Total Coliform (cfu/100ml)	0	3	4	12	460				10
Turbidity	0.85	34.20	0.33	5.75	8.64	0.31	0.55	0.72	5
TOC	2.7	2.8	2.7	0.8	1.3	1.1	1.0	1.3	10

Notes

Yellow = Acceptable

Exceeds standard limits

Blank = Not Analysed

0 = below detection limit of analytical technique

EC measurements in mS/m, Turbidity in NTU, other parameters in mg/ℓ

8.3.5.2 Groundwater Composition

The major ion composition of the groundwater is used to classify it into various chemical types. Piper and Schoeller diagrams are useful for chemical characterisation of water and was used to chemically classify the water from the sampled boreholes. The Piper diagram indicates the distribution of cations and anions in separate triangles and then a combination of the chemistry in the central diamond. Water with similar chemical signatures will plot in close proximity to one another on the diagram.

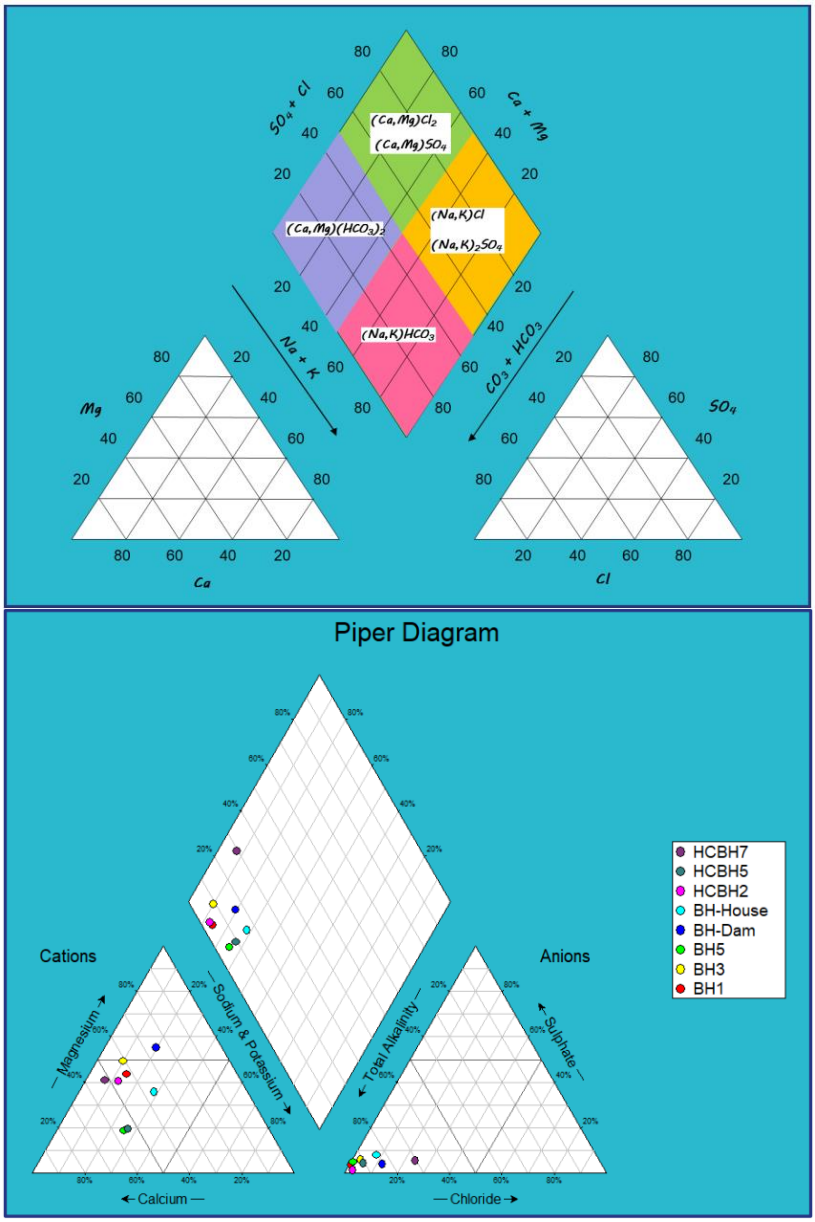


Figure 21: Piper Diagram - Hydrochemical facies (Geovation, 2021)

From Figure 21 all of the sampled boreholes are classified as having mainly a calcium/magnesium – bicarbonate hydrofacies. To determine the dominant cation/anion of each sampled borehole, a Schoeller diagram was compiled. Schoeller diagrams are used to show the relative concentrations of anions and cations typically expressed in milliequivalents per liter.

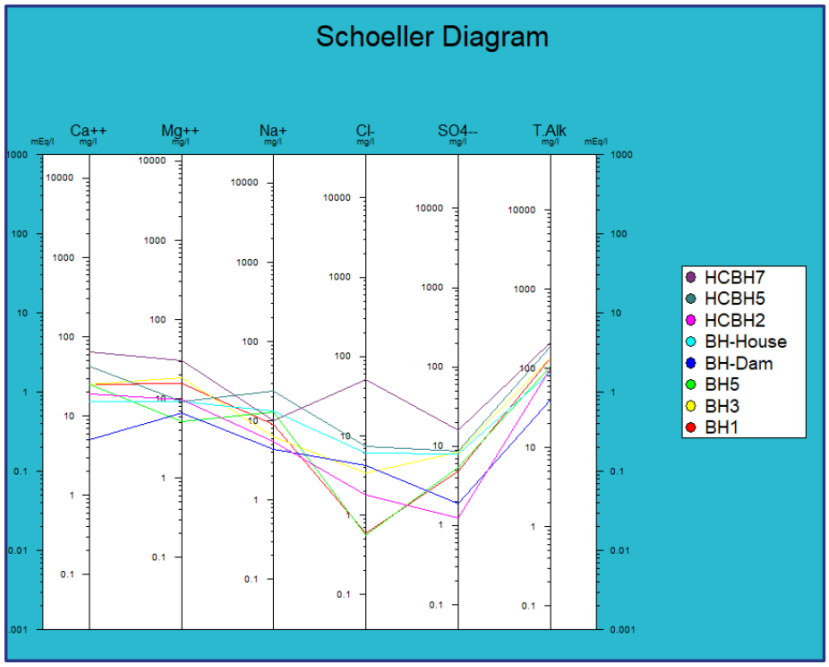


Figure 22: Schoeller diagram - Relative concentrations of anions and cations (Geovation, 2021)

From the Schoeller diagram it can be confirmed that the boreholes have a chemical character and associated source as depicted in Table 41.

Table 41: Chemical character of sampled boreholes

Ca $(HCO_3)_2$ type	**Mg $(HCO_3)_2$ type**
Recently recharged or recharging water.	Water associated with mafic igneous rocks (diabase).
BH5	BH1
HCBH2	BH3
HCBH5	BH-Dam
HCBH7	BH-House

8.4 Reserve Determination & Water Balance

The sustainable volume of groundwater that can be abstracted from the aquifer(s) underlying the site was determined using the GRDM software (version 4.0.0.0 (2010)) as basis. It takes the reserve into account when calculating the volume of water available for abstraction.

The assessment was done on a “rapid” level. The data used for the calculation was derived from the WRC90 dataset contained in the “GRDM” software driven by the Resource Directed Measures from the Department of Water and Sanitation. The site falls within quaternary catchment B20C and the default values, except where updated information was available, were used in the assessment in order to develop some guidance on the potential impact of the abstraction on the overall groundwater use in the catchment. It must be stated that the results achieved for the quaternary catchment is not necessarily

applicable on the delineated Groundwater Resource Unit (GRU) due to compartmentalisation. Geological lineaments may act as no-flow boundaries while rivers/streams may act as constant head boundaries subdividing the quaternary catchments in smaller GRU's with different exploitation potentials. The results of the GRU should rather be considered when allocating a volume of groundwater for abstraction for this specific project.

8.4.1 Definition of Reserve:

"The quantity and quality of water required to supply basic needs of people to be supplied with water from that resource and to protect aquatic ecosystems in order to secure ecologically sustainable development and use of water resources".

To be able to quantify the groundwater component of the Reserve, the following relationship has to be solved:

$$GW_{allocate} = (Re + GW_{in} - GW_{out}) - BHN - GW_{Bf}$$

where:

	$GW_{allocate}$	=	groundwater allocation
	Re	=	recharge
	GW_{in}	=	groundwater inflow
	GW_{out}	=	groundwater outflow
	BHN	=	basic human needs
	GW_{Bf}		groundwater contribution to baseflow

Under the National Water Act (Act No. 36 of 1998) the water use must be authorised. The water will be abstracted from borehole(s), and used for commercial (agriculture) purposes. Under these circumstances, the following (ground) water use is recognised as being relevant to the licence application:

- Section 21 (a) – taking water from a resource.

8.4.2 Water Demand and Abstraction Classification

The calculated water demand for the project is 0.02 Mm^3/annum. DWS categorises water use licence applications in three categories (presented in Appendix B) based on the amount of recharge that is used by the applicant in relation to the specified property:

- Category A: Small scale abstractions (<60% recharge)
- Category B: Medium scale abstractions (60-100% recharge)
- Category C: Large scale abstractions (>100% recharge)

8.4.3 Assessment on Quaternary Level

The property falls within quaternary catchment B20C and the most salient parameters relevant to this catchment is presented in Table 42.

Table 42: Most salient parameters relevant to catchment B20C.

Area km²	Protected Area (km²)	GA (m³/ha/a)	Recharge (Mm³/a)	Population	Basic Human Need (Mm³/a)	EWR Baseflow (Mm³/a)	Reserve (Mm³/a)	Current use (Mm³/a)
363.7	7.7	0	31.63	2343	0.02	4.00	4.02	8.2

It is assumed that General Authorisation as a possible route can be excluded.

The values used in Table 42 originates from data contained in the GRDM software and the "current use" represents registered groundwater users as contained in the WARMS data base up to 15 June 2021

8.4.3.1 Stress Classification

To provide a quantitative means of defining stress, a groundwater stress index was developed by dividing the volume of groundwater abstracted from a groundwater unit by the estimated recharge to that unit.

Stress Index = Abstraction/Recharge
= 0.91/31.61
= 0.26

The quaternary catchment is classified as Category C, which indicates "moderately" levels of stress in terms of abstraction/recharge. The resource is still being used sustainably. A category D classification implies that ~20.54 Mm³/a can be abstracted from the quaternary catchment before very detailed studies will be required.

Table 43: Guideline for determining the level of stress

Present Status Category	Description	Stress Index (abstraction/recharge)
A	Unstressed or slightly stressed	<0.05
B		0.05 - 0.20
C	Moderately Stressed	0.20 – 0.40
D		0.40 – 0.65
E	Highly Stressed	0.65 – 0.95
F	Critically Stressed	>0.95

8.4.3.2 Reserve & Water available for allocation

The following table summarizes the reserve and water available for abstraction from the quaternary catchment.

Table 44: A summary of the Reserve for the catchment.

Quantification of Reserve: B20C	
Human Need:	
Population	2343
Basic human need (l/p/d)	25
Basic human need total (Mm^3/a)	0.02
Recharge	
Recharge (Mm^3/a)	31.63
Baseflow	
Baseflow (Mm^3/a)	4.00
Maint. Low flow (Mm^3/a)	0.00
EWR (Mm^3/a)	4.00
Flow	
Net Flow (Mm^3/a)	0.00
Reserve	
Reserve as % recharge	12.7
Groundwater allocation (Mm^3/a)	27.61
Current abstraction (Mm^3/a)	8.20

From Table 44 it becomes evident that 12.7% of the recharge is allocated to the Reserve and that 27.61 Mm^3/a is available for allocation. The current abstraction from the catchment is 8.20 Mm^3/a which leaves a volume of 19.41 Mm^3/a available for allocation. This "current abstraction" represents registered groundwater users as contained in the WARMS data base up to 15 June 2021.

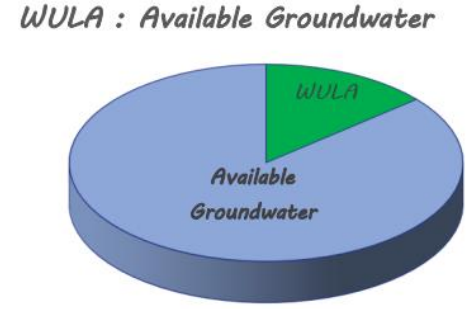
8.4.4 Assessment on Groundwater Resource Unit level

If the calculation is based on the GRU delineated for the project using Vegter's (1995) range of recharge and baseflow figures, the following emerges:

Table 45: Water Balance within the GRU

Area	**Surface Area (ha)**	**Groundwater Recharge to GRU using recharge figure of 50 mm/a**	**Groundwater Recharge to GRU using recharge figure of 70 mm/a**
GRU	348	174000 **m^3/a**	261000 **m^3/a**
	Recharge to GRU	0.174 **Mm^3/a**	0.261 **Mm^3/a**
		477 **m^3/day**	715 **m^3/day**
		5.5 **l/second**	8.3 **l/second**
	Registered Use	0.0 **m^3/a**	0.0 **m^3/a**
	Current abstraction	12191.0 **m^3/a**	12191.0 **m^3/a**
RESERVE	Basic Human Need	2800.0 **m^3/a**	2800.0 **m^3/a**
	Base Flow (EWR)	10.0 **mm/a**	25.0 **mm/a**
		34800 **m^3/a**	87000 **m^3/a**

Area	Surface Area (ha)	Groundwater Recharge to GRU using recharge figure of 50 mm/a	Groundwater Recharge to GRU using recharge figure of 70 mm/a
Groundwater available for abstraction		124209 **m^3/a** 0.124 **Mm^3/a** 340299 **l/day** 3.9 **l/second**	159009 **m^3/a** 0.159 **Mm^3/a** 435641 **l/day** 5.0 **l/second**
Application (WULA)		0.02 **Mm^3/a**	0.02 **Mm^3/a**
WULA as % of Groundwater available in GRU		16.10 **%**	12.58 **%**



(Geovation, 2021)

Based on the water balance results, it is recommended to apply for an allocation of 0.02 Mm^3/annum which places the application in Category A (small scale abstractions - <60% recharge to the GRU) see the Water Demand and Abstraction Classification section). The tested boreholes will be able to supply in 100% of the demand, as well as the applied volume.

8.5 Aquifer Classification

The aquifer(s) underlying the project area were classified in accordance with "A South African Aquifer System Management Classification, December 1995" by Parsons. Classification has been done in accordance with the following definitions for Aquifer System Management Classes:

- Sole Aquifer System: An aquifer which is used to supply 50% or more of domestic water for a given area, and for which there is no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
- Major Aquifer System: Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (Electrical Conductivity of less than 150 mS/m).
- Minor Aquifer System: These can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important for local supplies and in supplying base flow for rivers.

- Non-Aquifer System: These are formations with negligible permeability that are regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.

Based on the available information it can be concluded that aquifer system in the study area can be classified as a "Sole Aquifer System". There are no reasonably available alternative sources other than groundwater should the aquifer be impacted upon or depleted.

In order to achieve the Groundwater Quality Management Index a points scoring system, as presented in Table 46 and Table 47 below, was used.

Table 46: Ratings for the Aquifer System Management and Second Variable Classifications:

Aquifer System Management Classification		
Class	**Points**	**Study area**
Sole Source Aquifer System:	6	6
Major Aquifer System:	4	
Minor Aquifer System:	2	
Non-Aquifer System:	0	
Special Aquifer System:	0 - 6	
Second Variable Classification (Weathering/Fracturing)		
Class	**Points**	**Study area**
High:	3	
Medium:	2	
Low:	1	1

Table 47: Ratings for the Groundwater Quality Management (GQM) Classification System:

Aquifer System Management Classification		
Class	**Points**	**Study area**
Sole Source Aquifer System:	6	6
Major Aquifer System:	4	
Minor Aquifer System:	2	
Non-Aquifer System:	0	
Special Aquifer System:	0 - 6	
Aquifer Vulnerability Classification		
Class	**Points**	**Study area**
High:	3	
Medium:	2	2
Low:	1	

The vulnerability, or the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer, in terms of the above, is classified as medium. The level of groundwater protection based on the Groundwater Quality Management Classification:

GQM Index = Aquifer System Management x Aquifer Vulnerability
= 6 X 2 = 12

Table 48: GQM index for the study area

GQM Index	Level of Protection	Study Area
<1	Limited	
1 - 3	Low Level	
3 - 6	Medium Level	
6 - 10	High Level	
<10	Strictly Non-Degradation	12

The ratings for the Aquifer System Management Classification and Aquifer Vulnerability Classification yield a Groundwater Quality Management Index of 12 for the study area, indicating that a “Strictly Non-Degradation” level of groundwater protection is required.

The values in Table 46 are naturally subjective, but is based on the aquifer descriptions given previously. The importance of each aquifer should provide guidance on the protection to be assigned to each area.

In terms of DWS’s overarching water quality management objectives which is (1) protection of human health and (2) the protection of the environment, the significance of this aquifer classification is that if any potential risk exists, measures must be triggered to limit the risk to the environment. In this instance it would be the (1) protection of the “Sole Aquifer”, (2) the external groundwater users in the area, and (3) maintain baseflow to the non-perennial stream which drains the subject area.

9 Environmental noise

There may be environmental noise impacts associated with the construction phase of the development, however, there is little impact foreseen during the operational stage of the farm.

10 Visual aspects

There is no specialist study done for visual aspects as the development is not likely to be visible to any persons besides the adjacent landowners.

11 Cultural and heritage resources

Information for this section was extracted from the Phase I Archaeological Impact Assessment (Coetzee, 2021).

11.1 Archaeological Background

Southern African archaeology is broadly divided into the Early, Middle and Later Stone Ages; Early, Middle and Later Iron Ages; and Historical or Colonial Periods. This section of the report provides a general background to archaeology in South Africa and focuses on more site-specific elements where relevant.

11.1.1 The Stone Ages

The earliest stone tool industry, the Oldowan, was developed by early human ancestors which were the earliest members of the genus Homo, such as Homo habilis, around 2.6 million years ago. It comprises tools such as cobble cores and pebble choppers (Toth & Schick 2007). Archaeologists suggest these stone tools are the earliest direct evidence for culture in southern Africa (Clarke & Kuman 2000). The advent of culture indicates the advent of more cognitively modern hominins (Mitchell 2002: 56, 57)

The Acheulean industry completely replaced the Oldowan industry. The Acheulian industry was first developed by Homo ergaster between 1.8 to 1.65 million years ago and lasted until around 300 000 years ago. Archaeological evidence from this period is also found at Swartkrans, Kromdraai and Sterkfontein. The most typical tools of the ESA (Early Stone Age) are handaxes, cleavers, choppers and spheroids. Although hominins seemingly used handaxes often, scholars disagree about their use. There are no indications of hafting, and some artefacts are far too large for it. Hominins likely used choppers and scrapers for skinning and butchering scavenged animals and often obtained sharp ended sticks for digging up edible roots. Presumably, early humans used wooden spears as early as 5 million years ago to hunt small animals.

Middle Stone Age (MSA) artefacts started appearing about 250 000 years ago and replaced the larger Early Stone Age bifaces, handaxes and cleavers with smaller flake industries consisting of scrapers, points and blades. These artefacts roughly fall in the 40-100 mm size range and were, in some cases, attached to handles, indicating a significant technical advance. The first Homo sapiens species also emerged during this period. Associated sites are Klasies River Mouth, Blombos Cave and Border Cave (Deacon & Deacon 1999).

Although the transition from the Middle Stone Age to the Later Stone Age (LSA) did not occur simultaneously across the whole of southern Africa, the Later Stone Age ranges from about 20 000 to 2000 years ago. Stone tools from this period are generally smaller, but were used to do the same job as those from previous periods; only in a different, more efficient way. The Later Stone Age is associated with: rock art, smaller stone tools (microliths), bows and arrows, bored stones, grooved stones, polished

bone tools, earthenware pottery and beads. Examples of Later Stone Age sites are Nelson Bay Cave, Rose Cottage Cave and Boomplaas Cave (Deacon & Deacon 1999). These artefacts are often associated with rocky outcrops or water sources. The LSA site, Fort Troje, is located just north of Cullinan and approximately 36 km north of the proposed Eggspert Kameelzynkraal poultry farm (Korsman et al. 1998: 95).

11.1.2 The Iron Age & Later History

The Early Iron Age marks the movement of farming communities into South Africa in the first millennium AD, or around 2500 years ago (Mitchell 2002:259, 260). These groups were agro-pastoralist communities that settled in the vicinity of water in order to provide subsistence for their cattle and crops. Archaeological evidence from Early Iron Age sites is mostly artefacts in the form of ceramic assemblages. The origins and archaeological identities of this period are largely based upon ceramic typologies. Some scholars classify Early Iron Age ceramic traditions into different “streams” or “trends” in pot types and decoration, which emerged over time in southern Africa. These “streams” are identified as the Kwale Branch (east), the Nkope Branch (central) and the Kalundu Branch (west). Early Iron Age ceramics typically display features such as large and prominent inverted rims, large neck areas and fine elaborate decorations. This period continued until the end of the first millennium AD (Mitchell 2002; Huffman 2007). Some well-known Early Iron Age sites include the Lydenburg Heads in Mpumalanga, Happy Rest in the Limpopo Province and Mzonjani in Kwa-Zulu Natal.

The Middle Iron Age roughly stretches from AD 900 to 1300 and marks the origins of the Zimbabwe culture. During this period cattle herding appeared to play an increasingly important role in society. However, it was proved that cattle remained an important source of wealth throughout the Iron Age. An important shift in the Iron Age of southern Africa took place in the Shashe-Limpopo basin during this period, namely the development of class distinction and sacred leadership. The Zimbabwe culture can be divided into three periods based on certain capitals. Mapungubwe, the first period, dates from AD 1220 to 1300, Great Zimbabwe from AD 1300 to 1450, and Khami from AD 1450 to 1820 (Huffman 2007: 361, 362).

The Late Iron Age (LIA) roughly dates from AD 1300 to 1840. It is generally accepted that Great Zimbabwe replaced Mapungubwe. Some characteristics include a greater focus on economic growth and the increased importance of trade. Specialisation in terms of natural resources also started to play a role, as can be seen from the distribution of iron slag which tend to occur only in certain localities compared to a wide distribution during earlier times. It was also during the Late Iron Age that different areas of South Africa were populated, such as the interior of KwaZulu Natal, the Free State, the Gauteng Highveld and the Transkei. Another characteristic is the increased use of stone as building material. Some artefacts associated with this period are knife-blades, hoes, adzes, awls, other metal objects as well as bone tools and grinding stones.

In terms of general project area, the region is well known for LIA sites. The area west of Wonderboompoort is associated with one of the earliest LIA sites. Further to the west a high concentration of sites is also found that stretches to Olifantspoort in the Magaliesberg. These sites date to the Moloko period that roughly stretched from AD 1100 – 1500 (Van Vollenhoven 2006).

Oral traditions of Nguni-speaking Ndebele groups indicate their sites in the area to the east of Pretoria, while heritage reports conducted on the stone-walled sites of this area suggest that Ndebele-speaking people inhabited this area between the late 1600s and mid-1800s (Antonites 2020).

According to Van Vuuren (2006), Ndebele oral traditions state that they first settled at Emhlangeni, translating to “At the reeds”, near Randfontein in the Gauteng Province. Accordingly, they entered the Pretoria region during the early to mid- 1600s and settled at KwaMnyamana, which translates to “Place of the Black Hills”. KwaMnyamana is located close to the Hippo Quarries crusher site on the farms De Onderstepoort (300JR) and Doornpoort (295JR). The first chief to settle at this site was called Musi. A split between his sons caused the Ndebele to divide into several tribal entities. The descendants of the youngest son, Ndzundza, moved further to the east, while the descendants of the eldest son, Manala, stayed behind.

The first composite pre-colonial Manala settlement was known as Ezotshaneni and is roughly situated on both sides of the current Cullinan-Bapsfontein roads (R515 and R25) and with one section located south of the N4 national road between the Donkerhoek and Cullinan off-ramps. The eastern section of the site includes the Osspruit. The following farms are associated with Ezotshaneni: Kleinsonderhout (519JR), Rhenosterfontein (514JR), Rietvlei (513JR), Witfontein (521JR), Puntlyf (520JR), Boschkop (543JR), Roodekopies (546JR), Kameel-zijn-kraal (547JR), Onbekend (398JR), Witpoort (551JR), Knoppiesfontein (549JR), Vlakfontein (548JR), Boscchkop (369JR). Of importance to the proposed poultry farm, is the reference to Kameel-zijn-kraal. Accordingly, this was known as KwaMangungu (“Place of the drums”) and refers to the drums used during the girls’ initiation rituals (Van Vuuren 2006).

A later Ndebele invasion that was led by Mzilikaze in 1827, settled at Kungwini, present day Wonderboom in Pretoria North. In 1832, the Zulu king Dingane attacked Mzilikaze at Kungwini. According to Van Vollenhoven (2006), the Sotho-Tswana groups are the largest Bantu language speaking people who are formed by the Northern and Southern Sotho, as well as the Tswana. These groups are responsible for large stone-walled towns and according to oral histories, these groups re-established themselves after the 1827 arrival of Mzilikaze during the Mfecane/Difaquane.

According to Huffman (2007), the pottery associated with the general area surrounding Pretoria belongs to the Buispoort facies of the Moloko Branch of the Urewe Tradition. A likely date range of AD 1700 – 1840 is suggested.

The 1st Anglo-Boer War - The Battle of Bronkhorstspruit

In 1874 Lord Carnarvon, the Colonial State Secretary, wished to unite British territory and the two Republics under the British flag. Because none of these states were in favour of uniting, Carnarvon reasoned that through uniting with the Transvaal, the others would follow. Due to poor relations, the only option left was annexation. In 1877 Shepstone was send from Natal to Pretoria with a police force of 25 with the goal to annex the Transvaal. On 12 April 1877, Shepstone raised the British flag and the Transvaal was annexed without firing a single shot. Several deputations were sent to England to regain independence, but both failed. Consequently S. P. J. Kruger, P. Joubert and M. W. Pretorius decided to gather the nation at Paardekraal to discuss the future of the Transvaal. During the meeting, which lasted from 12 to 16 December 1880, it was decided that Heidelberg would serve as the seat of the government. British forces were stationed in most of the towns, but were too weak to launch attacks on the Boer forces. British forces were therefore ordered from Lydenburg to support forces in Pretoria. Upon receiving this news, Frans Joubert was sent from Heidelberg to Pretoria with a force consisting of between 200 and 300 men to intercept and stop these reinforcements. According to the historian, Theal, the British forces under Col. Anstruther consisted of 257 men and 34 wagons. On 20 December 1880 they arrived at the place known today as Bronkhorstspruit. A brief exchange of words in which Joubert requested Anstruther to discontinue his mission resulted in a 10 to 20-minute battle over open field. After a significant number of casualties on the British side, Col. Anstruther, who was mortally wounded, requested that the white flag be raised. According to Theal, 66 on the British side were killed and 72 wounded. Later, 10 of the wounded died as well. On the Boers' side, one commando member was killed in action and another five wounded. Later, another succumbed to his wounds. The captives were transported to Heidelberg and from there to the Vaal River. From there they were allowed to go to the Free State. This was the first open battle of the First Boer War (Roodt 1949: 7-9).

The photo below (refer to specialist study) depicts the settlement of Paul Grobler on the farm Klipeiland, where the Battle of Bronkhorstspruit took place. Grobler bought the farm from Salomon Prinsloo in the 1850's and renamed it from Kalkoenkrans to Klipeiland. One of the wounded commando members was treated in this homestead. In the background the homesteads of Marthinus Johannes Grobler can be observed (Rex 1969: 14). The Farm Klipeiland is located approximately 22 km to the northeast of the proposed poultry farm.

11.2 Methodology

Archaeological reconnaissance of the study area was conducted during June 2021 (Winter) through a combination of systematic and unsystematic pedestrian site surveys that lasted one day (Figure 24). The inspection consisted of a systematic pedestrian survey of the undisturbed sections associated with the study area. The transects were spaces roughly 60 m apart where movement was not hampered by dense vegetation.

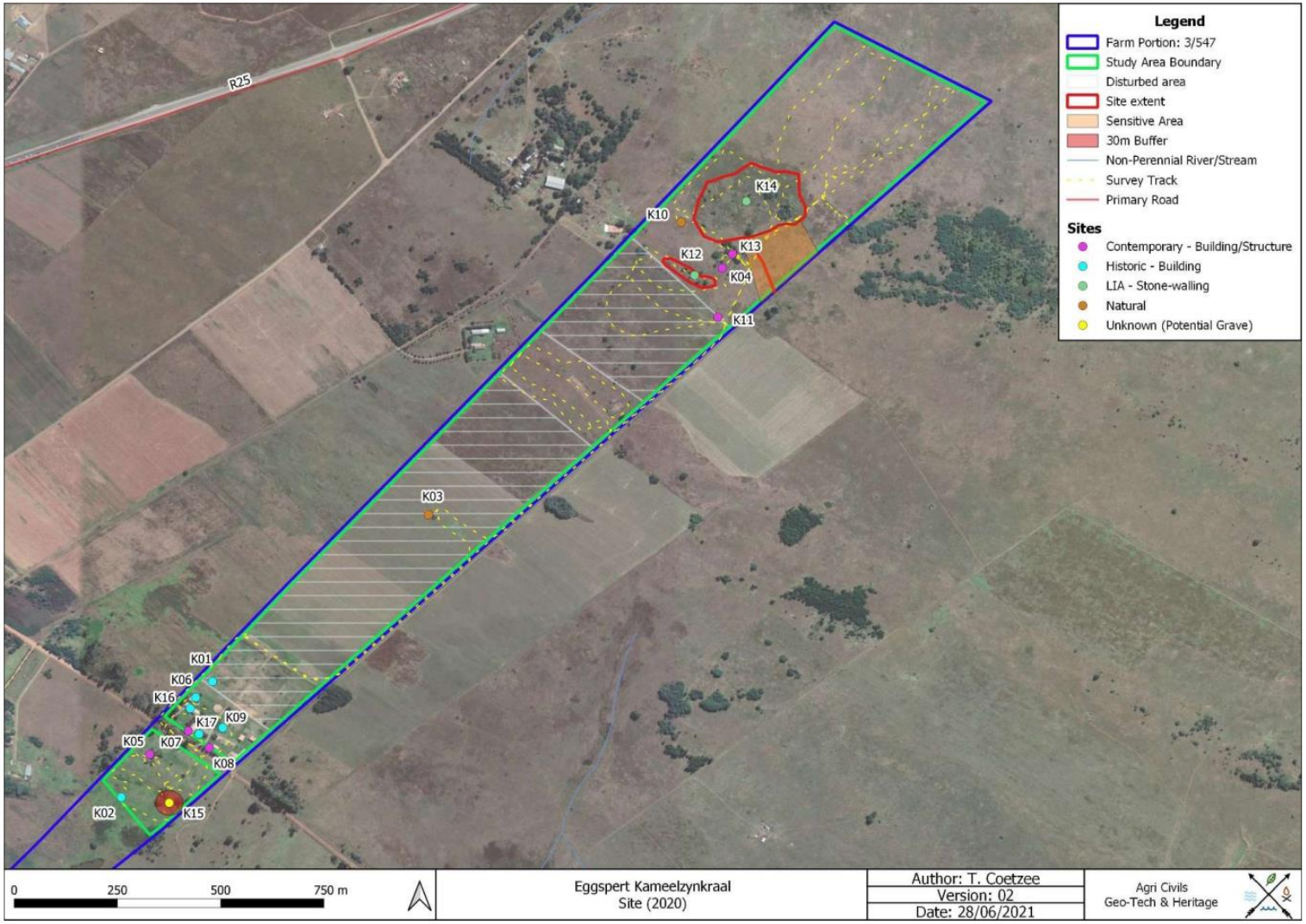


Figure 23: Study area with survey track indicated on a 2020 satellite image (Coetzee, 2021).

Table 49: Site coordinates & description (Coetzee, 2021)

Name	Off. Name	Latitude	Longitude	Description	Age	Current Status	ID Source
K01	2528DC-K01	-25.929303	28.509427	Building	Historic	Demolished	Topo 1944
K02	2528DC-K02	-25.931823	28.507442	Building	Historic	Ruin	Aerial 1939
K03	2528DC-K03	-25.925674	28.514125	Natural	Natural	Intact	Aerial 2020
K04	2528DC-K04	-25.920309	28.520520	Building	Contemporary	Demolished	Aerial 2005
K05	2528DC-K05	-25.930888	28.508058	Building	Contemporary	Ruin	Topo 1995
K06	2528DC-K06	-25.929648	28.509061	Building	Historic	Intact	Aerial 1961
K07	2528DC-K07	-25.930378	28.508899	Building	Contemporary	Intact	Topo 1984
K08	2528DC-K08	-25.930741	28.509357	Building	Contemporary	Intact	Topo 1984
K09	2528DC-K09	-25.930308	28.509648	Building	Historic	Demolished	Aerial 1961
K10	2528DC-K10	-25.919308	28.519625	Natural	Natural	Intact	Aerial 2020
K11	2528DC-K11	-25.921373	28.520423	Structure	Contemporary	Intact	Topo 2003
K12	2528DC-K12	-25.920459	28.519916	Stone walling	LIA	Intact	Survey
K13	2528DC-K13	-25.919998	28.520742	Structure	Contemporary	Intact	Aerial 2008
K14	2528DC-K14	-25.918852	28.521042	Stone walling	LIA	Intact	Aerial 1939
K15	2528DC-K15	-25.931944	28.508485	Potential Grave	Unknown (Potential Grave)	Unknown	Survey
K16	2528DC-K16	-25.929886	28.508941	Building	Historic	Intact	Aerial 1961
K17	2528DC-K17	-25.930444	28.509133	Building	Historic	Intact	Aerial 1961

11.3 Archaeological and Historical Remains

11.3.1 Stone Age Remains

No Stone Age archaeological remains were observed within the demarcated study area. Archaeological studies done on the surrounding areas also did not locate material pertaining to the Stone Age.

11.3.2 Iron Age Farmer Remains

One stone-walled site and one potential stone-walled site were observed during the survey. Site K12 is located directly north of the northern-most disturbed area along a small ridge. The site consists of linear free standing stone-walling of which the exact extent could not be determined due to dense vegetation, but appears to be approximately 90 m. The site could also not be identified on aerial or satellite imagery. A possibility also exists that the rocks were moved from the previously cultivated field located directly to the south. The feature in Figure 18 of the specialist study appears more representative of such a situation. However, the stone-walling appears to be similar to typical LIA stone-walling. It might also be that a LIA stone-walled site did exist but was impacted during the creation of the cultivated field. No material culture was observed at the site.

Site K14, first observed on satellite imagery, consists of several stone-walled enclosures (Figure 27). Historical aerial imagery dating to 1939, 1961, 1965 and 1976 (Appendix A: Figures 43, 45 – 47 of the original report) also indicate the site. The site is located approximately 60 m north of Site K12 and is associated with very dense vegetation that significantly hampered free movement and visibility. The observed walls all are roughly packed and uncoursed. One undecorated potsherd was observed at the site. Several footpaths and a jeep track intersect the site as well. When the 1939 aerial image (Appendix A: Figure 43 of the original report) is inspected, a linear feature stretching from the site towards another stone-walled enclosure approximately 180 m to the southeast is observed. This feature, likely to be an early road, is not visible on subsequent aerial imagery. The low visibility might be attributed to the likely possibility that feature is not as prominent as the enclosures. The estimated area of the site as calculated on Google Earth imagery, is approximately 3.3 ha.

Sites K12 & K13 are similar in appearance to the sites observed by Antonites (2020) that are located approximately 1 km to the northwest. It is therefore likely that that these sites form part of the same complex as historical Google Earth imagery shows a relatively dense concentration of stone-walled sites in the general area. The heritage study done by the National Cultural History Museum (2003) also recorded stone-walled enclosures belonging to the LIA in the vicinity of the Bronkhorstspruit Dam.

Table 50: Iron Age Remains (Coetzee, 2021)

Name	Type	Source	Year	Status	Age	Estimated extent (ha)
K12	Stone-walling	Field	N/A	Intact	LIA	0.3
K14	Stone-walling	Aerial	2008	Intact	LIA	3.3

11.3.3 Historical

Six sites potentially dating to the historic period were identified on using a combination of historical topographical maps and aerial imagery.

Table 51: Historic Sites (Coetzee, 2021)

Name	Type	Source	Year	Status	Age
K01	Building	Topo	1944	Demolished	Historic
K02	Building	Aerial	1939	Ruin	Historic
K06	Building	Aerial	1961	Intact	Historic
K09	Building	Aerial	1961	Demolished	Historic
K16	Building	Aerial	1961	Intact	Historic
K17	Building	Aerial	1961	Intact	Historic

Site K01 was identified on the 1944 topographical map as a building located along the western boundary of the study area and just north of the current werf (Appendix A: Figure 44 of original report). No building, however, is visible on any of the aerial images and topographical maps. A cultivated field is visible on the 1961 aerial image (Appendix A: Figure 45 of original report) and no evidence of a building was observed during the site visit. The area is presently utilised as an equestrian grazing camp.

Site K02 is located along the southern boundary of the study area and was identified on the 1939 aerial image as a structure (Appendix A: Figure 43 of original report). The 1944 topographical map (Appendix A: Figure 44 of original report), however, indicates the presence of a building, while no building or feature is indicated on any of the remaining aerial images or topographical maps. The site visit revealed a small stone-walled enclosure angular in shape. It is therefore likely that this structure is at least 77 years of age. The use of this structure is unknown.

Sites K06, K16 and K17 consist of intact buildings on the werf. These sites were identified on the 1961 aerial image (Appendix A: Figure 45 of original report) and are present on subsequent aerial images as well. However, it should be noted that the extents are not clear on the historical images. Several buildings are also visible on the topographical maps. Because it is unclear whether Sites K06 and K16 formed part of the original structures observed on the 1961 aerial image, the possibility exists that these sites or parts thereof date to historical times. According to historical Google Earth imagery, Site K17 used to be part of a larger structure, but was altered between 2005 and 2008. If the remaining section of the building forms part of the building observed on the 1961 aerial image, the building would be 60 years of age. These buildings appear to be modern and might have been renovated in recent years.

Site K09, also a building identified on the 1961 aerial image, is located to the northeast of Site K17 (Appendix A: Figure 45 of original report). The building appears to have been demolished between 1965

and 1976 (Appendix A: Figures 46 & 47 of original report). The site visit confirmed an open section on the werf.

11.3.4 Contemporary Remains / Natural Sites

Two sites (K03 & K10) were identified on contemporary satellite imagery as disturbances (Table 52). The site visit confirmed that Site K03 consists of rocks in the middle of a cultivated field. It is likely that these rocks were removed from the surrounding areas during the creation of the cultivated field. Site K10 was confirmed to be a natural rock outcrop.

Six contemporary sites (Table 52) were identified on aerial images and topographical maps. Four of these sites (K07, K08, K11, K13) are associated with intact buildings, one with a building ruin (K05) and one with a demolished site (K04). These sites do not exceed 60 years of age.

Table 52: Contemporary Sites (Coetzee, 2021).

Name	Type	Source	Year	Status	Age
K03	Natural	Aerial	2020	Intact	Contemporary
K04	Building	Aerial	2005	Demolished	Contemporary
K05	Building	Topo	1995	Ruin	Contemporary
K07	Building	Topo	1984	Intact	Contemporary
K08	Building	Topo	1984	Intact	Contemporary
K10	Natural	Aerial	2020	Intact	Contemporary
K11	Structure	Topo	2003	Intact	Contemporary
K13	Structure	Aerial	2008	Intact	Contemporary

Site K04 is located just south of the boma on the northern section of the study area. The site was first identified on 2005 Google Earth satellite imagery. No building is visible on any of the historical aerial images and no building or structure is indicated on any of the topographical maps. Upon visiting the site, a building foundation measuring roughly 6 X 6 m were observed. The use of the building is unknown.

Site K05 is associated with two buildings, one stone building with no roof and one brick building with no roof (Figure 40). Both buildings are in a dilapidated state. Several modern cement slabs were also observed. The first buildings in this vicinity are indicated on the 1995 topographical map (Appendix A: Figure 49 of the original report) and shows the presence of the stone building, as well as another building further to the southeast. The 2003 topographical map indicates an additional building between the previously identified buildings (Appendix A: Figure 50 of the original report), while the 2010 topographical map (Appendix A: Figure 51 or the original report) again only shows the one building to the northwest.

Historical Google Earth imagery also show several buildings/structures in 2005, but by 2008 the majority of the buildings/structures have been demolished. The remains of these demolished sites were noted during the site visit.

Site K07, currently stables, was first observed as a building on the 1984 topographical map (Appendix A: Figure 48 of the original report). The building is rectangular in shape, constructed form bricks, and is oriented in a NE-SW direction. The building is also indicated on the 1995 topographical map (Appendix A: Figure 49 of the original report), but it is only on the 2003 topographical map that the same rectangular shape is observed (Appendix A: Figure 50 of the original report). This suggests that the original building might have been altered or was completely demolished and replaced by the current stables. A few modern stores were also observed to the northeast of Site K08.

Site K08 is a building located directly north of the gravel road. A building is first indicated on the 1984 topographical map (Appendix A: Figure 48 of the original report). By 1995 (Appendix A: Figure 49 of the original report) a rectangular building of completely different dimensions is indicated, while the 2003 topographical again shows a small building (Appendix A: Figure 50 of the original report). However, no buildings or structures are shown on any of the historical aerial images, suggesting the building is of contemporary construction.

Site K11 was identified as a circular cement water reservoir on the 2003 topographical map (Appendix A: Figure 50 of the original report). The site is also indicated on the 2010 topographical map (Appendix A: Figure 51 of the original report) and is visible on contemporary satellite imagery. No indications were observed on any of the remaining aerial images or topographical maps. Site K13 consists of a modern boma and associated brick building and is located between LIA sites K12 and K14. The site is not indicated on any of the historical topographical maps or aerial images, but was identified on the 2008 Google Earth satellite image. The boma is constructed from stone, while the toilet building is constructed from bricks. The toilet building, however, is in a dilapidated state.

11.3.5 Graves

According to Mrs Marais (Alet Marais, pers. Comm. 2021), the previous owner informed her of a potential grave to the south of the gravel road and near the border of the study area. Accordingly, the grave is located under a heap of rocks, but it was never confirmed.

Table 53: Graves (Coetzee, 2021)

Name	Type	Source	Year	Status	Age
K15	Potential Grave	Field	Unknown	Unknown	Unknown (Potential grave)

The heritage studies done by Van Schalkwyk (2013), as well as Antonites (2020), recorded cemeteries in the general study area.

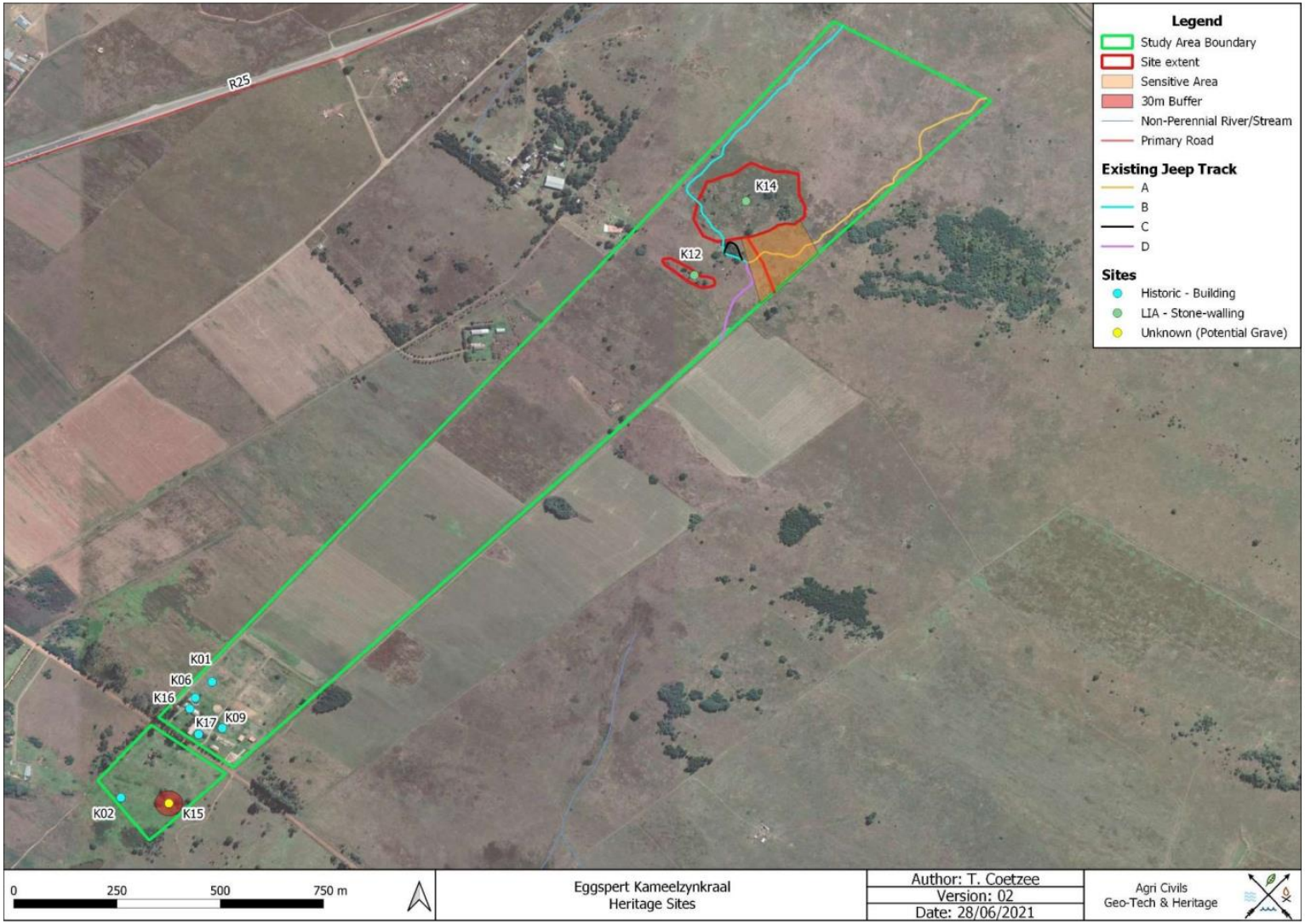


Figure 24: Heritage sites indicated on a 2020 satellite image (Coetzee, 2021).

11.4 Statement of significance

As can be seen form heritage studies done in the surrounding areas, as well as the findings made in this study, the greater study area is considered to be significant from a heritage perspective. Locally, historical buildings and structures are limited to the southern section of the study area. Two of these sites (K01 & K09) have been demolished and are not considered to be significant from a heritage perspective. Site K02 consists of an angular stone-walled enclosure in a dilapidated state. A possibility exists that this structure exceeds 60 years of age and might therefore be significant from a heritage perspective. The remaining historical sites (K06, K16, K17) are associated with intact buildings. It is unclear whether these buildings have been demolished and rebuilt or form part of the original buildings. Should these buildings, or any parts thereof, consist of the original buildings, it will be protected under the NHRA (25 of 1999).

The two identified natural sites are not significant from a heritage perspective (K03 & K10). These sites were identified on contemporary satellite imagery as disturbances. The site visit confirmed that one site consists of rocks that appear to have been removed during the creation of a cultivated field (K03), while the other is a natural rock outcrop (K10).

Three of the contemporary sites are located in the northern quarter of the study area (K04, K11, K13) and three in the southern quarter (K05, K07, K08). These sites consist of brick or stone buildings and it has been established that these sites do not exceed 60 years of age and are not considered significant from a heritage perspective. Four of the contemporary sites are intact (K07, K08, K11, K13), one consists of a building ruin (K05) and one has been demolished (K04).

Research has shown that two of the sites (K12 & K14) form part of a culturally significant Late Iron Age landscape. Several Late Iron Age stone-walled sites are associated with the greater study area, but are increasingly threatened by agricultural activities and development. Since Kameel Zyn Kraal is specifically mentioned in Manala Ndebele oral traditions (Van Vuuren 2006), the sites are significant in the local cultural landscape. These sites are protected by the NHRA (25 of 1999).

Although the existence of the grave (K15) near the south-eastern corner of the study area could not be verified, the area surrounding this site should be regarded as sensitive. Graves are significant from a heritage perspective as the Human Tissues Act (65 of 1983) and Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925), as well as the National Heritage Resources Act 25 of 1999 apply.

Table 54: Individual site ratings.

Site /Survey Point Name	Type	Rating	Field Rating/Grade	Significance	Recommendation
2528DC-K01	Building-Demolished	General Protection C	4 C	Low	No recording necessary
2528DC-K02	Building-Ruin	General Protection B	4 B	Medium	Record site
2528DC-K03	Natural	General Protection C	4 C	Low	No recording necessary
2528DC-K04	Building-Demolished	General Protection C	4 C	Low	No recording necessary
2528DC-K05	Building-Ruin	General Protection C	4 C	Low	No recording necessary
2528DC-K06	Building	General Protection B	4 B	Medium	Record site
2528DC-K07	Building	General Protection C	4 C	Low	No recording necessary
2528DC-K08	Building	General Protection C	4 C	Low	No recording necessary
2528DC-K09	Building-Demolished	General Protection C	4 C	Low	No recording necessary
2528DC-K10	Natural	General Protection C	4 C	Low	No recording necessary
2528DC-K11	Structure	General Protection C	4 C	Low	No recording necessary
2528DC-K12	Stone-walling	Local	Grade 3 A	High	Mitigation not advised
2528DC-K13	Structure	General Protection C	4 C	Low	No recording necessary
2528DC-K14	Stone-walling	Local	Grade 3 A	High	Mitigation not advised
2528DC-K15	Potential Grave	Local	Grade 3 A	High	Mitigation not advised
2528DC-K16	Building	General Protection B	4 B	Medium	Record site
2528DC-K17	Building	General Protection B	4 B	Medium	Record site

11.5 Background to Palaeontology of the area

One of the formations, the Silverton Formation, in the development area may contain fossils. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in height and up to 10 mm in diameter and can be present in the development area.

Chemical sediments such as fine-grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. These Early Proterozoic Transvaal stromatolitic dolomites formed and released free oxygen at around 2900 – 2400 Ma. Stromatolites are common in for example the Malmani dolomites, accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006). Chert may contain fossils such as echinoids or sponges if nodular, although not common and is rated unlikely.

Table 55: Taken form The Palaeotechnical Report (Groenewald and Groenewald 2014)

Magaliesburg (Vm; Vmg; Vlm)		Coastal sandstones with mudrocks	Microbial mat structures (Dessicated mats sometimes resemble trace fossils	Pretoria group subunits with stromatolites probably also contain microfossils. This may also apply to carbonaceous mudrocks. ALERT FOR POTENTIALLY FOSSILIFEROUS LATE CEONOZOIC CAVE BRECCIAS WITHIN OUTCROP AREA OF CARBONATE SUBUNITS - i.e. LIMESTONES DOLOMITES (breccias not individually mapped) Rooiberg Group was previously included within top of Transvaal Supergroup but now regarded as separate succession.
Igneous intrusions (Vsh; Vsh1)		Norite	No fossils recorded	
Silverton (Vsi)	Lydenburg (Vsl; Vld; Vld1	Shale, mudstone and carbonate layers	Stromatolites	
	Machadodorp (Vsm; Vsm1; Vsm2; Vmc)	Fine-grained tuff and basic lava	No fossils recorded	
	Boven (Vsb; Vbn; Vbn1)	Marine shale and mudrocks with tuff and minor carbonates	Stromatolites	
Igneous intrusions (Vdi; di)		Igneous intrusions	No fossils recorded	
Daspoort (Vda; Vhd; Vdq; Vdp)		Alluvial, fluvial and deltaic sandstones and mudrocks, marine sediments in east	Stromatolites	
Strubenkop (Vs; Vnd; Vst)		Lacustrine mudrocks with minor sandstone	No fossils recorded	
Dwaalheuwel (Vhw;Vhd)		Alluvial sandstones, conglomerates and mudrocks	No fossils recorded	

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally **LOW** to **VERY HIGH**.

Table 56: Criteria used (Fossil Heritage Layer Browser/SAHRA)

Rock Unit	Significance/Vulnerability	Recommended Action
Silverton Formation	High	Desktop study, Field Assessment likely
Pretoria Group	Moderate	Desktop study required

Databases and collections: Ditsong: National Museum of Natural History. National Museum of Bloemfontein.
Impact: **HIGH** There may be significant fossil resources that may be impacted by the development (shale).
The project includes one locality Option with a **HIGH** impact.
Option 1: A roughly rectangular area blocked in red with the Roodekoppies railway station to the north, the R25 Road to the north-west and surrounded by farms. The area is approximately 97 hectares in size.

12 Sensitive landscapes

The following sensitive areas have been identified:

- Land of high agricultural sensitivity
- Areas of high avifaunal, faunal and floral sensitivity
- Two late iron age sites of archaeological importance as well as a potential grave near the south-eastern corner of the study area (the sensitive areas have recommended buffer zones)
- Wetlands within the 500m ESA, but not on the proposed site.

The sensitivity map below indicates the proposed layout of the development as well as areas of environmental sensitivity.

IMPORTANT NOTE: The blue shaded areas indicating the wetland sensitivity theme on the map below are the 50-metre wetland buffers. Thus, NO infrastructure will be placed within the 50-metre wetland buffer areas.

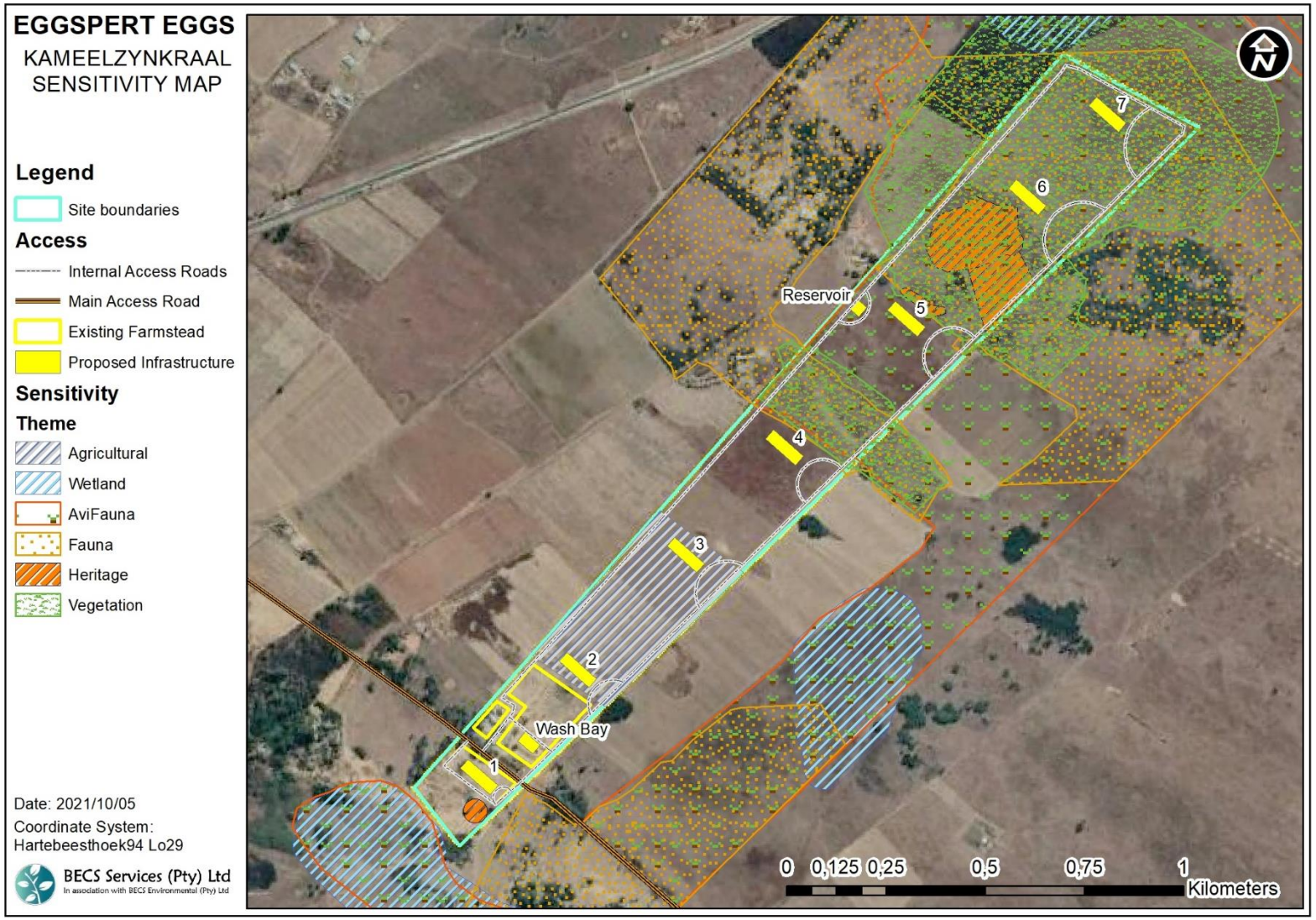


Figure 25: Environmental sensitivity map including layout plan

13 Regional socio-economic aspects

Information for this section was extracted from the Final IDP Tshwane Local Municipality 2019 (Tshwane Local Municipality, 2019).

13.1 Socio-economic profile

13.2 Demographic profile

Serving the people is one of the main objectives of any municipality and this is no different for the City of Tshwane. In fact, it is one of the key focus on which the city is building its vision is to “Deliver”. Thus, in order for us to effectively serve our people, we need to understand who our people are. Thus, this section will focus on the demographic make-up of the city, which includes analysis of the population of the\ region. The distribution of the values within a demographic variable and across households are of interest, as are the trends over time. Population statistics are important when analysing an economy, as the population growth directly and indirectly impacts employment and unemployment, as well as other economic indicators such as economic growth and per capita income. Table 57 indicates an 11-year trend of population estimations for City of Tshwane in comparison with the Gauteng province and the national total.

Table 57: Total population- City of Tshwane, Gauteng and National Total, 2007-2017 (number and percentage contribution)

	City of Tshwane	Gauteng	National Total	City of Tshwane as % of province	City of Tshwane as % of national
2007	2,480,000	10,600,000	48,400,000	23.3%	5.1%
2008	2,560,000	10,900,000	49,100,000	23.5%	5.2%
2009	2,640,000	11,200,000	49,800,000	23.6%	5.3%
2010	2,740,000	11,600,000	50,700,000	23.7%	5.4%
2011	2,830,000	11,900,000	51,500,000	23.8%	5.5%
2012	2,920,000	12,300,000	52,400,000	23.9%	5.6%
2013	3,010,000	12,600,000	53,200,000	23.9%	5.7%
2014	3,090,000	12,900,000	54,100,000	24.0%	5.7%
2015	3,160,000	13,200,000	54,900,000	24.0%	5.8%
2016	3,230,000	13,400,000	55,700,000	24.1%	5.8%
2017	3,310,000	13,700,000	56,500,000	24.1%	5.8%
Average Annual Growth					
2007-2017	2.92%	2.57%	1.56%		

With an estimated 3.31 million population, the City of Tshwane Metropolitan Municipality housed 5.8% and 24.1% of South Africa's and Gauteng’s total population in 2017 respectively. Between 2007 and 2017, the population growth rate in the City of Tshwane averaged 2.92% per annum, which is close to

double the growth rate of South Africa as a whole (1.56%). Gauteng's average annual growth rate came in just under at 2.57% over the same period.

As indicated below, in 2017, the City of Tshwane's population comprised of: 78.94% of the African population (2.61 million); 17.11% of the White population (566 000); 2.07% of the Coloured (68 500); and 1.88% of the Asian (62 100). Though the Asian population contributes the least in population shares in the City of Tshwane, it should be noted that it has recorded the highest average annual population growth rate over the 2007-2017 period. The table below also indicates the age distribution of the population in the City of Tshwane. The largest share of population in Tshwane is within the young working age (25-44 years) age category, with 1.21 million or 36.5% of the total population. The age category with the second largest population share is the (0-14 years) age category, with 24.5%; then followed by the older working age population (i.e. 45-64 years age category), with 592 000 people. The age category with the lowest number of people is the elderly population (i.e. 65 years and older age category), with only 207 000 people.

Table 58: Population by population group, gender and age- City of Tshwane Metropolitan Municipality, 2017

Age	African female	Male	White female	Male	Coloured female	Male	African female	Male
00-04	127,000	125,000	16,200	17,300	2,790	2,900	2,270	2,320
05-09	117,000	114,000	18,000	19,100	2,630	2,530	2,180	2,340
10-14	96,600	95,300	17,500	18,700	2,520	2,690	2,020	2,180
15-19	88,900	85,500	17,600	17,700	2,540	2,580	2,010	2,080
20-24	113,000	108,000	19,800	20,100	3,010	2,970	2,040	2,110
25-29	137,000	137,000	18,000	19,000	3,200	2,940	2,080	2,560
30-34	144,000	143,000	17,500	18,000	3,240	2,920	2,440	3,110
35-39	127,000	131,000	18,700	18,000	3,170	2,840	3,060	3,580
40-44	93,200	98,500	19,700	18,900	2,810	2,710	3,240	3,320
45-49	69,100	74,500	21,400	19,300	2,520	2,240	2,220	2,830
50-54	55,200	58,700	20,700	19,000	2,060	1,780	1,600	1,920
55-59	44,500	45,600	18,600	17,300	1,720	1,380	1,350	1,200
60-64	36,300	35,000	16,200	13,900	1,230	1,090	1,110	930
65-69	26,400	25,800	15,800	12,400	871	728	919	813
70-74	15,500	14,900	13,900	10,500	567	403	638	516
75+	16,300	11,300	22,900	14,100	522	395	709	400
Total	**1,310,000**	**1,310,000**	**292,000**	**273,000**	**35,400**	**33,100**	**29,900**	**32,200**

13.3 Educational Levels

According to the United Nations definition of education, a person is an adult at 15 years or older. The education measure in this section represents the highest level of education of an individual, using the

15 years and older age category. Furthermore, the age of 15 is also the legal age at which children may leave school in South Africa.

Table 59: Highest level of education: Age 15+ City of Tshwane, Gauteng and National Total, 2017 (number and percentage)

	City of Tshwane	Gauteng	National Trust	City of Tshwane as % of province	City of Tshwane as % of national
No schooling	78,800	280,000	2,360,000	28.1%	3.3%
Grade 0-2	22,100	101,000	702,000	22.0%	3.2%
Grade 3-6	111,000	506,000	3,170,000	21.9%	3.5%
Grade 7-9	256,000	1,230,000	6,060,000	20.7%	4.2%
Grade 10-11	457,000	2,180,000	8,270,000	21.0%	5.5%
Certificate / diploma without matric	14,600	158,200	192,000	25.0%	7.6%
Matric only	802,000	3,300,000	10,400,000	24.3%	7.7%
Matric certificate / diploma	226,000	753,000	2,150,000	30.0%	10.5%
Matric Bachelor's degree	201,000	612,000	1,520,000	32.9%	13.3%
Matric Postgrad degree	109,000	314,000	722,000	34.7%	15.1%

The City of Tshwane as the country's leading metro on education outcomes, has saw improvements on number of indicators. The number of people without any schooling decreased between 2007 and 2017 by an average annual rate of -1.58%, while the number of people in the 'matric only' category increased from 533,000 to 802,000. The number of people with 'matric and a certificate/diploma' increased by an average annual rate of 4.35%, while the number of people with a 'matric and a Bachelor's' degree increased by an average annual rate of 6.18%.

13.4 Employment profile

Total employment consists of two parts: employment in the formal sector, and employment in the informal sector. Trends in employment within different sectors and industries indicate significant structural changes in the economy. Employment data is also used in the calculation of productivity, earnings per worker and other economic indicators. In 2017, City of Tshwane employed 1.22 million people, which is: 24.50% of total employment in Gauteng (4.99 million); 7.70% of total employment in South Africa (15.9 million). Employment in the City of Tshwane increased annually at an average rate of 2.62% from 2007 to 2017.

Table 60: Total employment – City of Tshwane, Gauteng and National total, 2007- 2017 (numbers)

	City of Tshwane	Gauteng	National Total
2007	945,000	4,090,000	13,500,000
2008	996,000	4,320,000	14,100,000
2009	1,000,000	4,350,000	14,000,000
2010	986,000	4,290,000	13,600,000
2011	1,010,000	4,370,000	13,800,000
2012	1,050,000	4,500,000	14,000,000
2013	1,090,000	4,640,000	14,500,000
2014	1,120,000	4,770,000	15,100,000
2015	1,160,000	4,850,000	15,500,000
2016	1,190,000	4,890,000	15,700,000
2017	1,220,000	4,990,000	15,900,000
Average Annual growth			
2007-2017	**2.62%**	**2.01%**	**1.61%**

Total employment can be broken down into formal and informal sector employment. Formal sector employment is measured from the formal business side, and informal employment is measured from the household side, as formal businesses have not been established. Formal employment is much more stable than informal employment. Informal employment is much harder to measure and manage, simply because it cannot be tracked through the formal business side of the economy. Informal employment is, however, a reality in South Africa and cannot be ignored. The number of people formally employed in City of Tshwane Metropolitan Municipality was 1.06 million in 2017, which was about 86.43% of total employment. The number of people employed in the informal sector was 166 000 or 13.57% of total employment. Informal employment in City of Tshwane increased from 144 000 in 2007 to an estimated 166 000 in 2017. In 2017, the trade sector recorded the highest number of informally employed people, with a total of 67 400 employees or 40.59% of total informal employment. This can be expected, as the barriers to enter the trade sector in terms of capital and skills required is lower than with most of the other sectors. The manufacturing sector has the lowest informal employment - 11 000 - and only contributes 6.65% to total informal employment.

Some of the economic sectors have little or no informal employment: due to well-regulated mining safety policies, and strict registration of a mine, the mining industry has little or no informal employment. The electricity sector is also well regulated, making it difficult to obtain information on informal employment. Domestic workers and employment in the agriculture sector are typically counted under a separate heading. The informal sector is vital in areas with very high unemployment and very low labour participation rates. Unemployed people see participating in the informal sector as a survival strategy. The most desirable situation would be to get a stable formal job, but because the formal economy is

not growing fast enough to generate adequate jobs, the informal sector is used as a survival mechanism.

13.5 Basic service delivery

Housing

In 2016, the City of Tshwane had 628 000 very formal dwelling units representing 61.09% of the city's total households; 197 000 formal dwelling units, that is, 19.21% of total households); and 185 000 informal dwelling units which made up the last 18.02% of total households (Figure 26). In regional terms, the region in the City with the highest number of very formal dwelling units was Region 6, with 170 000 or 27.03% of total very formal dwelling units in the metro, while the region with the lowest number of very formal dwelling units was Region 5, with 14 300 or 2.28% of total very formal dwelling units in the City.

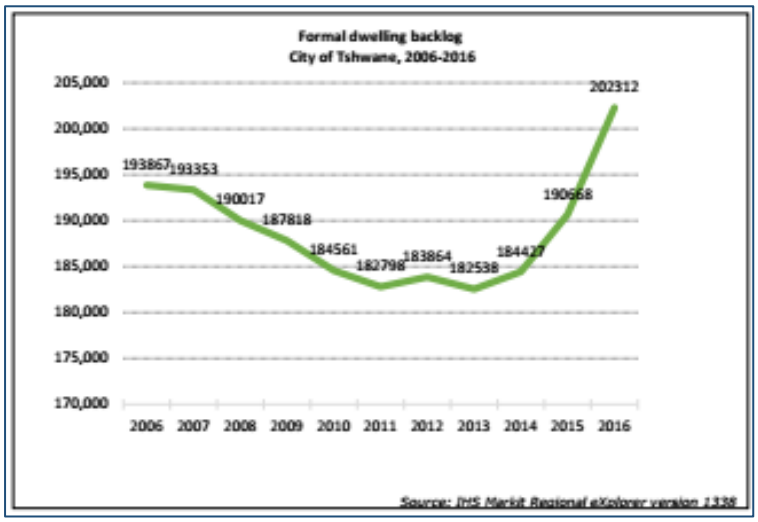
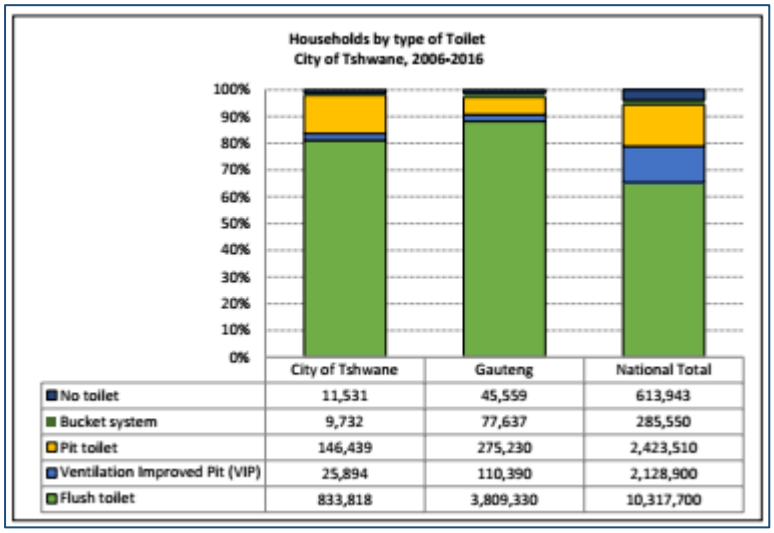


Figure 26: Formal dwelling backlog

Sanitation

Sanitation is one of the basic necessities, which contributes to human dignity and quality of life and is an essential pre-requisite for success in the fight against poverty, hunger and child deaths among other pressing socio-economic challenges South Africa faces. The City of Tshwane, in line with the country, places an on-going focus on the reduction of the sanitation backlog by ensuring universal access to sanitation. In comparison with the national and provincial figures, in 2016, the figure illustrates that the City of Tshwane had a total of 833 818 flush toilets (81.16% of total households), 25 894 VIP toilets (2.52% of total households) and 146 439 (14.25%) of total household pit toilets. Looking at the sanitation backlogs in Tshwane (the number of households without a hygienic toilet) over time, it is known that in 2006 the number of households without a hygienic toilet in City of Tshwane Metropolitan Municipality was 158 000. This increased annually at a rate of 0.62% to 168 000 in 2016. Though the City made advances in addressing sanitation backlogs in the period 2009 to 2013, the on-going growth of

households, particularly in informal settlements, due to the high in-migration into the region as well as from population growth, has put additional strain on household infrastructure.



	City of Tshwane	Gauteng	National Total
No toilet	11,531	45,559	613,943
Bucket system	9,732	77,637	285,550
Pit toilet	146,439	275,230	2,423,510
Ventilation Improved Pit (VIP)	25,894	110,390	2,128,900
Flush toilet	833,818	3,809,330	10,317,700

Figure 27: Households by type of toilet

Water

Access to safe water is a fundamental human need and plays an important role in socio-economic development. Water is a unique resource due to its biological functions and the fact that some water is required for essentially all development activities; the total absence of water would constitute an absolute impediment to development. To this end, the City of Tshwane continues to prioritise the provision of water services to its residents, not just in response to the Constitutional mandate of local government, but also in an effort to improve the socio-economic conditions of the residents of Tshwane.

With a focus on households categorised according to their main access to water, in the following manner: regional/local water scheme, borehole and spring, water tank, dam/pool/stagnant water, river/stream and other methods used as main access to water, the category of 'No formal piped water' includes households that obtain water from water carriers and tankers, rain water, boreholes, dams, rivers and springs, in 2016, Tshwane had 694 453 (or 67.59%) households with piped water inside the dwelling; 231 258 (22.51%) households had piped water inside the yard; and 40 760 (3.97%) households had no formal piped water.

Electricity

Electrification provides a solid basis for development of local communities. Once a community has access to electricity, it can also have access to safe potable water, food security, as well as lighting. In addition, it reduces the need for collecting and using other traditional sources of energy (Goldemberg et al 2000). At an international level, universal access to electricity is not only critical for improving living standards but deemed indispensable for eradicating poverty and achieving the Sustainable

Development Goals (UNGA 2015). In the City of Tshwane, looking at households categorised into three electricity usage categories: (1) households using electricity for cooking; (2) households using electricity for heating and; (3) households using electricity for lighting, in 2016, the City had 33 800 (3.29%) households with electricity for lighting only; 872 000 (84.92%) households had electricity for lighting and other purposes and 121 000 (11.79%) households did not use electricity.

Refuse disposal

Environmental hygiene plays a vital role in the prevention of many diseases that are caused by waste. Environmental hygiene further impacts on the natural environment and the preservation of important natural assets, such as water resources. This report makes a distinction between formal and informal refuse removal. When refuse is removed by the local authority, it is referred to as formal refuse removal. Informal refuse removal is where either the household or the community disposes of the waste, or where there is no refuse removal at all. in 2016, Tshwane had 854 000 (83.14%) households that had their refuse removed weekly by the authority. Additionally: 19 500 (1.90%) households had their refuse removed less often than weekly by the authority; 93 500 (9.10%) households had to remove their refuse personally (own dump). In 2016, at 208 000 or 24.30% of the total Tshwane households, Region 1 had the highest number of households where the refuse was removed weekly by the authority. The region with the lowest number of households where the refuse was removed weekly by the authority was Region 5 representing 21 900 or 2.56% of the total Tshwane households.

v) Impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts

This section includes the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts can be reversed; may cause irreplaceable loss of resources; and can be avoided, an assessment of each identified potentially significant impact and risk, including cumulative impacts, as well as how these impacts can be managed or mitigated and level of residual risk.

1 Soils, land capability, surrounding land use and landscape character

Activity, nature, and consequence of impact:

Construction of 7 chicken houses, a wash bay and reservoir including related structures which potentially are access roads, an office small storage building, parking area etc. Existing vegetation at all structure footprints will be removed and footprints will be covered with concrete, paving and gravel depending on the structure type. It will cause the productive soil potential (land capability) at all structure footprints to cease in terms of crop farming (grain and vegetables) and rangeland (meat – cattle and sheep), although the chicken farm will produce meat without using the productive potential of the soil resource. The current unproductive or low productive state at the development footprint will improve and a number of employment opportunities will be generated.

Cumulative impacts:

There are a small number of chicken farms observed in a 10 km radius. Although the chicken farms cause the productive soil potential to cease at structure footprints, production at these footprints continue without using the productive soil potential. Since the productive soil potential can re-establish after removal of the structures there is no cumulative impact of concern.

Assumptions, uncertainties, and gaps in knowledge:

The agricultural sensitivity was thoroughly assessed by means of a detailed soil, land capability and land use assessment and there are no uncertainties or gaps in knowledge or data.

Impact pre-mitigation:

	Cease of productive soil potential/land capability	**Change in agricultural productivity**
Intensity and magnitude	3 The productive soil potential in terms of crop farming and grazing will cease at chicken farm structure footprints and immediate surroundings and will remain ceased as long as the structures exist.	1 Although the productive soil potential at the chicken house footprints will cease, meat will be produced without utilizing the productive soil potential. The current non-productive state will change to productive and a positive impact will be created.
Resource replaceability	2 The productive soil potential will remain ceased as long as the structures exists but are not destroyed. It can be regained but only when the structures are removed.	1 The increased productivity and positive impact do not impact on a natural resource.
Duration	3 The impact will remain for the entire operational life of the activity and permanently thereafter if not mitigated.	2 The positive impact will remain for the entire operational phase of the chicken farm, but will end at any point that the chicken production unit is discontinued.
Extent or spatial scale	1 The impact will be site specific.	1 The positive impact will be site specific.
Probability	3 The impact will definitely occur.	3 The positive impact will definitely occur.
Significance	**12** **High**	**8** **Medium (Positive)**

Impact post-mitigation:

	Cease of productive soil potential/land capability	**Change in agricultural productivity**
Intensity and magnitude	1 The impact cannot be mitigated during the construction or operational phases. The impact will be mitigated during the decommissioning phase by removal of the structures where after the productive soil potential will re-establish.	1 The impact is positive and does not require any mitigation since it does not negatively affect natural processes or function or natural resources. The current non-productive state will improve and change to productive.

	Cease of productive soil potential/land capability	**Change in agricultural productivity**
Resource replaceability	1 The productive soil potential will be lost during the operational live of the activity but will be regained after removal of the structures during the decommissioning phase.	1 The increased productivity and positive impact does not impact on a natural resource.
Duration	2 The impact will last for the entire operational life of the activity and will be mitigated thereafter by removal of the structures.	2 The positive impact will remain for the entire operational phase of the chicken farm, but will end at any point that the chicken production unit is discontinued.
Extent or spatial scale	1 The impact will be site specific.	1 The positive impact will be site specific.
Probability	3 The impact will definitely occur.	3 The positive impact will definitely occur.
Significance	**8** **Medium**	**8** **Medium (Positive)**

Environmental objective
To minimize the size of areas to be covered by concrete, paving and gravel and utilize all surrounding areas by diverse agricultural production units to optimize the productivity of the entire farm portion and subsequently maximize the contribution to the food supply chain of the country.

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Mitigation hierarchy**
Design of the site plan; minimise concrete slabs, paved and gravelled sections; Proper surface runoff control plan and prevention measures at all structure footprints to prevent soil erosion.	Pre-construction, construction and operational	Maintenance register	Site inspections	Continuously throughout operation	Farm/Site manager	Minimise and rehabilitate

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
Preserve natural grass up to a safe distance of structures to preserve productive soil functions. Fence off all structures to enable safe use of surrounding agricultural land. Introduce other productive agricultural uses on current unproductive land as supporting units for the chicken farm.						

Stakeholder expectations and / or comments
None received.
Residual and latent risks
If effective management takes place, there should not be residual impacts. No latent impacts foreseen.

2 Vegetation and animal life

2.1 Destruction of sensitive vertebrate habitat including clearing of land for chicken houses, construction camp and potential pollution of the soil and water

Activity, nature, and consequence of impact:

These may be at one or several locations; area will be cleared and levelled where necessary, site office may be temporary structures and machinery, building supplies and temporary staff facilities (excluding accommodation) will be housed here. The impacts could include:

- Removal of vegetation
- Levelling and compaction of soils
- Storage of machinery, supplies and staff facilities

This could lead to the loss of vegetation and/or species of conservation concern, alteration and loss of microhabitats, altered vegetation cover, increased erosion and contamination of soil and groundwater. This will lead to some terrestrial species becoming permanently and proportionally rarer within local context. The

sources of these impacts include the removal of vegetation by clearing the bush, felling of protected trees and use of veldfires. The pollution of the drainage lines on neighbouring properties will have an impact on the survival of many vertebrate species.

Cumulative impacts:

Pollution of the soil and groundwater. Construction activities in or near CBA will result in cumulative impact to the sensitive vertebrate habitat on the study site and even beyond. It is imperative that effective protective measures should be put into place and monitored in the CBA. A rehabilitation plan should be put into action should this sensitive area suffer degradation.

Assumptions, uncertainties, and gaps in knowledge:

Site visits for species identification are conducted over short time periods and not on a regular basis during several seasons over a period of time.

Impact pre-mitigation:

	Destruction of vertebrate habitat (construction phase)	**Destruction of vertebrate habitat (operational phase)**
Intensity and magnitude	3 Magnitude: High	3 Magnitude: High
Resource replaceability	3 Definite potential of loss.	3 Definite potential of loss.
Duration	1 The impact is short-term.	3 The impact is long-term.
Extent or spatial scale	2 The impact will affect the local area.	2 The impact will affect the local area.
Probability	3 The impact will definitely occur.	3 The impact will definitely occur.
Significance	**12** **High**	**14** **High**

Impact post-mitigation:

	Destruction of vertebrate habitat (construction phase)	Destruction of vertebrate habitat (operational phase)
Intensity and magnitude	1 Magnitude: Low	1 Magnitude: Low
Resource replaceability	1 Low potential of loss.	1 Low potential of loss.
Duration	1 The impact is short-term.	3 The impact is long-term.
Extent or spatial scale	1 The impact will be site specific.	1 The impact will be site specific.
Probability	2 The impact is probable.	2 The impact is probable.
Significance	**6** **Low**	**8** **Medium**

Environmental objective
To prevent the destruction of sensitive vertebrate habitat.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
Construction camp must be located outside of areas classified as a Critical Biodiversity Areas (CBA). Sensitive habitat should ideally be cordoned off to prevent access.	Planning and construction	Awareness and cordon off tape	Site inspections	Continuous until operation	Farm/Site manager	Prevent
No open fires may be lit for cooking or any other purposes, unless in specifically designated and secured areas	Planning and construction	Awareness and training	Site Inspections	Continuous until operation	Farm/Site manager	Prevent

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately, strictly prohibit any pollution/littering. Ensure there is a method statement in place to remedy any accidental spillages immediately. No vehicles may be washed on site, except in suitably designed and protected areas No vehicles may be serviced or repaired on the property, unless it is an emergency situation in which case adequate spillage containment must be implemented	Construction	Spill handling procedure, spill kits, waste management procedure	Site Inspections	Continuous	Farm/Site manager	Prevent/Minimise
Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge. Monitoring should continue for at least two years after construction is complete.	Operational	Alien species programme	Alien species monitoring	For at least two years after construction is complete.	Farm/Site manager	Minimise

Stakeholder expectations and / or comments
None received.
Residual and latent risks
Compaction on construction camp could result in altered topsoil characteristics and vegetation composition. These areas are also prone to invasion by alien invasive plant species. Impacts on sensitive areas are likely to be permanent unless the development takes place only in the least sensitive areas.

2.2 Flora and Red Data Mammals, Herpetofauna and Avifauna

Activity, nature, and consequence of impact:

All Red Data species listed as Critically Endangered, Vulnerable, Near Threatened or Data Deficient are discerning species and became endangered as a result of the deterioration of their preferred habitats. Many of the Red Data mammals have already been killed or driven from the area.

The impacts could include:

- Removal of vegetation
- Pollution of habitat
- Killing of mammals and herpetofauna

This could lead to the loss of Red Data mammal and herpetofauna species of conservation concern.

Disturbance of resident bird species is usually caused by construction activities and is therefore short term but can also continue over the long term into the operational and maintenance phases. Two Red Data avifaunal species (SCC) were flagged for the footprint area according to the National Screening Tool:

- African Grass Owl (*Tyto capensis*), and
- African Marsh Harrier (*Circus ranivorus*)

Cumulative impacts:

The main concerns with the development is loss of natural open grassland habitat resulting in the displacement or exclusion of nationally threatened, rare, endemic or range-restricted bird species through lost habitat on the site. Construction and operational activities will result in cumulative impact to the sensitive mammal habitat on the study site and even beyond. It is imperative that effective protective measures should be put into place and monitored in sensitive areas. A rehabilitation plan should be put into action should any sensitive areas suffer degradation.

Assumptions, uncertainties, and gaps in knowledge:

Site visits for species identification are conducted over short time periods and not on a regular basis during several seasons over a period of time.

Impact pre-mitigation:

	Loss of red data species and flora (construction phase)	**Loss of red data species and flora (operational phase)**
Intensity and magnitude	2 Magnitude: Moderate.	2 Magnitude: Moderate.

	Loss of red data species and flora (construction phase)	**Loss of red data species and flora (operational phase)**
Resource replaceability	3 Low reversibility.	3 Low reversibility.
Duration	1 The impact is short-term.	3 Permanent.
Extent or spatial scale	2 Limited to local area.	2 Limited to local area.
Probability	3 Highly probable.	3 Highly probable.
Significance	**11** **Medium**	**13** **High**

Impact post-mitigation:

	Loss of red data species and flora (construction phase)	**Loss of red data species and flora (operational phase)**
Intensity and magnitude	1 Magnitude: Minor.	1 Magnitude: Minor.
Resource replaceability	1 Low potential of loss.	1 Low potential of loss.
Duration	1 The impact is short-term.	3 Permanent.
Extent or spatial scale	1 Limited to site.	1 Limited to site.
Probability	1 Low probability.	1 Low probability.
Significance	**5** **Low**	**7** **Low**

Environmental objective

To prevent the loss of red data species of conservation concern.

To reduce the loss of vegetation.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
All new development must be located outside of the area classified as CBA's. and the development of the chicken farm and other buildings should take place on the most disturbed area of the site. Access roads must be kept to a minimum and must lead directly to or from the development.	Planning and construction	Awareness and cordon off tape	Site inspections	Continuous until operation	Farm/Site manager	Prevent
Sensitive habitat should ideally be cordoned off to prevent access while construction takes place. If any holes or trenches are dug for construction, they should be completed quickly; otherwise, these excavations may act as a death trap for small mammals and herpetofauna.	Construction	Awareness and cordon off tape	Site inspections	Continuous until operation	Farm/Site manager	Prevent
No vehicles should be allowed to move in or across the wet areas or floodplain area and possibly get stuck. This leaves visible scars and destroys habitat, and it is important to conserve areas where there are tall reeds or grass, or areas where there is short grass and mud. During the construction phase, noise must be kept to a minimum to reduce the impact of the development on the fauna residing on the site.	Construction	Boundaries (fences) and signage restricting entry.	Frequent inspections.	Continuous	Farm/Site manager	Prevent
Hold meetings with construction workers about the common goal for mammals/herpetofauna (wildlife) in	Construction	Awareness and training	Training attendance registers	Continuous until operation	Farm/Site manager	Prevent

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
general and rare mammal/herpetofauna species in particular. The legal protection and value of Red Data status must be explained to the construction workers.						
Prevent any pollution of the soil or drainage lines on neighbouring properties (areas to be fenced off). Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area. Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (erosion management plan required). Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. After construction, clear any temporarily impacted areas of all foreign materials, re-apply and/or loosen topsoils and landscape to surrounding level.	Construction	Stormwater Management Plan/Erosion management plan	Stormwater infrastructure Site inspections	Continuous until operation	Farm/Site manager	Minimise
Colonisation of the disturbed areas by plant species from the surrounding natural vegetation must be monitored to ensure that indigenous vegetation cover is sufficient within one growing season due to the high degree of invasive species in the area.	Construction	Alien species programme	Alien species monitoring	Continuous until operation	ECO	Minimise
Complete the project in as short a time frame as possible.	Operational	Cordon off tape	Site inspections	Continuous	Farm/Site manager ECO	Minimise

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
Monitor the area to ensure that the development stays within the demarked areas. Monitor colonisation by exotics or invasive plants and control these as they emerge. Plant indigenous vegetation from the surrounding areas to re-establish indigenous plant cover. Where possible, trees naturally growing on the site should be retained as part of the landscaping. With proper cultivation of specific indigenous plant species, the bird numbers and species in the area could even increase. Measures to ensure that these trees survive the physical disturbance from the development should be implemented. A tree surgeon should be consulted in this regard.		Alien species programme	Alien species monitoring			
Alien and invasive plants must be removed.	Operational until closure	Alien eradication plan	Site inspections	As per eradication plan	Farm/Site manager	Prevent
Dumping of builders' rubble and other waste in the areas earmarked for exclusion must be prevented, through fencing or other management measures. These areas must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics etc. to ensure continuous biodiversity.	Construction	Rehabilitation plan and cordon off tape.	Rehabilitation monitoring and site inspections	Continuous	Farm/Site manager	Minimise
The open grassland areas, as well as some disturbed grassland, fallow field and pastures bordering the open grassland areas should also be regarded as highly sensitive for Secretarybird and other typical Highveld grassland avifaunal species. The disturbed grassland forms a corridor that links the grassland	Planning, Construction and Operational	Ecological Management Plan	Avifaunal surveys	Continuous	Citizen scientists	N/A

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
areas on the study site to the surrounding grassland areas surrounding the study site. No development, disturbances or human related activities should be allowed within these sensitive habitat systems.						
The owner/managing agent must commit in writing to the long-term implementation of an ecological management plan and how this must be audited annually by GDARD.	Operational	Ecological Management Plan	Audits	Yearly	Owner	Minimise
Domestic pets, especially domestic cats must be excluded from all residential development areas where possible	Planning, Construction and Operational	N/A	N/A	Continuous	Farm/Site manager	Prevent
Proper veld management practises should be implemented with respect to grazing, burning and control of woody invasions. Timing of burning: repeatedly burning of grassland long after the growing season has started may negatively impact nestling birds (eggs), nestlings or juvenile birds in spring-summer. Repeatedly burning more than just fire breaks too early in the season, i.e. in autumn, may result in insufficient vegetation cover and food availability for bird to survive the winter. Annual burning of the natural grassland vegetation should be avoided and less than half of the grassland area should be burnt less than once a year. Grassland management must ensure the removal of muribund herbaceous vegetation every four years. Options include fire, grazing and cut and baling.	Planning, Construction and Operational	Awareness and training Ecological Management Plan	N/A	Continuous	Farm/Site manager	Minimise

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
Prolonged over grazing should be prevented Selective grazing by concentrated grazers should be avoided (sheep and Blesbok). Late-season intensive grazing should be minimised. Grazing on new growth immediately after a burn every year should be avoided.	Planning, Construction	Ecological Management Plan	N/A	Continuous until operation	Farm/Site manager	Minimise
Where possible, work should be restricted to one area at a time, as this will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories. Where possible the construction of the proposed development should take place during the winter months during the time when most avifaunal species are not breeding.	Planning, Construction	N/A	N/A	Continuous until operation	Farm/Site manager	Minimise
All areas designated as sensitive in a sensitivity mapping exercise (see Sensitivity Mapping Rules for Biodiversity Assessments) should be incorporated into an open space system. Development should be located on the areas of lowest sensitivity. The open space system should be managed in accordance with an Ecological Management Plan that complies with the Minimum Requirements for Ecological Management Plans and forms part of the EMP.	Planning, Construction and Operational	Ecological Management Plan	Inspections	Continuous	Farm/Site manager	Minimise
The open space system (including sensitive areas) should be fenced off prior to construction commencing (including site clearing and pegging). All construction-related impacts (including service roads,	Planning, Construction	Fencing off areas	Inspections	Continuous until operation	Farm/Site manager	Minimise

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
temporary housing, temporary ablution, disturbance of natural habitat, storing of equipment/building materials/vehicles or any other activity) should be excluded from the open space system. Access of vehicles to the open space system should be prevented and access of people should be controlled, both during the construction and operational phases.						
In order to minimize artificially generated surface stormwater runoff, total sealing of paved areas such as parking lots, driveways, pavements and walkways should be avoided. Permeable material should rather be utilized for these purposes.	Construction, Operational	SWMP	Inspections	Continuous	Farm/Site manager	Minimise
An appropriate management authority (e.g. the body corporate) that must be contractually bound to implement the Environmental Management Plan (EMP) and Record of Decision (ROD) during the operational phase of the development should be identified and informed of their responsibilities in terms of the EMP and ROD.	Operational	Inspections	Inspections	Continuous	Operational executive	Minimise

Stakeholder expectations and / or comments
None received.
Residual and latent risks
The decline of mammal species and herpetofauna is likely to continue unless the development takes place in the least sensitive areas and people are educated about mammals/ herpetofauna in particular and Red Data species specifically.

2.3 Poaching of wildlife in the vicinity

Activity, nature, and consequence of impact:

The site is vulnerable to hunting/trapping by farm workers/construction workers. Harassing and hunting by farm workers/ construction workers could be expected. The killing of wildlife like small antelope, scrub hares, snakes and game birds by construction workers is a possibility.

Cumulative impacts:

Certain species becoming proportionally rarer or even becoming locally extinct.

Assumptions, uncertainties, and gaps in knowledge:

Site visits for species identification are conducted over short time periods and not on a regular basis during several seasons over a period of time.

Impact pre-mitigation:

	Poaching (construction phase)	**Poaching (operational phase)**
Intensity and magnitude	3 Magnitude: Very high	3 Magnitude: High
Resource replaceability	3 Low reversibility.	3 Low reversibility.
Duration	1 The impact is short-term.	3 Permanent.
Extent or spatial scale	2 Limited to local area.	2 Limited to local area.
Probability	3 Highly probable.	3 Highly probable.
Significance	**12** **High**	**14** **High**

Impact post-mitigation:

	Poaching (construction phase)	**Poaching (operational phase)**
Intensity and magnitude	2 Magnitude: Moderate.	1 Magnitude: Low.
Resource replaceability	2 Moderate potential of loss.	1 Low potential of loss.
Duration	1 The impact is short-term.	3 Permanent.
Extent or spatial scale	1 Limited to site.	1 Limited to site.
Probability	2 Medium probability.	1 Low probability.
Significance	**8** **Medium**	**7** **Low**

Environmental objective
To prevent poaching during the construction and operational phase.

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Mitigation hierarchy**
Hunting of birds and mammals by organised dogs hunting in rural areas surrounding the study site should be avoided, controlled and managed to prevent the extinction of the natural biodiversity surrounding the study site and all other expanding rural developing areas	Planning, Construction and Operational	Training and awareness	Ad hoc inspections	Continuous	Farm/Site manager	Prevent

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
Education of construction workers about the value of wildlife and environmental sensitivity. The use of hunting dogs by farm workers must be discouraged. Restrict access to the suitable/sensitive habitats of fauna.	Planning and construction	Awareness and company disciplinary code	Site inspections	Continuous until operation	Farm/Site manager	Prevent
If any herpetological species are encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity The contractor/contractors must ensure that no animals are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.	Planning and construction	Training and awareness	Training attendance registers	Continuous until operation	Farm/Site manager	Prevent

Stakeholder expectations and / or comments
None received.
Residual and latent risks
With education, the impact can be kept to a minimum.

3 Surface water

Activity, nature, and consequence of impact:

No aquatic ecosystems were observed on site however systems were observed within the 500 m ESA. These include seepage wetlands and channelled valley bottom wetland including impoundments. The impact assessment below addresses the issue of activities impacting on these aquatic ecosystems. The wetland systems are impacted but remain functional. Changes to flood attenuation, streamflow regulation, erosion control and carbon storage (among other features) can be expected, however the impacts are largely reduced with mitigation measures.

Cumulative impacts:

There are a small number of chicken farms observed in a 10 km radius. Any release of waste water from these farms may cause cumulative pollution.

Assumptions, uncertainties, and gaps in knowledge:

To determine the riparian or wetland boundary, indicators are used. If these are not present during the site visit, it can be assumed that they were dormant or absent and thus if any further indicators are found during any future phases of the project, the author cannot be held responsible due to the indicator's variability. Even though every care was taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time, and budget.

Impact pre-mitigation:

	Flood attenuation	**Streamflow regulation**	**Sediment trapping**	**Phosphate, nitrate, and toxicant assimilation**	**Erosion control**	**Carbon storage**	**Habitat**	**Biota**	**Geomorphology**
Intensity and magnitude	2	2	2	1	2	2	1	1	2
Resource replaceability	2	1	2	2	1	1	1	2	3
Duration	3	2	2	2	2	2	2	1	1
Extent or spatial scale	2	1	2	1	1	2	1	1	3
Probability	3	3	2	2	2	2	1	2	2
Significance	**12 High**	**9 Medium**	**10 Medium**	**8 Medium**	**8 Medium**	**9 Medium**	**6 Low**	**7 Low**	**11 Medium**

Impact post-mitigation:

	Flood attenuation	Streamflow regulation	Sediment trapping	Phosphate, nitrate, and toxicant assimilation	Erosion control	Carbon storage	Habitat	Biota	Geomorphology
Intensity and magnitude	1	1	2	1	2	2	1	1	2
Resource replaceability	1	1	1	1	1	1	1	1	1
Duration	2	2	1	2	1	1	1	1	1
Extent or spatial scale	1	1	1	1	1	1	1	1	1
Probability	2	2	1	1	1	2	1	1	2
Significance	**7 Low**	**7 Low**	**6 Low**	**6 Low**	**6 Low**	**7 Low**	**5 Low**	**5 Low**	**7 Low**

Environmental objective
To reduce the impact on the wetlands or riparian areas.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
The storm water from the developments (chicken houses) must not be allowed to drain to the aquatic ecosystems- this includes the avoidance of sheet flow runoff into the aquatic ecosystems,	Planning, construction and operational	Stormwater Management Plan	Stormwater infrastructure/ Site inspections	Continuous	Farm/Site manager	Minimise

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
Road access must remain gravel with runoff not allowed to flow into the aquatic ecosystems within the 500 m ESA, The incorporation of sustainable urban drainage principals into the designs for the for the site albeit smaller scale, Compilation of systematic adaptive aquatic ecosystem rehabilitation plan, Compilation of monitoring plan to ensure impacts are timeously observed and addressed as soon as possible, The use of trench breakers in the trenches- especially in sloped areas is required, if needed.						
The drainage lines and associated wetlands and impoundments as delineated by an aquatic specialist as well as a buffer zone from 50 m (wetlands outside the urban area) from the edge of the delineated wetland edge should be regarded as of high sensitivity and no development, disturbances or human related activities should be allowed within these sensitive habitat systems.	Planning, construction and operational	Buffer zones, Layout plan	N/A	Continuous	Farm/Site manager	Prevent

Stakeholder expectations and / or comments
None received.
Residual and latent risks
If effective management takes place, there should not be residual impacts. No latent impacts foreseen.

4 Groundwater quality and quantity

4.1 Depletion of groundwater resource

Activity, nature, and consequence of impact:

Over-abstraction of groundwater from boreholes is likely to lead to depletion of the water levels in the area over time. This can cause damage to the aquifer and might impact on neighbouring groundwater users that are reliant on the same source of water. Reduced baseflow to streams/rivers and groundwater dependent ecosystems (wetlands).

Cumulative impacts:

Since the impact is negligible negative with mitigation, cumulative impacts to groundwater with other projects are not anticipated.

Assumptions, uncertainties, and gaps in knowledge:

The assessment of the predicted significance of impacts for a proposed development is by its nature, inherently uncertain – environmental assessment is thus an imprecise science. To deal with such uncertainty in a comparable manner, a standardised and internationally recognised methodology has been developed. This methodology will be applied in this study to assess the significance of the potential environmental impacts of the proposed development.

Impact pre-mitigation:

	Depletion of the groundwater resource due to over-abstraction (construction phase)	**Depletion of the groundwater resource due to over-abstraction (operational phase)**
Intensity and magnitude	2 Natural and/ or social functions and/ or processes are moderately altered	3 Natural and/ or social functions and/ or processes are notably altered
Resource replaceability	1 The resource is not damaged irreparably or is not scarce	1 The resource is not damaged irreparably or is not scarce
Duration	1 Short term: Impact will last between 1 and 5 years	2 Medium term: Impact will last between 5 and 10 years
Extent or spatial scale	1 Limited to the site and its immediate surroundings	2 Extending across the site and to nearby settlements

	Depletion of the groundwater resource due to over-abstraction (construction phase)	**Depletion of the groundwater resource due to over-abstraction (operational phase)**
Probability	2 The impact has occurred here or elsewhere and could therefore occur	3 It is most likely that the impact will occur
Significance	**7** **Low**	**11** **Medium**

Impact post-mitigation:

	Depletion of the groundwater resource due to over-abstraction (construction phase)	**Depletion of the groundwater resource due to over-abstraction (operational phase)**
Intensity and magnitude	2 Natural and/ or social functions and/ or processes are slightly altered	2 Natural and/ or social functions and/ or processes are somewhat altered
Resource replaceability	1 The resource is not damaged irreparably or is not scarce	1 The resource is not damaged irreparably or is not scarce
Duration	1 Brief: Impact will not last longer than 1 year	1 Brief: Impact will not last longer than 1 year
Extent or spatial scale	1 Limited to specific isolated parts of the site	2 Limited to the site and its immediate surroundings
Probability	1 Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur	1 Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
Significance	**6** **Low**	**7** **Low**

Environmental objective
To maintain and monitor the regional groundwater table.

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
Monitoring of static groundwater levels. • Time dependant data is required to understand the regional groundwater flow dynamics. • A lowering in the static water levels may indicate that the aquifer is utilised in an unsustainable way and abstraction rates need to be decreased.	Operational until closure	Monitoring & Conditions of the Water Use License	Groundwater monitoring program	Monthly	Manager	Minimise
Monitoring of groundwater abstraction volumes. • Calculate monthly & annual abstraction volumes.	Operational until closure	Monitoring & Conditions of the Water Use License	Groundwater monitoring program	Monthly	Manager	Minimise

Stakeholder expectations and / or comments
None received.
Residual and latent risks
If effective management takes place, there should not be residual impacts. No latent impacts foreseen.

4.2 Groundwater quality deterioration

Activity, nature, and consequence of impact:

Over-abstraction of groundwater from a borehole can potentially draw poorer water quality from the adjacent geohydrological environment into the borehole. This is likely to affect the groundwater quality in the area in general and might affect the supply in other boreholes within the fractured aquifer. Based on data acquired during the desk study and water quality results from boreholes sampled during the hydrocensus, it can be safely assumed that the water quality in the adjacent aquifers is of similar quality. Also, the water demand is well within the sustainable supply of the aquifer and this impact is highly improbable of occurring.

Cumulative impacts:

Since the impact is negligible negative with mitigation, cumulative impacts to groundwater with other projects are not anticipated.

Assumptions, uncertainties, and gaps in knowledge:

The assessment of the predicted significance of impacts for a proposed development is by its nature, inherently uncertain – environmental assessment is thus an imprecise science. To deal with such uncertainty in a comparable manner, a standardised and internationally recognised methodology has been developed. This methodology will be applied in this study to assess the significance of the potential environmental impacts of the proposed development.

Impact pre-mitigation:

	Groundwater quality deterioration as a result of over-abstraction (construction phase)	**Groundwater quality deterioration as a result of over-abstraction (operational phase)**
Intensity and magnitude	2 Natural and/ or social functions and/ or processes are moderately altered	3 Natural and/ or social functions and/ or processes are notably altered
Resource replaceability	1 The resource is not damaged irreparably or is not scarce	1 The resource is not damaged irreparably or is not scarce
Duration	2 Short term: Impact will last between 1 and 5 years	2 Medium term: Impact will last between 5 and 10 years
Extent or spatial scale	1 Limited to the site and its immediate surroundings	2 Extending across the site and to nearby settlements
Probability	1 Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere.	1 Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere.
Significance	**7** **Low**	**9** **Medium**

Impact post-mitigation:

	Groundwater quality deterioration as a result of over-abstraction (construction phase)	**Groundwater quality deterioration as a result of over-abstraction (operational phase)**
Intensity and magnitude	1 Natural and/ or social functions and/ or processes are negligibly altered	1 Natural and/ or social functions and/ or processes are negligibly altered
Resource replaceability	1 The resource is not damaged irreparably or is not scarce	1 The resource is not damaged irreparably or is not scarce
Duration	1 Brief: Impact will not last longer than 1 year	1 Brief: Impact will not last longer than 1 year
Extent or spatial scale	1 Limited to the site and its immediate surroundings	1 Limited to the site and its immediate surroundings
Probability	1 Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur	1 Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
Significance	**5** **Low**	**5** **Low**

Environmental objective
To maintain and monitor the regional groundwater quality.

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Mitigation hierarchy**
Chemical monitoring of groundwater for Chemical & Microbial parameters. Specifically; • Major ions and trace elements. • *E.Coli* & Total Coliforms	Operational until closure	Monitoring & Conditions of the Water Use License	Groundwater monitoring program	Bi-annually	Manager	Minimise

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
• Changes in chemical and microbial composition may indicate areas of groundwater contamination and be used as an early warning system to implement management/remedial actions. • To determine whether the water is fit for the intended use.						

Stakeholder expectations and / or comments
None received.
Residual and latent risks
If effective management takes place, there should not be residual impacts. No latent impacts foreseen.

5 Archaeological, historical and cultural aspects

5.1 Surface and subsurface impact on heritage resources due to rehabilitation

Activity, nature, and consequence of impact:

During the proposed construction and operational phases, surface and subsurface impacts may take place. These activities can lead to irreparable damage or complete destruction of heritage resources if not correctly managed.

Cumulative impacts:

If mitigation measures are adhered to, none are foreseen.

Assumptions, uncertainties, and gaps in knowledge:

Dense vegetation hampered the visibility of archaeological material towards the northern boundary of the study area. Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the construction phase.

Impact pre-mitigation:

Site No (2528DC)	K01	K02	K03	K04	K05	K06	K07	K08	K09	K10
Site Type	**Building-Demolished**	**Building-Ruin**	**Natural**	**Building-Demolished**	**Building-Ruin**	**Building**	**Building**	**Building**	**Building-Demolished**	**Natural**
Intensity and magnitude	3	3	1	1	1	3	1	1	3	1
Resource replaceability	3	3	1	1	1	3	1	1	3	1
Duration	3	3	1	1	1	3	1	1	3	1
Extent or spatial scale	1	1	1	1	1	1	1	1	1	1
Probability	2	2	1	1	1	2	1	1	2	1
Significance	**12: High**	**12: High**	**None**	**5: Low**	**5: Low**	**12: High**	**5: Low**	**5: Low**	**12: High**	**None**

Site No (2528DC)	K11	K12	K13	K14	K15	K16	K17
Site Type	**Structure**	**Stone-walling**	**Structure**	**Stone-walling**	**Potential Grave**	**Building**	**Building**
Intensity and magnitude	1	3	1	3	3	3	3
Resource replaceability	1	3	1	3	3	3	3
Duration	1	3	1	3	3	3	3
Extent or spatial scale	1	2	1	2	1	1	1
Probability	1	2	1	2	1	2	2
Significance	**5: Low**	**13: High**	**5: Low**	**13: High**	**11: Medium**	**12: High**	**12: High**

Impact post-mitigation:

Site No (2528DC)	K01	K02	K03	K04	K05	K06	K07	K08	K09	K10
Site Type	**Building-Demolished**	**Building-Ruin**	**Natural**	**Building-Demolished**	**Building-Ruin**	**Building**	**Building**	**Building**	**Building-Demolished**	**Natural**
Intensity and magnitude	1	1	1	1	1	1	1	1	1	1
Resource replaceability	1	1	1	1	1	1	1	1	1	1

Site No (2528DC)	K01	K02	K03	K04	K05	K06	K07	K08	K09	K10
Site Type	**Building-Demolished**	**Building-Ruin**	**Natural**	**Building-Demolished**	**Building-Ruin**	**Building**	**Building**	**Building**	**Building-Demolished**	**Natural**
Duration	1	1	1	1	1	1	1	1	1	1
Extent or spatial scale	1	1	1	1	1	1	1	1	1	1
Probability	1	1	1	1	1	1	1	1	1	1
Significance	**5: Low**	**5: Low**	**5: Low**	**5: Low**	**5: Low**	**5: Low**	**5: Low**	**5: Low**	**5: Low**	**5: Low**

Site No (2528DC)	K11	K12	K13	K14	K15	K16	K17
Site Type	**Structure**	**Stone-walling**	**Structure**	**Stone-walling**	**Potential Grave**	**Building**	**Building**
Intensity and magnitude	1	1	1	1	1	1	1
Resource replaceability	1	1	1	1	1	1	1
Duration	1	1	1	1	1	1	1
Extent or spatial scale	1	1	1	1	1	1	1
Probability	1	1	1	1	1	1	1
Significance	**5: Low**	**5: Low**	**5: Low**	**5: Low**	**5: Low**	**5: Low**	**5: Low**

Environmental objective

Ensure that heritage resources are not impacted.

Site No (2528DC)	Management measures to be applied	Phase applicable to management measure	Management Tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation Hierarchy
K01	Care should be exercised when developing in this vicinity	Construction	General awareness	Site inspections	Inspections during construction	ECO/Heritage specialist	Only necessary if resources are found	Prevent

Site No (2528DC)	Management measures to be applied	Phase applicable to management measure	Management Tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation Hierarchy
K02	Avoid site	Construction & development	General awareness	inspections Site	Inspections during construction and development	ECO/Heritage specialist	None	Prevent
K03	None	None	None	None	None	N/A	None	N/A
K04	None	None	None	None	None	N/A	None	N/A
K05	None	None	None	None	None	N/A	None	N/A
K06	Avoid site	Construction & development	General awareness	inspections Site	Inspections during construction and development	ECO/Heritage specialist	None	Prevent
K07	None	None	None	None	None	N/A	None	N/A
K08	None	None	None	None	None	N/A	None	N/A
K09	Care should be exercised when developing in this vicinity	Construction	General awareness	Site inspections	Inspections during construction	ECO/Heritage specialist	Only necessary if resources are found	Prevent
K10	None	None	None	None	None	N/A	None	N/A
K11	None	None	None	None	None	N/A	None	N/A
K12	Avoid site	Construction & development	General awareness	Site inspections	Inspections during construction, development and operational phases	ECO/Heritage specialist	Only if vegetation clearing is considered	Prevent
K13	None	None	None	None	None	N/A	None	N/A
K14	Avoid site	Construction & development	General awareness	Site inspections	Inspections during construction, development and operational phases	ECO/Heritage specialist	Only if Phase 2 AIA is considered	Prevent

Site No (2528DC)	Management measures to be applied	Phase applicable to management measure	Management Tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Financial provision for long-term maintenance and/or environmental costs	Mitigation Hierarchy
K15	Establish conservation buffer of 30 m around the site	Construction & development	General awareness	Site inspections	Inspections during construction and development	ECO	Only necessary if relocation is considered	Prevent
K16	Avoid site	Construction & development	General awareness	Site inspections	Inspections during construction and development	ECO/Heritage specialist	None	Prevent
K17	Avoid site	Construction & development	General awareness	Site inspections	Inspections during construction and development	ECO/Heritage specialist	None	Prevent

Stakeholder expectations and / or comments
None received.
Residual and latent risks
If effective management takes place, there should not be residual impacts. No latent impacts foreseen.

5.2 Destruction of fossil heritage

Activity, nature, and consequence of impact:

The development footprint is situated on a geological layer with a high palaeontological sensitivity. The nature of the impact is the destruction of Fossil Heritage. Loss of fossil heritage will have a negative impact.

Cumulative impacts:

None are foreseen.

Assumptions, uncertainties, and gaps in knowledge:

The accuracy and reliability of the report **may be** limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.
5. Lack of rocky outcrops.
6. Inaccessibility of site.
7. Insufficient data from developer and exact lay-out plan for all structures (for this report all required data/information was provided).

Impact pre-mitigation:

	Destruction of fossil heritage
Intensity and magnitude	2 The intensity/magnitude of the impact is moderate as it may continue in a modified way. The loss of resources occurs but natural cultural and social processes continue, albeit in a modified manner.
Resource replaceability	3 The resource is irreplaceable.
Duration	3 In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be permanent.
Extent or spatial scale	1 The extent of the impact only extends in the region of the development activity footprint and may include transport routes.
Probability	3 The probability of the impact occurring will be high.
Significance	**12** **High**

Impact post-mitigation:

	Destruction of fossil heritage
Intensity and magnitude	1 With Mitigation the impact will be low and the cumulative impact is low.
Resource replaceability	3 The resource is irreplaceable.
Duration	3 The expected duration of the impact is assessed as potentially permanent.
Extent or spatial scale	1 The extent of the impact only extends in the region of the development activity footprint and may include transport routes.
Probability	2 Impacts on palaeontological heritage during the construction and preconstruction phase could potentially occur but are regarded as having a moderate possibility.
Significance	**10** **Medium**

Environmental objective
To ensure that fossil heritage is not impacted.

Management measures to be applied	**Phase applicable to management measure**	**Management tools**	**Monitoring programmes**	**Management timeframe and schedule**	**Responsibilities for implementation and long-term maintenance**	**Mitigation hierarchy**
Threats to the National Heritage are earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of the fossils by development, vehicle traffic, and human disturbance.	Construction	N/A	Site inspections	Continuously throughout construction	Farm/Site manager and construction personnel	Avoid

Management measures to be applied	Phase applicable to management measure	Management tools	Monitoring programmes	Management timeframe and schedule	Responsibilities for implementation and long-term maintenance	Mitigation hierarchy
Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden as a desktop study could have missed fossiliferous outcrops.						
Immediately cease all construction activities if a fossil is unearthed and contact SAHRA for further investigation. The area must be fenced-off with a 30 m barrier and the construction workers must be informed that this is a no-go area. If fossils were found, they must be placed in a safe area for further investigation.	Construction	N/A	Site inspections	Continuously throughout construction	Farm/Site manager and construction personnel	Avoid

Stakeholder expectations and / or comments
None received.
Residual and latent risks
No residual/latent impacts foreseen.

6 Socio-economic

Activity, nature, and consequence of impact:

The proposed development will create jobs in the construction phase and the operational phase which is a long-term socio-economic benefit. During the construction phase, approximately 50 skilled contractors specialising in the poultry industry will be required, which may not necessarily be from the local community. However, during the operational phase, 31 jobs will be created which will benefit the local community.

Cumulative impacts:

Local benefits of the proposed development include benefits to the local economy through possible job creation, poverty alleviation, social upliftment, food security, and local supplier procurement during the construction phase as well as during the operational phase of the development (Fourie, 2021).

Assumptions, uncertainties, and gaps in knowledge:

The skilled contactors employed during the construction phase may not necessarily be local individuals.

Impact pre-mitigation:

	Change in employment figures
Intensity and magnitude	1 The current employments figure of 0 at agricultural units and 6 at the horse stable will increase to approximately 31 during the operational phase of the chicken farm and a positive impact is thus created in terms of employment.
Resource replaceability	1 The increased employment figures and positive impact does not impact on a natural resource.
Duration	2 The positive impact will remain for the entire operational phase of the chicken farm, but will become negative at any point that the chicken production unit is ceased.
Extent or spatial scale	1 The positive impact will be site specific.
Probability	3 The positive impact will definitely occur.
Significance	**8** **Medium (Positive)**

Impact post-mitigation:

	Change in employment figures
Intensity and magnitude	1 The impact is positive and does not require any mitigation since it does not negatively affect natural processes or function or natural resources. The development will create employment opportunities and current employments figures will rise
Resource replaceability	1 The increased employment figures and positive impact does not impact on a natural resource.

	Change in employment figures
Duration	2 The positive impact will remain for the entire operational phase of the chicken farm, but will end at any point that the chicken production unit is discontinued.
Extent or spatial scale	1 The positive impact will be site specific.
Probability	3 The positive impact will definitely occur.
Significance	**8** **Medium (Positive)**

vi) Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks

Impact assessment

The methodology used to assess the significance of an impact is based on the requirements as set out in EIA Regulations, (GN 982) of 2014 i.t.o. the NEMA as well as the Proposed National Guideline on Minimum Information Requirements for Preparing EIA for Activities that Require EA, of 2018, GN 86 in terms of NEMA. The impact significance methodology described below also complies to Appendix B of the Operational Guideline to Integrated Water and Waste Management of 2010 in terms of the NWA. In the event of any Section 21c&i water uses in terms of the NWA being assessed, Appendix A of the General Authorisations of 2016, GN 509 in terms of the NWA will be used to construct a risk matrix. Regulation 3(b) of the General Authorisations of 2016, GN 509 in terms of the NWA states that a suitably qualified SACNASP professional member must determine risks associated with this risk matrix.

Impact identification and prediction means forecasting the change of environmental parameters due to developmental patterns. These parameters may also be changing due to climate change and should be included.

Method of assessment: Impact identification and prediction is a stepwise procedure to identify the direct, indirect, and cumulative impacts (relating to both positive and negative impacts) for which a proposed activity and its alternatives will have on the environment as well as the community. This should be undertaken by determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity aspects of sites and locations as well as the risk of impact of the proposed activity. Refer to part A(h)(iv) for a complete description of these environmental attributes. Sources of data to be used for gathering data on the environmental attributes as well as the impacts include; monitoring / sampling data collected and stored, assumptions and actual measurements, published data available from the departments or other stakeholders in the area as well as specialist studies. Likely impacts should be described qualitatively and then studied separately in detail. This provides consistent and systematic basis for the comparison and application of judgements.

Significance rating: Ratings should then be assigned to each criterion. Significance of impacts should be determined for each phase of the project lifecycle this includes; preconstruction, construction, operational, closure (including decommissioning) and post closure phases. The significance of impacts should further be assessed both with and without mitigation action. The description of significance is largely judgemental, subjective, and variable. However, generic criteria can be used systematically to identify, predict, evaluate, and determine the significance of impacts resulting from project construction, operation, and decommissioning. The process of determining impact magnitude and significance should never become mechanistic. Impact magnitude is determined by empirical prediction, while impact significance should ideally involve a process of determining the acceptability of a predicted

impact to society. Making the process of determining the significance of impacts more explicit, open to comment and public input would be an improvement of environmental assessment practice. Impact magnitude and significance should as far as possible be determined by reference to either legal requirements (accepted scientific standards) or social acceptability. If no legislation or scientific standards are available, the EAP can evaluate impact magnitude based on clearly described criteria. A matrix selection process is the most common methodology used in determining and ranking the site sensitivities:

- The consequence: includes the nature / intensity / severity of the impact, spatial extent of the impact, and duration of the impact.
    - The nature / intensity / severity of the impact: An evaluation of the effect of the impact related to the proposed development on the receiving environment. The impact can be either positive or negative. A description should be provided as to whether the intensity of the impact is high, medium, or low or has no impact in terms of its potential for causing negative or positive effects. Cognisance should be given to climate change which may intensify impacts.
    - The spatial extent of the impact: Indication of the zone of influence of the impact: A description should be provided as to whether impacts are either limited in extent or affect a wide area or group of people. Cumulative impacts must also be considered as the extent of the impact as may increase over time.
    - The duration of the impact: It should be determined whether the duration of an impact will be short-term, medium term, long term or permanent. Cumulative impacts must also be considered as the duration of the impact as it may increase over time.
- The likelihood: includes the probability of the potential occurrence of the impact, and frequency of the potential occurrence of the impact.
    - The probability of the impact: The probability is the quality or condition of being probable or likely. The probability must include the degree to which these impacts can be reversed; may cause irreplaceable loss of resources; and can be avoided, managed, or mitigated.
    - The frequency of the potential occurrence of the impact.
- The significance: This is worst case scenario without any management measures. See below how significance is determined: Impact that may have a notable effect on one or more aspects of the environment or may result in noncompliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity, and probability of occurrence. Mitigation measures should be provided with evidence or motivation of its effectiveness.

Example of significance rating:

Prior to mitigation

Intensity and magnitude	1 Natural processes or functions are not affected and will adequately return to its natural state. The impact will be completely reversed with correct management, and can be completely avoided, managed, or mitigated.	2 Natural processes or functions are affected, and natural processes or functions will continue in a modified manner. The impact will be reversed to some degree with correct management, and can be somewhat avoided, managed, or mitigated	3 Natural processes or functions are to the extent where it temporarily or permanently ceases. The impact cannot be reversed even with correct management, and cannot be avoided, managed, or mitigated
Resource replaceability	1 Loss of resource can be completely replaced.	2 Loss of resource can somewhat be replaced.	3 Resources will be completely lost.
Duration	1 The impact will be short-lived.	2 The impact will last for the entire operational life of the activity but will be mitigated thereafter.	3 The impact will not cease after the operational life of the activity ceases but will be permanent.
Extent or spatial scale	1 The impact will be site specific.	2 The impact will affect the local area.	3 The impact will affect an area larger than just the local area.
Probability	1 It is unlikely that the impact will occur.	2 There is a probability for the impact to occur.	3 The impact will definitely occur.
Significance	None or low If the sum of the above ranking is equal or more than 5 and 7, and no ranking equals 3.	Medium If the sum of the above ranking is equal or more than 8 to 11.	High If the sum of the above ranking is 12 or more.

Post to mitigation

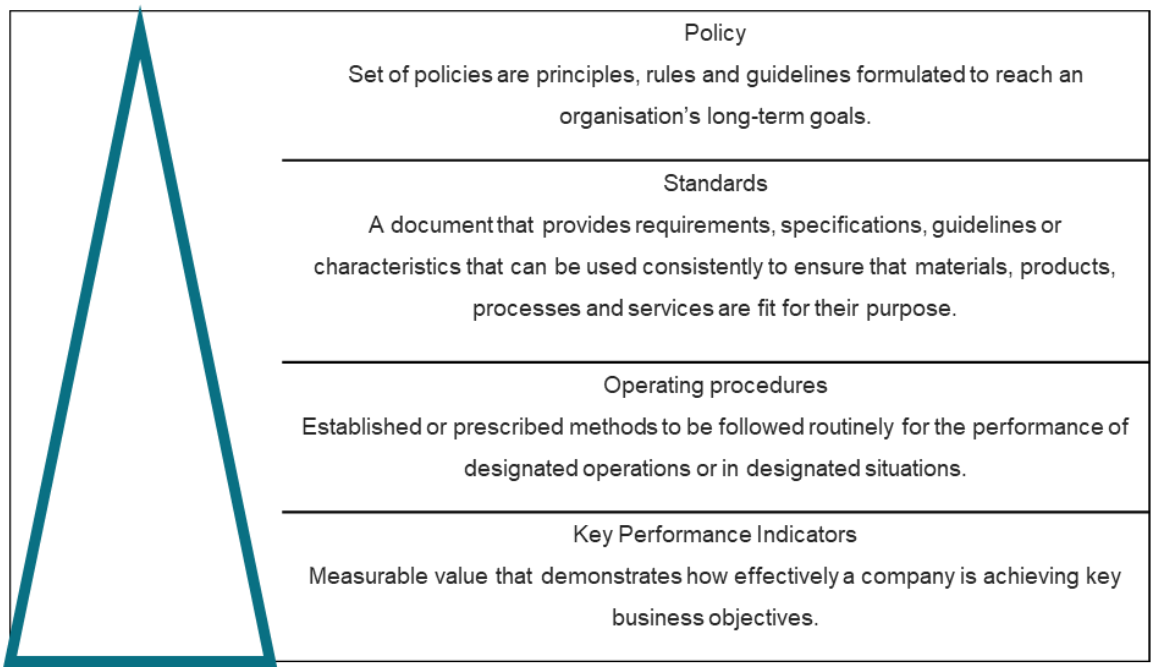
Intensity and magnitude	1 Natural processes or functions are not affected and will adequately return to its natural state. The impact will be completely reversed with correct management, and can be completely avoided, managed, or mitigated.	2 Natural processes or functions are affected, and natural processes or functions will continue in a modified manner. The impact will be reversed to some degree with correct management, and can be somewhat avoided, managed, or mitigated	3 Natural processes or functions are to the extent where it temporarily or permanently ceases. The impact cannot be reversed even with correct management, and cannot be avoided, managed, or mitigated

Resource replaceability	1 Loss of resource can be completely replaced.	2 Loss of resource can somewhat be replaced.	3 Resources will be completely lost.
Duration	1 The impact will be short-lived.	2 The impact will last for the entire operational life of the activity but will be mitigated thereafter.	3 The impact will not cease after the operational life of the activity ceases but will be permanent.
Extent or spatial scale	1 The impact will be site specific.	2 The impact will affect the local area.	3 The impact will affect an area larger than just the local area.
Probability	1 It is unlikely that the impact will occur.	2 It is likely for the impact to occur.	3 The impact will definitely occur.
Significance	None or low If the sum of the above ranking is equal or more than 5 and 7, and no ranking equals 3.	Medium If the sum of the above ranking is equal or more than 8 to 11.	High If the sum of the above ranking is 12 or more.

Mitigation and management

Management methodology is based on the requirements as set out in EIA Regulations, (GN 982) of 2014 i.t.o. the NEMA as well as the Proposed National Guideline on Minimum Information Requirements for Preparing EIA.

Management statements detail the processes, procedures and practices required to achieve an impact management outcome. A hierarchy of management tools used can also be used as seen below.



Mitigation should include measures in the following order of priority. The aim is to prevent adverse impacts from happening or, where this is unavoidable, to limit their significance to an acceptable level.

Avoiding or preventing impacts

If the biodiversity (an ecosystem, habitat for threatened species, ecological corridor or area that provides essential ecosystem services) is of conservation value or importance, it is best to plan to avoid

or prevent impacts altogether by changing the location, siting, method or processes of the mining activities and related infrastructure.

Minimising impacts

Minimising impacts of mining is a mitigation measure that deals with the environment in general. In areas where the biodiversity is to be affected is of conservational value or importance, then every effort should be made to minimise those impacts that cannot be avoided or prevented. Mining companies should strive to minimise impacts on biodiversity to ensure environmental protection. Section 2 of NEMA contains environmental management principles that resonates with minimising the impact rather than stopping at mitigation, this is imperative in the mining sector.

Rehabilitating impacted areas

Rehabilitation is the measures that are undertaken to "as far as it is reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which aligns to the generally accepted principle of sustainable development. A closure plan is an essential part of rehabilitation and must be developed based on the establishment of the closure objectives and criteria.

Biodiversity offsets

Biodiversity offsets are measurable conservation gains that help to balance any significant biodiversity losses that remain after actions to avoid, minimise, and restore negative impacts have been taken. They are the last stage of mitigation and should be considered after appropriate avoidance, minimisation, and rehabilitation/restoration measures have been applied already.

When dealing with management, impact management outcomes must:

- be set for the expected activity-based impacts;
- describe the desired outcome of the management measure/s prescribed or the standard to be achieved (environmental objective);
- be clearly documented and identified per project phase as in the impact identification and significance rating process (this must be aligned to the mines closure objectives, and must therefore include predicted long-term result of the applied management measures);
- be measurable to determine compliance, which includes time frames and schedule for the implementation of the management measures; responsibilities for implementation and long-term maintenance of the management measures; financial provision for long-term maintenance; and monitoring programmes to be implemented;
- be informed by stakeholder expectations; and
- ensure legal compliance;

Finally, the impact assessment must refer to the residual and latent impact after successful implementation of the management measures.

vii) The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected

The preferred alternative is to place 5 chicken houses within areas of high biodiversity and agricultural sensitivity whilst abiding by all mitigation measures. The second alternative is to remain outside of the sensitive areas, which would result in the loss of five chicken houses. This is not economically viable. The community would benefit with the development of all seven chicken houses as this results in the highest number of employment and skills development opportunities.

viii) The possible mitigation measures that could be applied and the level of risk

Refer to Part A, section (h)(v) for all mitigation measures that could be applied and the level of risk.

ix) Motivation where no alternative sites were considered

Not applicable, there is one site layout alternative.

x) Statement motivating the preferred site

The preferred alternative is to place 5 chicken houses within areas of high biodiversity and agricultural sensitivity whilst abiding by all mitigation measures. The community would benefit with the development of all seven chicken houses as this results in the highest number of employment and skills development opportunities.

i) Full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity

Refer to Part A(h)(v & vi) above for a full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (In respect of the final site layout plan) through the life of the activity.

j) Assessment of each identified potentially significant impact and risk

Refer to Part A(g)(v & vi) above for a full description of all impacts as well as their significance. This includes potentially significant impact and risks.

k) Summary of specialist reports complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report

- According to the Phase I Archaeological Impact Assessment: A total of 17 sites were recorded during the pedestrian survey and inspection of historical aerial images and topographical maps: The six sites dating to the historic period consist of three intact sites, two demolished sites and one building ruin. Although modern in appearance, the intact sites, or parts thereof, might exceed 60 years of age and should therefore be avoided by the proposed development (K06, K16, K17). The demolished sites (K01 & K09) might be associated with subsurface culturally significant material and care should therefore be exercised when developing in the vicinity of these sites. The stone-walled ruin (K02) appears to have been associated with a building during historical times and should be avoided by the proposed development.

  The Late Iron Age sites (K12 & K14), as well as the associated sensitive area, are considered culturally significant and should be avoided by the proposed development or any other activity since these sites can be linked via oral traditions to the Manala Ndebele groups of Kameel Zyn Kraal that date to between 1600 and 1800. Should impact not be avoidable, a Phase 2 AIA will be required. The area to the north of Site K14, however, may be accessed via the existing jeep track to the east of the site.

  Subject to adherence of the recommendations and approval by SAHRA (South African Heritage Resources Agency), the proposed Eggspert Kameelzynkraal poultry farm may continue. Should skeletal remains be exposed during rehabilitation, all activities must be suspended and the relevant heritage resources authority contacted (See National Heritage and Resources Act, 25 of 1999 section 36 (6)). Also, should culturally significant material be discovered during the course of the said development, all activities must be suspended pending further investigation by a qualified archaeologist.
- The Desktop Palaeontological Impact Assessment was undertaken in June 2021 in winter in mild and dry conditions during the official Level 2 of the Covid-19 lockdown, as this is a desktop study the season and time has no influence, and the following is reported:

  The Project includes one locality Option present in Tshwane: A roughly rectangular area blocked in red with the Roodekoppies railway station to the north, the R25 Road to the north-west and surrounded by farms. The area is approximately 97 hectares in size. The only Option presented is situated on the shales of the Silverton Formation, Pretoria Group, Transvaal Supergroup which may contain micro stromatolitic fossils.

  Recommendation: The potential impact of the development on fossil heritage is HIGH for the Silverton Formation and therefore a Phase 1: Field Survey may be necessary for this development if a chance fossil is found during the development (according to SAHRA protocol).

- According to the Geohydrological Study: Based on the available information it can be concluded that aquifer system in the study area can be classified as a "Sole Aquifer System". There are no reasonably available alternative sources other than groundwater should the aquifer be impacted upon or depleted. The ratings for the Aquifer System Management Classification and Aquifer Vulnerability Classification yield a Groundwater Quality Management Index of 12 for the study area, indicating that a "Strictly Non-Degradation" level of groundwater protection is required.

  Based on the field work, interpretation of available and newly acquired data, the abstraction of groundwater from the site will have an overall "negligible – negative" impact on the investigated geohydrological environment after implementation of appropriate mitigation measures. During the rating and ranking procedure of impacts, all identified impacts could be countered by appropriate mitigation. Based on the water balance results, it is recommended to apply for an allocation of 0.02 Mm^3/annum which places the application in Category A (small scale abstractions - <60% recharge to the GRU). The tested boreholes will be able to supply in 100% of the demand, as well as the applied volume. Based on the results, it is recommended that the application be approved. It is however imperative that the applicant implements the proposed "Environmental Management & Groundwater Monitoring Program".
- According to the Aquatic Ecosystem Delineation, no aquatic ecosystems were observed on site however systems were observed within the 500 m ESA. These include seepage wetlands and channelled valley bottom wetland including impoundments. These systems were not addressed in terms of PES and EIS as they are not directly on site. The assessment addresses the issue of activities impacting on the aquatic ecosystems.

  Albeit no aquatic ecosystems were observed on site the application of buffers remain. A generic buffer of 50 meters is given as minimum by the GDARD guideline. The risk assessment for the activities on site using GN509 was calculated to low. The impact assessment was also calculated to low. It must be clearly noted that any development on the study site will have an impact on the aquatic ecosystems and must be authorised in terms of Section 21 of the National Water Act (1998). It is recommended that a comprehensive aquatic ecosystem rehabilitation plan for the development must be compiled to ensure the functionality of the system remains post development.
- According to the Agricultural Agro-Ecosystem Assessment, two environmental impacts were identified, and one socio-economic impact was identified and rated by means of an environmental impact rating method provided by BECS. The 2 environmental impacts are ceasing of productive soil potential at structure footprints and change in agricultural productivity. The significance of the first impact was rated as high (negative) and the second as medium

(positive) prior to mitigation. The impacts were rated as medium (negative) and medium (positive) after mitigation. The socio-economic impact was rated as medium (positive).

Although the chicken farm will cause the productive soil potential to cease at structure footprints, covering approximately 1.75 ha, production at these footprints will continue without using the productive soil potential. Eggs and meat will be produced at these footprints, which imply that there will not be a reduction in productivity but rather an increase, since the site is currently unproductive. Considering that productivity will increase and that there will not be a permanent loss of any agricultural resource, the impact can be considered as positive, which render the severity as very low. Since the productive soil potential can re-establish after removal of the structures the impact is regarded as acceptable.

The proposed development is an agricultural production unit that occupies a small footprint with a low impact on natural resources and the environment and will contribute to food security and should therefore be approved.

- According to the Avifaunal Habitat Assessment, depending on the placement of the footprint area of the study site, the natural habitat will be affected directly by the development. Although considered to be ecologically important for avifaunal species, particularly bird species, the site is insignificantly small in relation to the many thousands of hectares of natural veld in the surrounding areas. None of the Red Data avifaunal species mentioned were recorded within the study area during the time of the site survey but the wetland habitat systems as delineated by an aquatic specialist and its buffers should be regarded as of high sensitivity as well as the open natural grassland habitat to the north and east of the study site. Apart from the grassland habitat in the northern regions of the study site, the habitat within the footprint area of the development does not offer suitable habitat for any of the other Red Data avifaunal species recorded for the 2528DC q.d.g.c. and these species are only likely to move through the area on rare to very rare occasions.
- According to the Terrestrial Ecological Assessment, the terrestrial ecology of the site remains albeit impacted by alien vegetation and in situ land use. Many natural drivers of the site remain in operation without anthropogenic interventions. Modernisation of sections of the site has occurred but these seem to have a small footprint.
- According to the Flora Assessment, it was found that the *Searsia discolor* rocky grassland, the *Combretum – Diospyros* rocky outcrop vegetation and the *Alloteropsis – Hyparrhenia* grassland study units comprise natural vegetation and are deemed sensitive. The Mixed alien and indigenous vegetation study unit and the Cultivated fields study unit are not considered sensitive. The alien invasive species should be removed. No Red List species were recorded, but two Orange List species were found on the study site.

- According to the Mammals and Herpetofauna Habitat Assessment, No important wetland feature occurs on the site, but according to the GDARD C-Plan 3.3 the north-eastern third of the site and a strip of rocky grassland that runs from north-west to south-east through the centre of the site are situated within a Critical Biodiversity Area. An Ecological Support Area runs north-west of the site along the Critical Biodiversity Area. The Endangered Species treat the site as part of their home ranges / territories. There is a small possibility that seven mammal species may occur on the site. The Blasius's (Peak-saddle) horseshoe bat, short-eared trident bat, Southern African hedgehog, leopard, serval, brown hyena and African striped weasel are included as a precautionary measure. According to the Screening report for the site the possible occurrence of the rough-haired golden mole (*Chrysospalax villosus*) should be investigated. Rough-haired golden moles prefer dry, sandy ground on the fringes of marshes or vleis, but no suitable wetland habitat is present on the site. This species should not occur on the site due to the absence of wetlands. The study site forms part of the distribution range of species 7. This species 7 prefers rocky hillsides and rocky outcrops. There is limited rupicolous habitat on the site, but this species could occur on the study site. If development is approved, the access roads must be kept to a minimum and must lead directly from the existing roads. This will minimise habitat destruction and dust pollution. The removal of exotic plants is imperative. The strip of rocky grassland that runs from north-west to south-east through the centre of the site and which is situated within a Critical Biodiversity Area must be excluded from development. The development of the chicken farm and other buildings should take place on the most disturbed area of the site. If any holes or trenches are dug for construction, they should be completed quickly; otherwise these excavations may act as a death trap for small mammals and herpetofauna. The removal of invasive plants will increase the quality of habitat for most of the vertebrates. Education of the construction staff about the value of wildlife and environmental sensitivity is very important. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance. From a vertebrate perspective, there is no objection against the proposed development if the mitigation recommendations are adhered to.

l) Environmental impact statement

(i) Summary of the key findings of the environmental impact assessment

Construction of 7 chicken houses, a wash bay and reservoir including related structures which potentially are access roads, an office small storage building, parking area etc. Existing vegetation at all structure footprints will be removed and footprints will be covered with concrete, paving and gravel depending on the structure type. It will cause the productive soil potential (land capability) at all structure footprints to cease in terms of crop farming (grain and vegetables) and rangeland (meat – cattle and

sheep), although the chicken farm will produce meat without using the productive potential of the soil resource. The current unproductive or low productive state at the development footprint will improve and a number of employment opportunities will be generated.

These may be at one or several locations; area will be cleared and levelled where necessary, site office may be temporary structures and machinery, building supplies and temporary staff facilities (excluding accommodation) will be housed here. The impacts could include:

- Levelling and compaction of soils
- Storage of machinery, supplies and staff facilities

This could lead to the loss of vegetation and/or species of conservation concern, alteration and loss of microhabitats, altered vegetation cover, increased erosion and contamination of soil and groundwater. This will lead to some terrestrial species becoming permanently and proportionally rarer within local context.

All Red Data species listed as Critically Endangered, Vulnerable, Near Threatened or Data Deficient are discerning species and became endangered as a result of the deterioration of their preferred habitats. Many of the Red Data mammals have already been killed or driven from the area.
The impacts could include:

- Removal of vegetation
- Pollution of habitat
- Killing of mammals and herpetofauna

This could lead to the loss of Red Data mammal and herpetofauna species of conservation concern.

Disturbance of resident bird species is usually caused by construction activities and is therefore short term but can also continue over the long term into the operational and maintenance phases. Two Red Data avifaunal species (SCC) were flagged for the footprint area according to the National Screening Tool:

- African Grass Owl (*Tyto capensis*), and
- African Marsh Harrier (*Circus ranivorus*)

Note that there are no suitable roosting, foraging or breeding habitat for African Grass Owl. The wetland habitat to the north of the study area should be surveyed in in summer during optimal conditions to confirm the presence of this species. There are also no large suitable wetland areas within the study area that will support populations of African Marsh Harrier. This species is only likely to move through the area a rare occasions to and from more suitable habitat surrounding the study site.

The site is vulnerable to hunting/trapping by farm workers/construction workers. Harassing and hunting by farm workers/ construction workers could be expected. The killing of wildlife like small antelope, scrub hares, snakes and game birds by construction workers is a possibility.

No aquatic ecosystems were observed on site however systems were observed within the 500 m ESA. These include seepage wetlands and channelled valley bottom wetland including impoundments. The wetland systems are impacted but remain functional. All potential impacts are of low risk with the implementation of mitigation measures.

Over-abstraction of groundwater from boreholes is likely to lead to depletion of the water levels in the area over time. This can cause damage to the aquifer and might impact on neighbouring groundwater users that are reliant on the same source of water. Reduced baseflow to streams/rivers and groundwater dependent ecosystems (wetlands). Since the impact is negligible negative with mitigation, cumulative impacts to groundwater with other projects are not anticipated.
Over-abstraction of groundwater from a borehole can potentially draw poorer water quality from the adjacent geohydrological environment into the borehole. This is likely to affect the groundwater quality in the area in general and might affect the supply in other boreholes within the fractured aquifer. Based on data acquired during the desk study and water quality results from boreholes sampled during the hydrocensus, it can be safely assumed that the water quality in the adjacent aquifers are of similar quality. Also, the water demand is well within the sustainable supply of the aquifer and this impact is highly improbable of occurring.

The development footprint is situated on a geological layer with a high palaeontological sensitivity. The nature of the impact is the destruction of Fossil Heritage.
During the proposed construction and operational phases, surface and subsurface impacts may take place. These activities can lead to irreparable damage or complete destruction of heritage resources if not correctly managed.
Dense vegetation hampered the visibility of archaeological material towards the northern boundary of the study area. Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the construction phase.

The proposed development will create jobs in the construction phase and the operational phase which is a long-term socio-economic benefit. During the construction phase, approximately 50 skilled contractors specialising in the poultry industry will be required, which may not necessarily be from the local community. However, during the operational phase, 31 jobs will be created which will benefit the local community.

(ii) Final Site Map

Refer to Addendum 1 for all the maps.

(iii) Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

The preferred alternative is to place 5 chicken houses within areas of high biodiversity and agricultural sensitivity whilst abiding by all mitigation measures. The second alternative is to remain outside of the sensitive areas, which would result in the loss of five chicken houses. This is not economically viable. The community would benefit with the development of all seven chicken houses as this results in the highest number of employment and skills development opportunities.

Environmental component	Negative implications	Positive implications
Soils, land capability, surrounding land use and landscape character	Existing vegetation at all structure footprints will be removed and footprints will be covered with concrete, paving and gravel depending on the structure type. It will cause the productive soil potential (land capability) at all structure footprints to cease in terms of crop farming (grain and vegetables) and rangeland (meat – cattle and sheep), although the chicken farm will produce meat without using the productive potential of the soil resource.	The current unproductive or low productive state at the development footprint will improve and a number of employment opportunities will be generated.
Vegetation and animal life	Animal and vegetation life, including red data species in the area may be disturbed due to activities that cause a loss of habitat and changes to the ecosystem functioning. Poaching may also be a threat to the animal life. Construction activities could lead to the introduction and establishment of alien invader species.	There will be no positive impact.
Surface water	Wetlands within the 500 metre ESA, surrounding the study site, may experience changes to flood attenuation, streamflow regulation, erosion control, carbon storage and other features.	There will be no positive impact.
Groundwater	The project will negatively impact groundwater resources as abstraction will take place and pollution may occur.	There will be no positive impact.
Archaeological, historical, and cultural aspects	Any existing archaeological, historical, and cultural aspects may be impacted negatively if they are disturbed.	There will be no positive impact.

Environmental component	Negative implications	Positive implications
Socio-economic	The project may have a negative impact on the surface water and groundwater quality which may affect surrounding users.	Local benefits include job creation, poverty alleviation, social upliftment, food security, and local supplier procurement.

m) Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMP as well as for inclusion as conditions of authorisation

Refer to Part A(h)(v) for all Proposed impact management objectives and the impact management outcomes for inclusion in the EIA/EMP Part B.

n) Final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment

The preferred alternative is to place 5 chicken houses within areas of high biodiversity and agricultural sensitivity whilst abiding by all mitigation measures. The second alternative is to remain outside of the sensitive areas, which would result in the loss of five chicken houses. This is not economically viable. The community would benefit with the development of all seven chicken houses as this results in the highest number of employment and skills development opportunities.

o) Any aspects which were conditional to the findings of the assessment which are to be included as conditions of authorisation

All management measures set out in this EIA/EMP must be complied with. The farm must further comply with any conditions set out under other authorisations such as the WUL.

p) Description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed

The following limitations, assumptions and gaps in knowledge was identified in each specialist study as seen below;

1. Avifauna Assessment

The Limnology team has appropriate training and registration, as well as extensive practical experience and access to wide-ranging data bases to consider the derived species lists with high limits of accuracy. In this instance the biodiversity of all Alignments has to a greater or lesser extent been jeopardized, which renders the need for field surveys unnecessary. In instances where uncertainty exists regarding

the presence of a species it is listed as a potential occupant, which renders the suggested mitigation measures and conclusions more robust.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on bone fide information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. Limnology can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

The on-site bird survey was done outside the main breeding season of most species and during the time when all Palaearctic and intra-African migrants had already migrating to the north. This, however, will not have an effect on recording Red Data species, since most Red Data species are resident to South Africa and the few Red Data species that are Palaearctic migrants are mainly threatened in their northern hemisphere distribution ranges.

The site surveys was done during several hours in one day and not on a regular basis during several season over a period of time thus the avifaunal biodiversity could change slightly as more species are confirmed from the various habitat system within the study area. The time of the day and weather condition also as has an effect on the number of species recorded in the study area during the site visit. The general assessment of species rests mainly on the 1987 atlas for birds of the then-Transvaal (Tarboton et al. 1987), the 1997 SABAP1 atlas data (Harrison et al. 1997) and the current data for the SABAP2 period for comparison, so any limitations in either of those studies will by implication also affect this survey and conclusions.

The general assessment of species rests mainly on the 1997 SABAP1 atlas data (Harrison et al. 1997) for comparison with the current SABAP2 atlas, so any limitations in either of those studies will by implication also affect this survey and conclusions.

Furthermore the number of atlas cards received and the diversity of habitat systems surveyed for avifaunal species within a q.d.g.c. or pentad or lack thereof could also have an effect on the avifaunal diversity that could potentially occur on the study site.

2. Aquatic Ecosystem Delineation

To determine the riparian or wetland boundary, indicators (as discussed above) are used. If these are not present during the site visit, it can be assumed that they were dormant or absent and thus if any further indicators are found during any future phases of the project, the author cannot be held responsible due to the indicator's variability. Even though every care was taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time, and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on bona fide information sources, as well as deductive reasoning. No biomonitoring or physical chemical aspects of water found on the study were done. The safety of the delineator is of priority and thus in areas deemed, as unsafe limited time was spent.

If the location of the study site is on and near underlying granitic geology the possible presence of cryptic wetlands must be investigated by a suitably qualified soil scientist with field experience.

Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage.

As aquatic systems are directly linked to the frequency and quantity of rain it will influence the systems drastically. If during dry months or dry seasons studies are done, the accuracy of the report's findings could be affected.

Limnology can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

3. Geohydrological Assessment

The assessment of the predicted significance of impacts for a proposed development is by its nature, inherently uncertain – environmental assessment is thus an imprecise science. To deal with such uncertainty in a comparable manner, a standardised and internationally recognised methodology has been developed. This methodology will be applied in this study to assess the significance of the potential environmental impacts of the proposed development.

4. Agricultural Agro-ecosystem Assessment

The agricultural sensitivity was thoroughly assessed by means of a detailed soil, land capability and land use assessment and there are no uncertainties or gaps in knowledge or data.

5. Palaeontological Impact Assessment

The accuracy and reliability of the report **may be** limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.
5. Lack of rocky outcrops.
6. Inaccessibility of site.
7. Insufficient data from developer and exact lay-out plan for all structures (for this report all required data/information was provided).

6. Flora assessment

The study site was visited in late autumn when most of the herbaceous plants and geophytes were becoming dormant, but it is assumed that more species of such growth forms occur on the site if the POSA list of species for the quarter degree square is taken as a guideline. Otherwise, sufficient information was received to accomplish the survey.

7. Mammals and Herpetofauna

Limnology Biodiversity and Aquatic Specialists are committed to the conservation of biodiversity but concomitantly recognise the need for economic development. Even though we appreciate the opportunity to learn through the processes of constructive criticism and debate, we reserve the right to form and hold our own opinions and therefore will not willingly submit to the interest of other parties or change statements to appease them.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. To some extent, conclusions are drawn and proposed mitigation measures suggested based on reasonable and informed assumptions based on bone fide information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage. Limnology Biodiversity and Aquatic Specialists can therefore not accept responsibility for conclusions drawn and mitigation measures suggested in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

8. Phase 1 Archaeological Impact Assessment

Dense vegetation associated with the northern quarter of the study area significantly hampered visibility and free movement at the time of surveying (June 2021). The extent of LIA Sites K12 & K14, consisting of stone-walling, could therefore not be determined during the survey. However, satellite imagery and historical aerial photographs proved useful in determining the extent of Site K14. Unfortunately, Site K12 is not visible on aerial data sources. No other access constraints were encountered.

9. Storm Water Management Plan

The proposed facilities will be constructed within a flat grassland agricultural region near the top of a watershed. Potential catchment areas generating runoff towards the planned facilities are negligible and considered low risk. Due to these small catchments within such a flat topography it is also not possible to calculate potential runoff during a 1:50 year flood event. This is however considered to be of insignificant importance and localised control measures to divert runoff is considered sufficient.

q) Reasoned opinion as to whether the proposed activity should or should not be authorised and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation

i) Reasons why the activity should be authorised or not

The proposed activity should be authorised as it will contribute to the layer poultry farming industry and commercial egg production which is an important component of South Africa's Gross Domestic Product (GDP). The project will also ensure that local individuals are employed and trained and will create opportunities for skill transfer within the local community.

ii) Conditions that must be included in the authorisation

The farm must update the water monitoring requirements as soon as DWS has issued a WUL.

r) Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised

The proposed activity does include operational aspects, and therefore no required date can be provided.

s) Undertaking under oath or affirmation by the environmental assessment practitioner in relation

The EAP herewith confirms.

a) the correctness of the information provided in the reports ☒

b) the inclusion of comments and inputs from stakeholders and I&APs ☒

c) the inclusion of inputs and recommendations from the specialist reports where relevant ☒

d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed ☒

I, Christopher Delport (9507265046081), hereby declare that I have no conflict of interest related to the work of this report. Specially, I declare that I have no business, personal, or financial interests in the property and/or mining right being assessed in this report, and that I have no personal or financial connections to the relevant property owners, or mine. I declare that the opinions expressed in this report are my own and a true reflection of my professional expertise and that there are no circumstances that may compromise my objectivity in performing such work.

The EIA/EMP will, should it comply with the provisions of section 24N of NEMA as well as the applicable EIA Regulations i.t.o. NEMA, be approved, become an obligation in terms of the approved EIA/EMP and EA.

Herewith I, the person whose name and identity number are stated below, confirm that I am the person authorised to act as representative of the, and confirm that the above EIA & EMP compiled in accordance with Appendices 3 & 4 of the EIA Regulations.

Full Names and Surname	Christopher Delport
Identity Number	9507265046081
Designation	EAP
Signature	

t) Details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts

(i) Annual forecasted financial provision calculation

This section is not applicable as this is not a mining activity.

(ii) Confirmation of the amount that will be provided should the right be granted

This section is not applicable as this is not a mining activity.

(iii) Method of providing financial provision contemplated in regulation 53

This section is not applicable as this is not a mining activity.

(iv) Capacity to manage and rehabilitate the environment

This section is not applicable as this is not a mining activity.

u) Indication of any deviation from the approved scoping report, including the plan of study

All specialist studies with their impacts and management have been included. From this, the maps and plans have been updated.

v) Any specific information that may be required by the competent authority

Refer to the letter sent to GDARD (Addendum 5C) as well as PART B Section n) below.

(i) Impact on the socio-economic conditions of any directly affected person

Refer to Part A(h)(v) above.

(ii) Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

Refer to Part A(h)(v) above.

w) Other matters required in terms of sections 24(4)(a) and (b) of the Act

24 (4) Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment-	
(a) must ensure, with respect to every application for an EA-	
i. Coordination and cooperation between organs of state in the consideration of assessments where an activity falls under the jurisdiction of more than one organ of state;	GDARD is the applicable authority for the proposed EA. DWS is, however the competent authority for the WULA. All other organs of state and stakeholders received the ESR and will receive the EIA/EMP for review.
ii. That the findings and recommendations flowing from an investigation, the general objectives of integrated environmental management laid down in this Act and the principles of environmental management set out in section 2 are taken into account in any decision made by an organ of state in relation to any proposed policy, programme, process, plan, or project;	All the findings from investigations have been included in this EIA/EMP.
iii. That a description of the environment likely to be significantly affected by the proposed activity is contained in such application;	Environmental baseline information, based on specialist studies, has been included in this EIA/EMP.
iv. Investigation of the potential consequences for or impacts on the environment of the activity and assessment of the significance of those potential consequences or impacts; and	Investigation of impact on the environment and assessment of the significance of the potential impacts have been done by specialists.

v. Public information and participation procedures which provide all I&APs, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures; and	Refer to Part A (h)(ii) for the PPP.
(b) must include, with respect to every application for an EA and where applicable-	
i. Investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity;	Investigation of impact on the environment and assessment of the significance of the potential impacts have been done by specialists.
ii. Investigation of mitigation measures to keep adverse consequences or impacts to a minimum;	Investigation of mitigation measures was done by the specialists.
iii. Investigation, assessment, and evaluation of the impact of any proposed listed or specified activity on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999), excluding the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act;	Refer to Part A(h)(v)(5)
iv. Reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information;	All gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information is included in the EIA/EMP.
v. Investigation and formulation of arrangements for the monitoring and management of consequences for or impacts on the environment, and the assessment of the effectiveness of such arrangements after their implementation;	A monitoring plan is included in the EIA/EMP.
vi. Consideration of environmental attributes identified in the compilation of information and maps contemplated in subsection (3); and	Environmental attributes identified were taken into consideration during the process.
vii. Provision for the adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question.	Refer to Part A(e) for adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question.

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

a) Details of the Environmental Assessment Practitioner

Refer to Part A(a) for the requirement for the provision of the details and expertise of the EAP.

b) Detailed description of the aspects of the activity that are covered by the EMP as identified by the project description

The requirement to describe the aspects of the activity that are covered by the EMP is already included in Part A(1)(h), and (g)(v) herein as required.

c) Map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers

Refer to Part A, section (h)(iv)(12).

d) Description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed, and mitigated as identified through the environmental impact assessment process for all phases of the development

i) Planning and design

Refer to part A(h)(v) above for all impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts can be avoided and mitigated. Various specialists were assigned to determine the impact during all phases of the project. Refer to Addendum 3 for the specialist studies. Refer to part A(e) above for the policy and legislative context in which the development will take place. Planning and design take cognisance of sustainable development principles: Section 2(3 & 4), of NEMA, section 2, 2(a)(ii), 22(2)(d) of NWA, section 2(a)(ii) of Section 2(3 & 4) of NEMA, section 2 of NWA. This ensures that the acticities will take place in accordance with generally accepted principles of sustainable development by integrating social, economic, and environmental factors into the planning and implementation. The farm has also ensured that all authorisation applications have taken place prior to operation in terms of the NWA and NEMA.

ii) Pre-construction activities

Refer to part A(h)(v) above for all impacts and risks identified including nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts can be avoided and mitigated. Various specialists were assigned to determine the impact during all phases of the project. Refer to Addendum 3 for the specialist studies. Refer to part A(e) above for the policy and legislative context in which site clearing and pre-construction activities take place. Pre-construction activities will only take place once the farm has been granted the relevant authorisations to go ahead.

iii) Construction activities

Refer to part A(h)(v) above for all impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts can be avoided and mitigated. Various specialists were assigned to determine the impact during all phases of the project. Refer to Addendum 3 for the specialist studies. Refer to part A(e) above for the policy and legislative context in which site clearing and construction activities take place.

iv) Rehabilitation of the environment after construction and closure

Rehabilitation and closure will take place per Section 24R of NEMA and Appendix 5 of the EIA Regulations. A closure plan will be submitted prior to closure to GDARD and NDEA.

1 End land use

The end land-use has not been identified yet. However, closer to the time of closure and rehabilitation the landowner will be consulted to decide on a suitable land use.

2 Residual impacts

- If effective management takes place, there should not be residual impacts on the agricultural potential of the land.
- If effective management takes place, there should not be residual impacts on the groundwater or surface water in the area.
- With education, the impact of poaching can be kept to a minimum.
- Compaction on construction camp could result in altered topsoil characteristics and vegetation composition. These areas are also prone to invasion by alien invasive plant species. Impacts on sensitive areas are likely to be permanent unless the development takes place only in the least sensitive areas.
- The decline of mammal species and herpetofauna is likely to continue unless the development takes place in the least sensitive areas and people are educated about mammals/ herpetofauna and Red Data species specifically.

3 Closure objectives

There is no intention of closing as this is an ongoing project and long-term investment.

4 Rehabilitation process

If closure does take place, the general objective is to restore the land to a self-sustaining, aesthetically pleasing landform. The rehabilitation process will include the safe and licensed removal of all infrastructure that has been placed on the site. The land will be ripped, seeded and re-sloped if necessary. The rehabilitation process will follow a rehabilitation plan which will be put in place closer to the time of closure.

v) Operation activities

Refer to part A(h)(v) above for all impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts can be avoided and mitigated. Various specialists were assigned to determine the impact during all phases of the project. Refer to Addendum 3 for the specialist studies. A WULA has been lodged and an IWWMP is still to be submitted which will contain an assessment of impacts relating to water management on the site.

f) Description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable

Refer to Part A(h)(v) as well as Part A(i) of this report.

(g) The method of monitoring the implementation of the impact management actions contemplated in paragraph (f)

Baseline monitoring is required to establish existing conditions that will help to define the requirements for site restoration and provide a basis for comparison of effects during the operation. Compliance monitoring should be carried out during the operation to ensure that the specified target limits are being met. The following environmental monitoring will be conducted at the chicken rearing farm.

i) Monitoring of impact management actions

All impacts identified in the impact assessment must be monitored to ensure the correct management thereof takes place.

1 Groundwater monitoring programme

The following is extracted from Geovation (2021):

The main objective of the proposed and discussed mitigation measures, pertaining to the identified impacts, is to maintain and monitor the regional groundwater table and quality to:

- Ensure that Schedule 1 water users within the catchment have adequate water supply to sustain the basic human need.
- Ensure that registered groundwater use within the catchment have adequate water supply.
- Ensure that adequate water is available to maintain groundwater dependent ecosystems (baseflow feeding the streams draining the subject area and wetlands).

A groundwater monitoring program was developed to reach the resource quality objectives. The onsite production boreholes need to be included in the network and are summarised below.

Table 61: Monitoring boreholes

Borehole	Objective
BH1	Impact monitoring
BH3	Impact monitoring
BH5	Impact monitoring
BH-Dam	Impact monitoring
BH-House	Impact monitoring

The table below presents the parameters and frequency that should form part of the groundwater monitoring program. It is proposed that the data should be captured into an appropriate electronic database for easy retrieval and submission to the relevant authority as required and reviewed by a geohydrologist on a bi-annual basis to ensure the source is utilised in a sustainable manner.

Table 62: Proposed monitoring requirements

Class	Parameter	Frequency	Motivation
Physical	Static groundwater levels	Monthly	Time dependant data is required to understand the regional groundwater flow dynamics. A lowering in the static water levels may indicate that the aquifer is utilised in an unsustainable way and abstraction rates need to be decreased. Conditions of the Water Use Licence.
	Groundwater abstraction volumes	Monthly	Calculate monthly & annual abstraction volumes. Conditions of the Water Use Licence.

Class	Parameter	Frequency	Motivation
Chemical and microbial	Major ions and trace elements. *E.Coli* & Total Coliforms	Bi-annually	Changes in chemical and microbial composition may indicate areas of groundwater contamination and be used as an early warning system to implement management/remedial actions. To determine whether the water is fit for the intended use. Conditions of the Water Use Licence.

2 Waste monitoring

As part of the monitoring programme, the following will be conducted:

- Manure is invoiced per cube and sold; accounting records for which will be available.
- Chicken mortalities will be recorded and disposed in mortality pits.
- The remainder of the waste will be domestic waste, in small quantities. This will go to skip and be removed by a registered company such as Eco Eye Waste Management.
- Eggspert Kameelzynkraal will make use of authorized/licenced contractors who can prove that they are compliant to all environmental and legal requirements.

3 Farm wide inspections

Mechanism for monitoring compliance:

- Extract all inspection requirements from environmental documents and make a list of inspections as well as the frequency of inspections.

Environmental component affected and impact	Monitoring and reporting frequency	Responsible persons
• All environmental components.	Continuous monitoring as and when necessary. Annually reporting.	Site manager.

(h) The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f)

Refer to Part B, section (g)(i) above.

(i) An indication of the persons who will be responsible for the implementation of the impact management actions

Refer to Part B, section (g)(i) above.

(j) The time periods within which the impact management actions contemplated in paragraph (f) must be implemented

Refer to Part B, section (g)(i) above.

(k) The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f)

Refer to Part B, section (g)(i) above.

l) Program for reporting on compliance, taking into account the requirements as prescribed by the Regulations

The performance of the EIA/EMP will be assessed every two years. An audit on the Water Use License will also be done to ensure compliance in all water uses and activities taking place if the license is granted.

m) Environmental awareness plan

This section includes:

1. Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work; and
2. Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment.

The following was extracted from the Environmental training procedure (BECS Environmental, 2016).

i) Induction training

1. Induction training is relevant to all new employees and contractors (including any employee and/or contractor that has not yet been trained on the environmental induction material) as well as all visitors.
2. Training will be repeated every 12 months.

3. Induction training will include the following:
    a. Relevant impacts and management as per the approved and operational EMP (these will be site- and job specific);
    b. Environmental procedures; and
    c. Environmental emergency procedure.
4. The trainee will after completion of induction:
    a. Sign the necessary induction form/book; and
    b. Have all relevant PPE necessary for the specific job.

ii) General environmental awareness training

1. Management will identify environmental awareness needs and related environmental topics.
2. The environmental awareness will include:
   a. The significant environmental impacts, actual or potential, of their work activities and the benefits of improved personal performance; and
   b. The potential consequences of departure from specified operating procedures.
3. Environmental awareness training will form part of the annual training.
4. Visual aids will be used, where applicable to help with awareness training. These could be in the form of posters displayed at specific work areas after training was done.

iii) Competency training

1. Management will identify job-related training needs for all employees who have or can have a significant impact on the environment.
2. A training needs matrix will be completed for Eggspert Kameelzynkraal.
3. Job specific training will convey the importance of conformance with the environmental procedures. Simplified summaries of these procedures may be used to ensure better understanding at lower levels of the organisation.

4. Management will identify specialised training needs. for personnel performing tasks, which can cause significant environmental impacts, or personnel who needs specialised environmental knowledge for areas of responsibility. These courses will be sourced externally.

5. Management will undergo legal training from time to time. A summary of this training will also be given to employees of Eggspert Kameelzynkraal.

iv) Development of training material

1. The Health and Safety Officer will develop and maintain training material for induction training, general environmental awareness, and competency training. This excludes specialised competency training which might be externally sourced.
2. This training material will be based on the approved and operational EMP as well as environmental procedures. Additional topics will also be included for general environmental awareness.
3. Training material will be reviewed using results from audits, changes to plant/operation, competency assessments and new significant aspects.

v) Scheduling of training

1. Once training topics and material have been compiled, the Health and Safety Officer will ensure employees are scheduled according to the needs identified.

vi) Training records

1. Upon completion of training, a training record will be completed. This may be in the following formats:
   a. Attendance registers;
   b. Sign off on procedure to demonstrate understanding of procedure; and/or
   c. Certificates of attendance / completion.

2. All training records will be kept for the period of employment plus an additional 5 years.

vii) Reconciliation to determine gaps in attendance

1. All employees and contractors must undergo all training as identified (as per training needs analysis). Reconciliation will be done on all training attendance registers, against the training schedules, to identify any shortcomings in training performed and reschedule if necessary.

viii) Competency assessment

1. An evaluation will be conducted on all employees and contractors. The aim is to identify both the effectiveness of training as well as the competence in performing the job.
2. Competency evaluation records will be completed by the approved training assessor and will be included with the attendance records.

n) Specific information required by the competent authority

The acceptance of the final scoping report received from GDARD on the 19th of August 2021, included comments for the consideration of the EAP. These comments were then sent again on the 2nd of November on the draft EIA report. These aspects are covered in the table below:

Comment raised	EAP's Response	Section reference in this EIA where issues and or response were incorporated
1. Description of the site/property/route and development The development entails the construction and operation of laying and rearing houses on Portion 3 of the farm Kameelzynkraal 547 JR which falls under the jurisdiction of the City of Tshwane Metropolitan Municipality. The entire proposed development has a total	Please note that the applicant has since confirmed that the site will only be used for the construction and operation of chicken rearing houses. Further, the site that is to be considered for the project is a Portion of Portion 3 of the farm Kameelzynkraal 547 JR, measuring 71 hectares in extent.	PART A c)

Comment raised	EAP's Response	Section reference in this EIA where issues and or response were incorporated
footprint of 5 hectares on a site that measures 97 hectares in extent.		
5. Specialist studies Attached specialist studies are noted; therefore , the applicant must compile all the specialist reports related to the proposed activity including a Report on Biosecurity measures. All the specialist reports including bio-security measures must form part of the final Environmental Impact Assessment Report.	All specialist reports will be appended to the final EIAR/EMP. A report on biosecurity measures has been developed and will be attached to the final EIAR.	Addendum 3K
6. Services required A bulk service comments from the Local Authority to determine infrastructure capacity to cater for the development must be included in the Environmental impact Assessment Report. This must include assurance of water supply, electricity and roads upgrade to cater for the proposed activity. Further, the sewage drainage line/alignment must be confirmed and included in the Environmental Impact Assessment Report.	Communication was received from CoT indicating that there are no services currently allocated to the stand in terms of water supply. Hence the client will make use of boreholes as per the WUL being applied for. The geohydrological report compiled by Geovation (Pty) Ltd indicates that the amount of ground water being applied for, for abstraction falls under Category A (small scale abstractions - <60% recharge to the Groundwater Resource Unit). This will be sufficient to meet all water needs. Further, septic tanks will be used for sewage on site, which is also an activity which falls under the WUL. In addition, CoT also confirmed that electricity to the existing area is currently supplied by Eskom and that the Electricity Planning and Development Division has no objection to the enquiry. The client has provided a tax invoice (which is still in the name of the previous owner) received from ESKOM - indicating that there is a 50 kVA ESKOM connection point on site.	Addendum 4F

Comment raised	EAP's Response	Section reference in this EIA where issues and or response were incorporated
	There is currently an access road to the site and traffic to/from the site is envisaged to be minimal. As a chicken house is not that big and fast to construct, we don't anticipate a lot of vehicles/trucks moving in and out during the construction phase. A maximum of 5 vehicles per day is expected. During the operational phase the farm manager will come to site in a bakkie daily. A Feed truck will come to the farm twice a week and a chicken truck will come once a month. In light of the above, we don't see that it will necessitate a road upgrade or cause traffic impacts. According to the Storm Water Management Plan conducted by Rational Environmental (Pty) Ltd. "The topography on the site is uniform and does not generate any concentrated runoff that can be identified as drainage lines. Evidence of non-perennial drainage lines only appears further south of the property with several small farm dams located approximately 800m downstream of the southern drainage catchment. Signs of a drainage line appears 500m downstream of the northern drainage catchment with a farm dam 1.6km north east of the last site located adjacent the neighbouring chicken farm facilities."	
7. Impacts identification, Assessment and Mitigation	The impact assessment includes specialist recommendations and are included in this report.	PART A h) v)

Comment raised	EAP's Response	Section reference in this EIA where issues and or response were incorporated
Specialist's recommendations and comments to be made in the studies to be attached in the Environmental Impact Assessment Report, including IAP's must be used to inform the impact assessment report, and must be integrated into the EMPr to be submitted in the Environmental Impact Assessment Report.		
10. Maps, layout plans, services route positioning The locality Map must be in colour and overlaid by sensitivity Map. The Department proposes the following recommendations to be included in the Environmental Impact Assessment Report: • The Layout Plan (A3 size) and indicate the site's access point(s) • Comment of the Stormwater and traffic impact studies from City of Tshwane division of Roads and Storm Water Management. A detailed stormwater management plan must be designed for the proposed development and must comment on the report.	An environmental sensitivity plan has been formulated, overlaying the proposed infrastructure on the environmental sensitivities as identified by the specialists. The map, as well as the Storm Water Management Plan has been forwarded to the City of Tshwane division of Roads and Storm Water Management for comments and approval.	Addendum 1B & Addendum 3J
11. Public Participation Process Attached Public participation process is noted; however, it must be conducted in terms of chapter 6 of EIA regulations, 2014 (as amended) and proof must be attached to the Environmental Impact Assessment Report. Should you be unable to submit comments, proof that attempts were made to obtain comments must be attached also.	Details of the public participation process followed have been included in this report as well as the addenda.	Addendum 4 & PART A h) ii)
12. Environmental Management Programme (EMPr) It is noted that the EMPr is not attached in the Final Scoping Report, therefore; an EMPr	The Environmental Management Programme (EMPr) has been included in this document.	This EIA.

Comment raised	EAP's Response	Section reference in this EIA where issues and or response were incorporated
with all environmental aspects associated with the proposed development and specialist mitigations and recommendations also including proper colours showing rating of impacts and mitigation measures must form part of the final report, If you have any queries regarding the contents of this letter, please contact the official of the Department using any of the above indicated contact details.		

1 Financial provision

Not applicable as this is a non-mining project.

2 Procedures for environmentally related emergencies and remediation

The following was extracted from the Environmental emergency's procedure (BECS Environmental, 2016).

2.1 List of environmental incidents

There have been no environmental incidents noted to date.

2.2 Major spillages onto soil or spillages into water resources

1. Eggspert Kameelzynkraal will as soon as reasonably practicable after obtaining knowledge of the incident, report through the most effective means reasonably available:
   a. the nature of the incident;
   b. any risks posed by the incident to public health, safety, and property;
   c. the toxicity of substances or by-products released by the incident; and
   d. any steps that should be taken in order to avoid or minimise the effects of the incident on public health and the environment to:
   e. the DWS and/or the Gauteng Department of Agriculture & Rural Development,
   f. the South African Police Services and the relevant fire prevention service;
      i. the relevant head of municipality; and
      ii. all persons whose health may be affected by the incident.

2. Eggspert Kameelzynkraal will, as soon as reasonably practicable after knowledge of the incident:
   a. take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety, and property of persons;
   b. undertake clean-up procedures;
   c. remedy the effects of the incident;
   d. assess the immediate and long-term effects of the incident on the environment and public health; and
   e. and take such measures as the catchment management agency may either verbally or in writing direct within the time specified by such institution.

3. Steps to be taken to contain, minimise and clean-up are as follow:
   a. Isolate and evacuate the affected area to prevent unauthorised access;
   b. If safe to do so, isolate source of leak or spillage to prevent further losses;
   c. Use appropriate PPE;
   d. Protect stormwater drains around the affected area by sealing them off:
   - Construct berm walls cross-stream using soil if pollution has escaped into drainage ditches; and
   - If possible, construct temporary retention dams across stream using soil, and divert flow into them.
   e. Transfer any residual contents and contaminated absorbents to suitable temporary storage containers;
   f. Obtain specialist advice on decontamination of surfaces, drains and interceptors;
   g. Remove any retention berms/temporary retention dams only when authorised; and
   h. Dispose of contaminated material as hazardous waste.

4. Eggspert Kameelzynkraal will, within 14 days of the incident, report to the DWS, and/or the Gauteng Department of Agriculture & Rural Development, and relevant head of municipality such information as is available to enable an initial evaluation of the incident, including:
   a. the nature of the incident;
   b. the substances involved and an estimation of the quantity released and their possible acute effect on persons and the environment and data needed to assess these effects;
   c. initial measures taken to minimise impacts;
   d. causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure; and
   e. measures taken and to be taken to avoid a recurrence of such incident.

2.3 Veldfires

1. The observer shall as soon as possible verbally report the occurrence to his Head of Department (HOD) OR Farm Manager.
2. In the case of a fire on Eggspert Kameelzynkraal land or adjacent land which may endanger life, property, or the environment, the owners of adjoining land and the relevant fire protection association shall be notified.
3. Eggspert Kameelzynkraal may enter an adjacent land in order to prevent a fire from spreading or to extinguish it if it is believed that a fire may endanger life, property, or the environment.

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