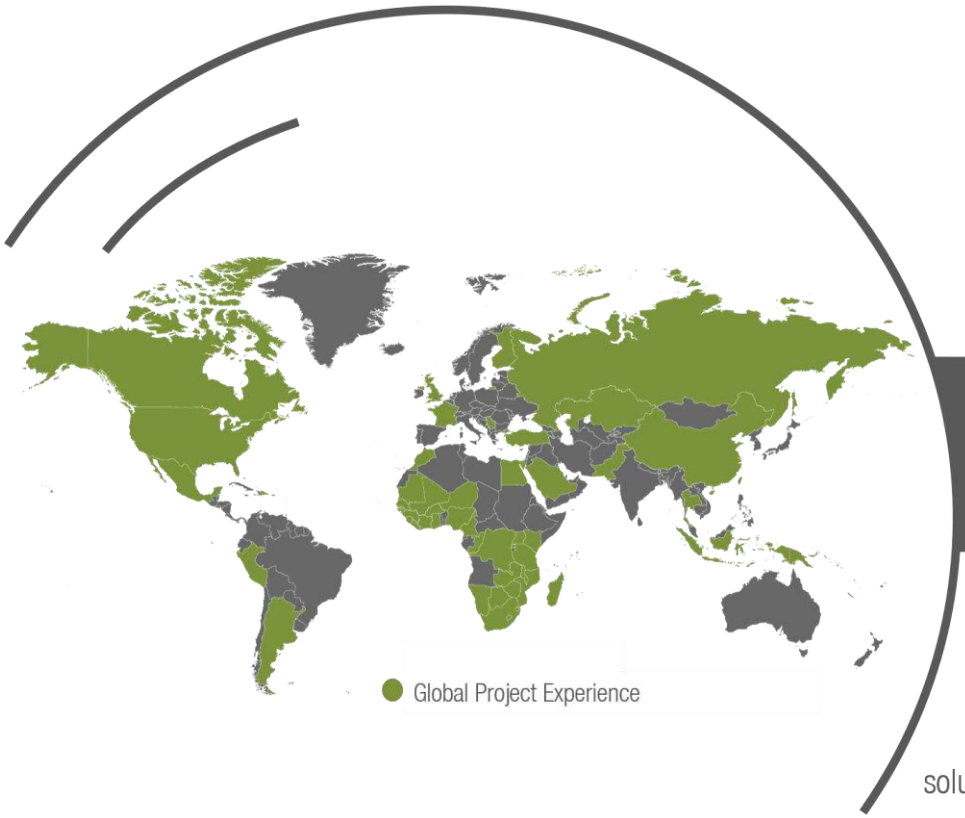

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Environmental Impact Assessment for the Dorstfontein East Mine Amendment, Mpumalanga Province

Terrestrial Ecology Impact Assessment

Prepared for:
Exxaro Coal Central (Pty) Ltd

Project Number:
EXX5725

July 2021

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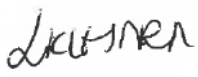
This document has been prepared by Digby Wells Environmental.

Report Type:	Terrestrial Ecology Impact Assessment
Project Name:	Environmental Impact Assessment for the Dorstfontein East Mine Amendment, Mpumalanga Province
Project Code:	EXX5725

Name	Responsibility	Signature	Date
Lusanda Matee	Report Compiler		March 2021
Lisa Hester	Fieldwork		April 2021
Stephen Burton Pr.Sci.Nat.	Report Compiler & Reviewer		July 2021

DETAILS AND DECLARATION OF THE SPECIALIST

Digby Wells and Associates (South Africa) (Pty) Ltd

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Full name:	Stephen Burton
Title/ Position:	Divisional Manager: Ecology and Atmospheric Sciences
Qualification(s):	BSc (Hons);MSc
Experience (years):	15
Registration(s):	South African Council for Natural Scientific Professions (SACNASP)

I, Stephen Burton, declare that: –

I act as the independent specialist in this application;

I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;

I declare that there are no circumstances that may compromise my objectivity in performing such work;

I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;

I will comply with the Act, Regulations and all other applicable legislation;

I have no, and will not engage in, conflicting interests in the undertaking of the activity;

I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of

any report, plan or document to be prepared by myself for submission to the competent authority;

All the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

July 2021

Date

Findings, recommendations and conclusions provided in this report are based on the best available scientific methods and the author's professional knowledge and information at the time of compilation. Digby Wells employees involved in the compilation of this report, however, accepts no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document.

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Any recommendations, statements or conclusions drawn from or based on this report must clearly cite or make reference to this report. Whenever such recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety.

EXECUTIVE SUMMARY

Exxaro Central Coal (Pty) Ltd (hereafter ECC) holds an approved Mining Right with reference number **MP 30/5/1/2/3/2/1 (51) MR** for opencast and underground mining at the Dorstfontein East Coal Mine (DECM) situated in the Mpumalanga Province. The current proposal aims to extend the existing approved underground mining area (approved under the ownership of Total Coal South Africa (Pty) Ltd, hereafter "Total") and introduce supporting infrastructure to achieve this. ECC aims to extend the underground mining area of the 2 Seam and 4 Seam associated with the Mining Right.

The proposed additional infrastructure triggers activities listed in the Environmental Impact Assessment (EIA) Regulations, 2014 (GN R 982 of 4 December 2014 as amended by GN R 326 of 7 April 2017) promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). To this end, Digby Wells Environmental (hereinafter Digby Wells) was appointed as the independent Environmental Assessment Practitioner (EAP) to complete the EIA in support of the Environmental Authorisation (EA) application.

The EIA process includes a suite of specialist studies including a Terrestrial Ecology Impact Assessment (TEIA) in support of the EIA process.

Based on Mucina & Rutherford (2006) classification of South Africa's vegetation, the proposed Project is located in an area dominated by the vegetation type Eastern Highveld Grassland, which according to those authors, is regarded as Endangered. According to the MBSP, moderately modified, other natural and heavily modified areas are present within the Project Area. According to the SAPAD and NPAES, no protected areas occur within the Project Area.

A single season site survey was undertaken in April 2021 during the wet season. The following details were recorded:

- Much of the project area has been either transformed or degraded largely through historical crop production and other agricultural activities.
- Identified vegetation communities included Wetlands, Secondary Grasslands, and Transformed cultivated areas and areas of Alien Invasive Plant (AIP) proliferation. The Wetlands are seen as sensitive landscapes in the context of this ecological report.

The mining activities in the identified vegetation communities have had direct negative ecological impacts, most notably vegetation clearing, habitat loss and fragmentation as well as AIP proliferation..

The vegetation communities associated with the highest species richness was the Wetland communities. However, in the context of the Project Area all the remaining natural vegetation provides habitat for numerous faunal and floral species and therefore is of conservation significance. Recommendations and mitigation measures are provided in the Impact Assessment. Important recommendations include the following:

- Management and control of AIP proliferation throughout the life of the Project;

- A Subsidence Risk Assessment should be undertaken;
- Monitoring of alien invasive sprawl during the operation is recommended as the surrounding vegetation is relatively intact and free from alien invasive plants;
- Vegetate stockpiles to prevent soil loss, organic material loss, erosion, and sedimentation; and
- After rehabilitation the area must be fenced, and animals (cattle) should be kept off the area until the vegetation is self-sustaining and established.

This assessment provides mitigation measures, continuous monitoring measures, encourages concurrent rehabilitation and monitoring plan.

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ACRONYMS, ABBREVIATIONS AND DEFINITION

AIP	Alien Invasive Plant
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EOO	Extent of Occurrence
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
GG	Government Gazette
GNR	General
ha	Hectares
km	Kilometres
MBSP	Mpumalanga Biodiversity Sector Plan
MNCA	Mpumalanga Nature Conservation (Act No. 10 of 1998)
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MRA	Mining Rights Area
MTIS	Mineable tonnes in-situ
Mtpa	Million tonnes per annum
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM:BA	National Environmental Management: Biodiversity Act, 1998 (Act No. 107 of 1998)
NPAES	National Protected Area Expansion Strategy
PCD	Pollution Control Dam
PR	Prospecting Right
QDS	Quarter Degree Square
ROM	Run of Mine
SAPAD	South African Protected Areas Database
SCC	Species of Conservation Concern
TOPS	Threatened or Protected Species
UCD	Universal Coal PLC
WUL	Water Use Licence

Legal Requirement		Section in Report
(1)	A specialist report prepared in terms of these Regulations must contain-	
(a)	details of-	
	(i) the specialist who prepared the report; and	Section 5
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 5
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page iii & iv
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
cA	And indication of the quality and age of the base data used for the specialist report;	Section 7
cB	A description of existing impacts on site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9
(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 7
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of the equipment and modelling used;	Section 6
(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying site alternatives;	Section 9
(g)	an identification of any areas to be avoided, including buffers;	Section 8
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 2-2 & Figure 7-3
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 9
(k)	any mitigation measures for inclusion in the EMPr;	Section 9 & 10
(l)	any conditions/aspects for inclusion in the environmental authorisation;	Section 13
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 11
(n)	a reasoned opinion (Environmental Impact Statement) -	Section 14

Legal Requirement		Section in Report
	whether the proposed activity, activities or portions thereof should be authorised; and	Section 14
	if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 14 & 15
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 13
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 13
(q)	any other information requested by the competent authority.	

1. Introduction

Exxaro Central Coal (Pty) Ltd (hereafter ECC) holds an approved Mining Right with reference number **MP 30/5/1/2/3/2/1 (51) MR** for opencast and underground mining at the Dorstfontein East Coal Mine (DECM) situated in the Mpumalanga Province. The current proposal aims to extend the existing approved underground mining area (approved under the ownership of Total Coal South Africa (Pty) Ltd, hereafter "Total") and introduce supporting infrastructure to achieve this. ECC aims to extend the underground mining area of the 2 Seam and 4 Seam associated with the Mining Right.

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The EIA process includes a suite of specialist studies including a (TEIA) in support of the EIA process.

2. Project Description

DECM was previously owned by Total and was ceded to ECC on 20 August 2015 which has an approved Environmental Management Programme (EMPr), dated October 2017.ECC is now applying to expand the underground mining areas as approved under Total. Subsequently, additional coal reserves have been identified for mining which were not covered under the existing approval. ECC is also approved to undertake underground mining of deeper coal reserves at DECM. The underground mining operations will be accessed from the existing Pit 2 open cast and Dorstfontein West operations. DECM, therefore, intends to further extend the Life-of-Mine (LoM) through the exploitation of these identified additional coal reserves between 2021 until 2034.

In addition, a portion of Pit 3, which is approved for opencast mining, will now be included in the underground mining extension.

The DCM East proposed project area is situated in Mpumalanga Province, 45 kilometres to the North, northwest of Bethal and 12 kilometres northeast of the town of Ga-Nala (Kriel). It is in the Highveld magisterial district, under the jurisdiction of the eMalahleni Local Council, Mpumalanga, South Africa as visually depicted in Figure 2-1

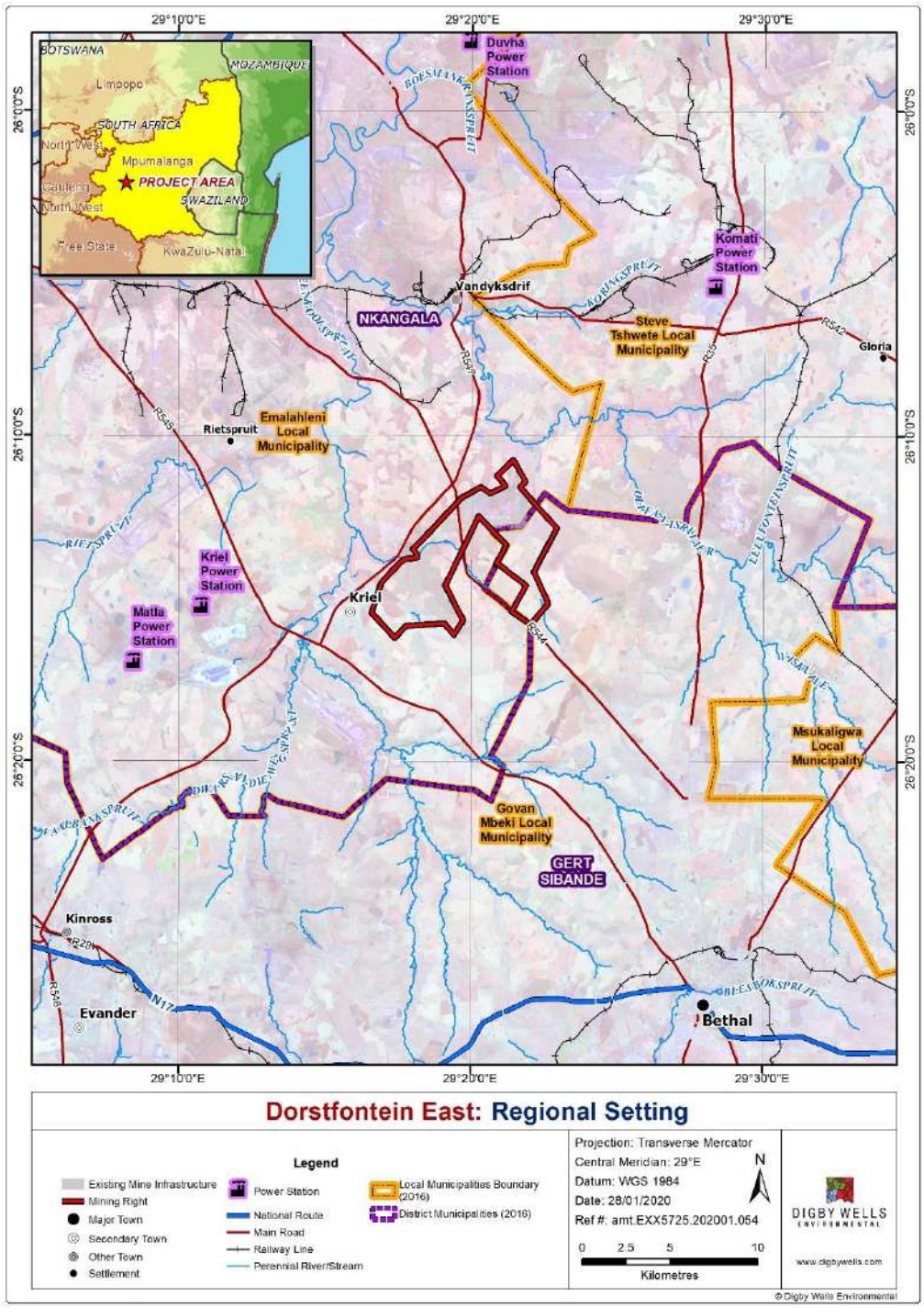

Figure 2-1: Regional location of the Dorsfontein East Mine East Mine project

2.1. Mining

The planned LoM is one year for the construction phase followed by an approximate 14-year operational (production) phase. A coal discard processing plant has been additionally

proposed to treat 100 kilotons per month (ktpm) of re-claimed coal discard, with a total of 1,200,000 tonnes per annum (tpa).

2.2. Infrastructure

2.2.1. Proposed Infrastructure

The required infrastructure/activities proposed for the extension are listed below and depicted in Figure 2-2. The approved and proposed underground area are described in Figure 2-3 and Figure 2-4 below.

- Portal ventilation fan;
- Sewage Treatment Plant;
- Water Treatment Plant;
- Potable Water storage tank;
- Erikson Pond;
- A new 22 kV overhead powerline from the existing substation to a new 22kV substation;
- Run of Mine (ROM) Stockpile conveyor at portal;
- Change house;
- Lamp room;
- Office;
- Clinic;
- Stores;
- Workshop area;
- Stone dust silo; and
- Coal discard processing plant.

An environmental regulatory process comprising of an amendment and consolidation of the Environmental Management Programme (EMPr) and Integrated Water Use License (IWUL) is required for the new proposals.

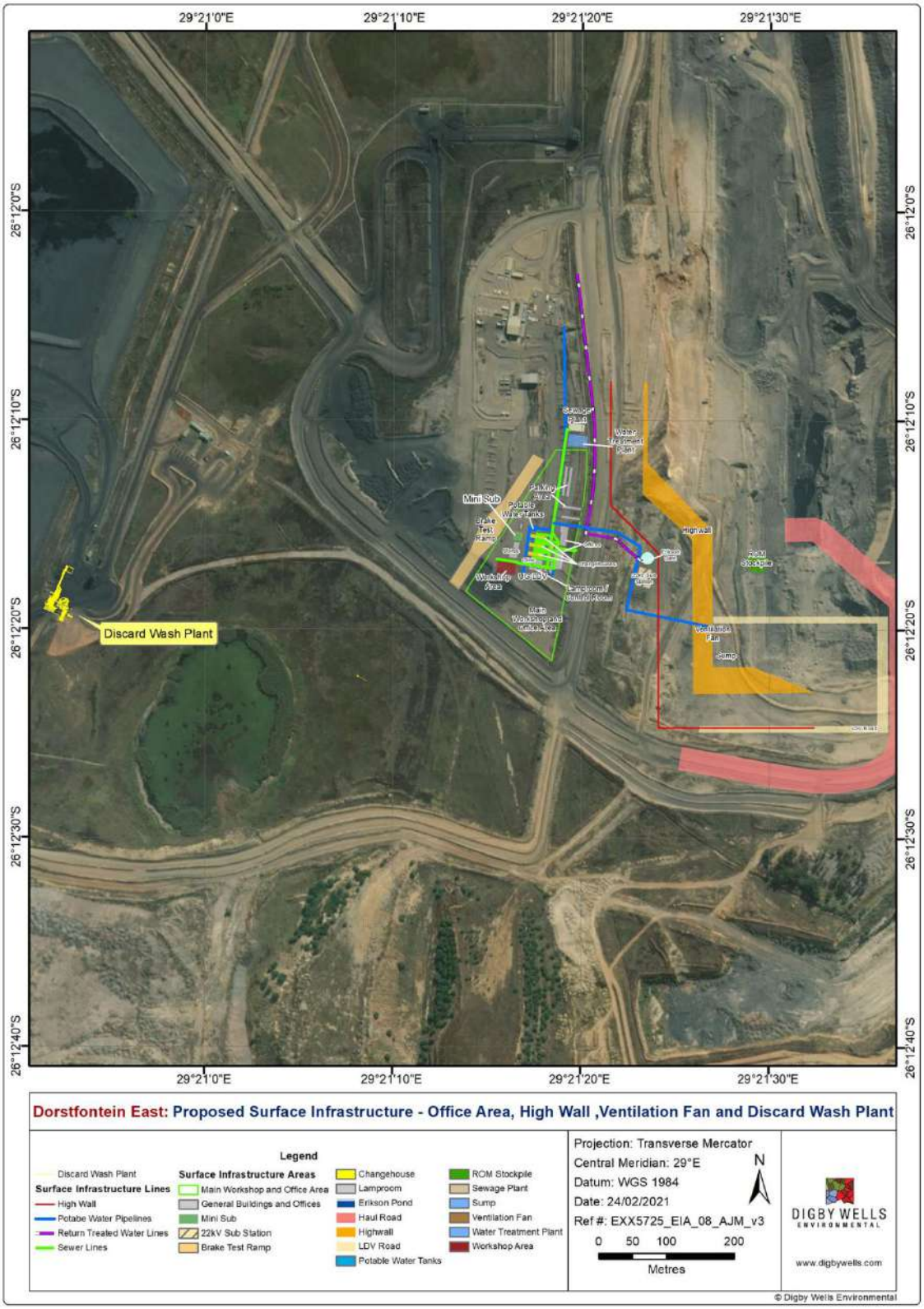

Figure 2-2: Surface Infrastructure Layout

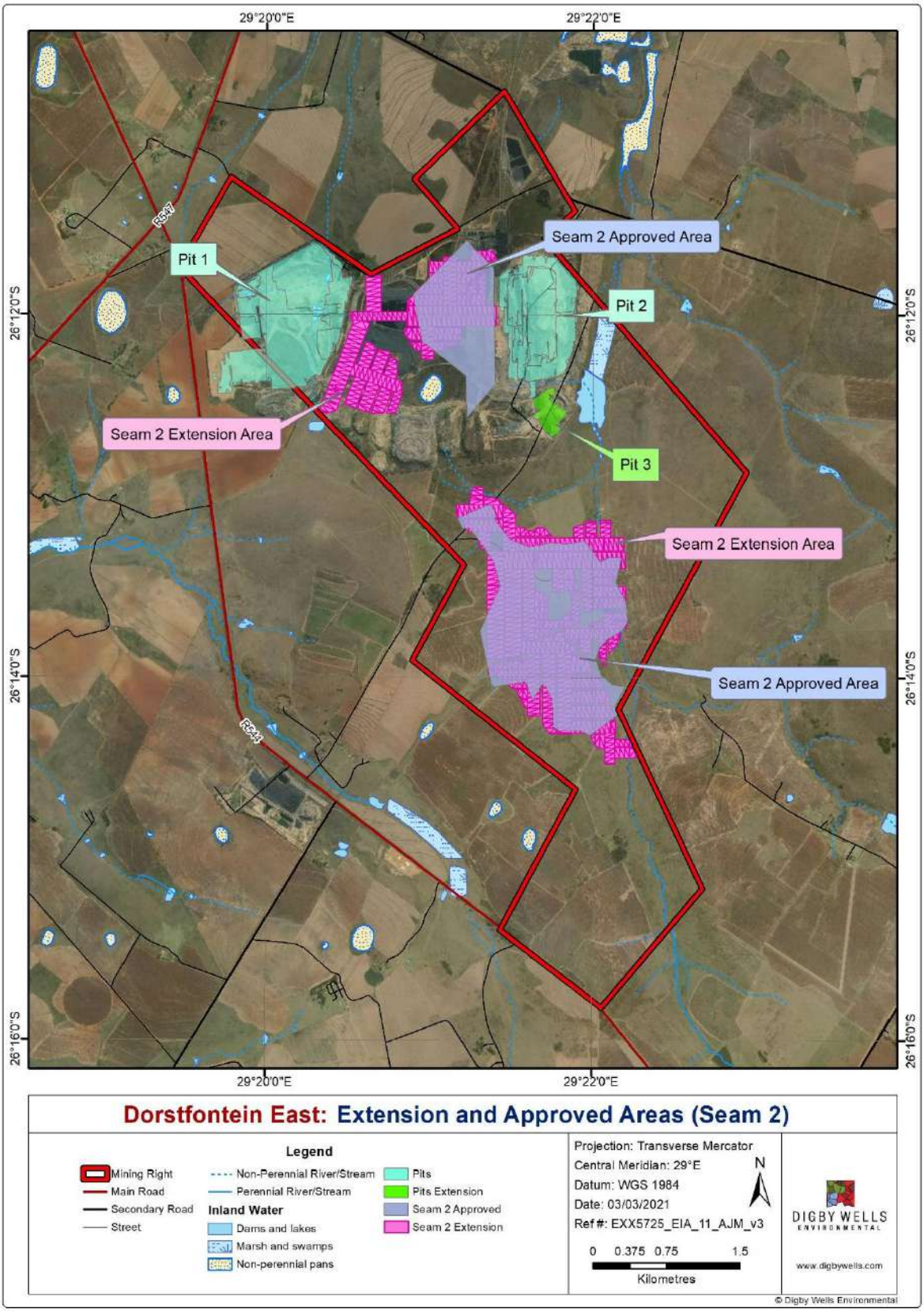

Figure 2-3: Approved and Proposed Underground Areas (Seam 2)

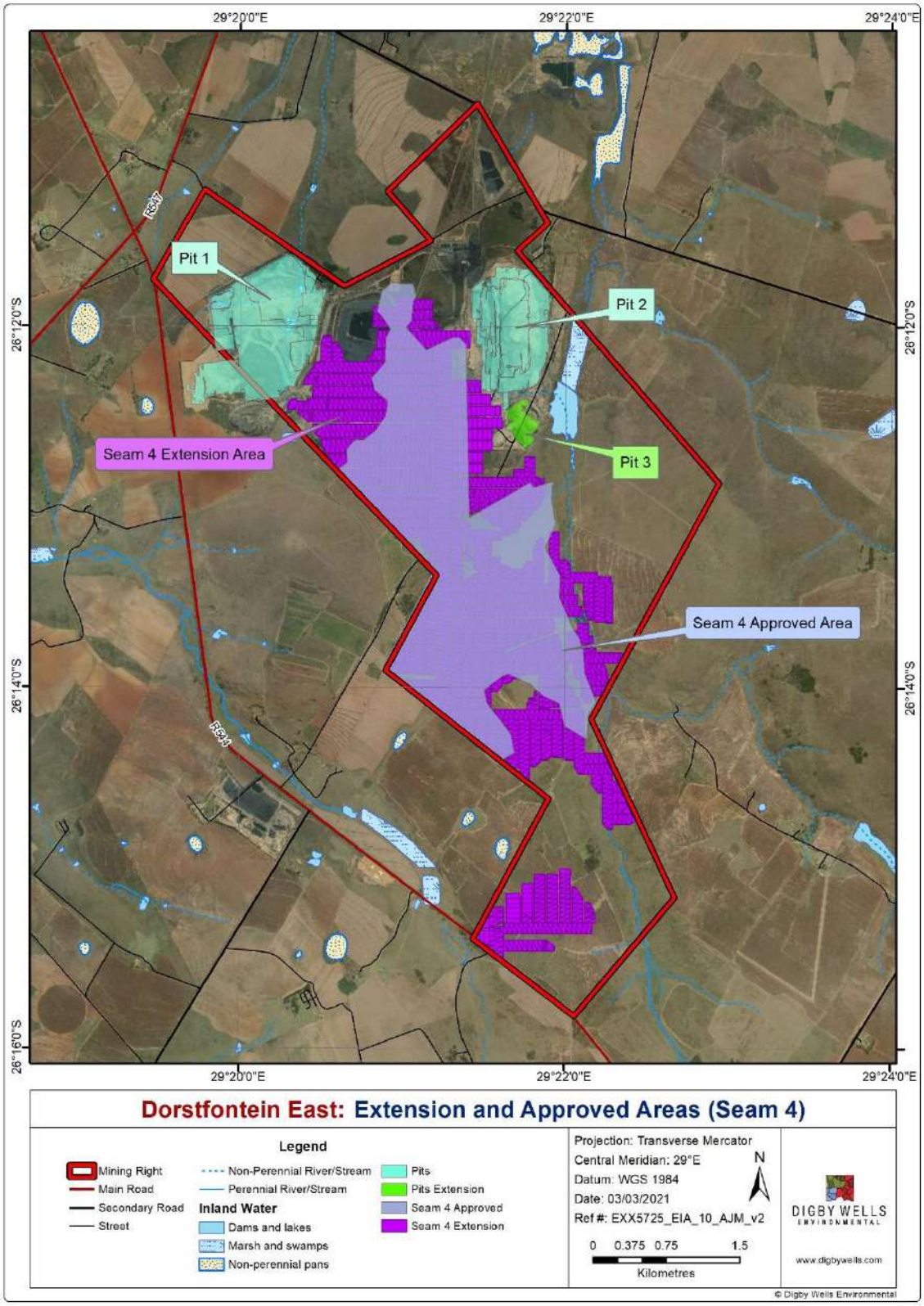

Figure 2-4: Approved and Proposed Underground Areas (Seam 4)

The Project list of activities for the construction, operation, and decommissioning phases are depicted in Table 2-1 below.

Table 2-1: Project Phases and Associated Activities

Project Phase	Project Activity
Construction Phase	Site/vegetation clearance for site establishment (infrastructure including ventilation fans, change houses, offices, ablutions, and workshops).
	In-pit RoM Stockpiling.
	Access road construction.
	Power line construction.
	Construction of infrastructure.
Operational Phase	Mining of coal by underground mining.
	Blasting (only when dikes and other geological features are encountered).
	In-pit RoM Stockpiling.
	Diesel storage and explosive magazine.
	Underground Mining Machinery Maintenance.
	Operation of water and sewer reticulation.
	Use of existing haul roads.
Decommissioning Phase	Demolition and removal of infrastructure – once mining activities have been concluded infrastructure will be demolished in preparation for the final land rehabilitation.
	Rehabilitation – rehabilitation mainly consists of spreading and landscaping of the preserved subsoil and topsoil, profiling of the land, and re-vegetation.
	Post-closure monitoring and rehabilitation.

3. Relevant Legislation, Standards and Guidelines

From an environmental and social perspective, the proposed project is required to comply with all the obligations in terms of the provisions of the NEMA and Mineral and Petroleum Resources Development Act (MPRDA). The additional legislative guidelines directing the Project and specifically related to flora and fauna, are outlined in further detail in Table 3-1 below.

Table 3-1: Applicable Legislation, Regulations, Guidelines and By-Laws

Legislation, Regulation, Guideline or By-Law	Applicability

National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) The NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive species. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance: • Alien and Invasive Species Lists, 2020 (terms of GNR 1003 in GG 43726 dated 18 September 2020 – effective from 18 October 2020); • Threatened and Protected Species Regulations; and National list of Ecosystems Threatened and in need of protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GNR 1002, 9 December 2011).	• A Fauna and Flora Impact Assessment has been undertaken; • The Project activities will be set out to abide by the guidelines set out in NEM:BA; • Areas of concern will be indicated and possible alternatives to avoid these areas; and Required mitigation measures will be included in the Environmental Management Programme (EMPr) in this report.
Mpumalanga Biodiversity Sector Plan (2014) The Mpumalanga Biodiversity Sector Plan (MBSP) is a spatial tool that forms part of the national biodiversity planning tools and initiatives that are provided for national legislation and policy. The MBSP was published in 2014 by the Mpumalanga Tourism and Parks Agency (MTPA) and comprises a set of maps of biodiversity priority areas accompanied by contextual information and land-use guidelines for use in land-use and development planning, environmental assessment and regulation, and natural resource management. Strategically the MBSP enables the province to: • Implement the NEM:BA, 2004 provincially, and comply with requirements of the National Biodiversity Framework, 2009 (NBF) and certain international conventions;	Provides background information about the ecology of the province and natural resource management as well as tools that can be used to guide decisions around biodiversity management.

• Identify those areas of highest biodiversity that need to be considered in provincial planning initiatives; and Address threat of climate change (ecosystem-based adaptation).	
Mpumalanga Nature Conservation Act (Act No. 10 of 1998) The Mpumalanga Nature Conservation Act (Act No. 10 of 1998) (MNCA) is responsible for making provisions with respect to nature conservation in the Mpumalanga province. It provides for, among other things, protection of wildlife, hunting fisheries, protection of endangered fauna and flora as listed in the Convention of International Trade in Endangered Species (CITES) of wild flora and fauna, the control of harmful animals, freshwater pollution and enforcement. The objectives of the MNCA are to consolidate the laws relating to nature conservation applicable in the Mpumalanga province and to provide for matters connected therewith. The MNCA focuses on the protection of critically endangered to vulnerable fauna, and flora within the province.	Provides background information about the ecology of the province and natural resource management as well as tools that can be used to guide decisions around biodiversity management.
SANBI, National Biodiversity Assessment (NBA) 2018 The NBA is a collaborative effort to synthesise the best available science on South Africa's biodiversity to inform policy and decision making in a range of sectors and contribute to national development priorities. It is used for the following: • The NBA is used to inform policy in the biodiversity sector, such as the National Biodiversity Framework and the National Protected Area Expansion Strategy, as well as informing policies and strategies of a range of other sectors that rely on natural resources, such as the water, agriculture and mining sectors.	The guideline provides practical guidance for determining the current state of the biodiversity and ecosystem identified within the area of interest as well as providing indication of threat status and protection level for both species and ecosystems.

• The NBA provides information to help prioritise the often limited resources for managing and conserving our biodiversity – actions can focus on preventing further loss and degradation of ecosystems and ecological infrastructure, on consolidating and expanding the protected areas network; and on interventions require to restore areas in bad condition so they become functional again. • The NBA provides context and information that feeds into strategic planning processes such as strategic Environmental Assessments and bioregional planning. The NBA provides information for a range of national level reporting processes such as the South Africa Environment Outlook and ensures that the DEA has the necessary biodiversity information to meet the international reporting commitments to the Convention on Biological Diversity (CBD).	

4. Assumptions, Limitations and Exclusions

The compilation of this Report is based on the following assumptions and limitations in Table 4-1.

Table 4-1: Limitations and Assumptions with Resultant Consequences of this Report

Assumptions and Limitations	Consequences
This fauna and flora study forms part of a larger EIA and should be read in conjunction with the EIA and other related specialist studies.	This report does not include any other specialist studies other than the fauna and flora assessment. This report cannot be used as a stand-alone report in the application for Environmental Authorisation
This Fauna and Flora Impact Assessment was conducted during April 2021. Furthermore, timing and brevity of the survey was not ideal and conducted at the end of the flowering season, hence some species may have been missed. Land access delayed the timing of the survey.	Findings, recommendations, and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation.
No form of this report may be amended or extended without the prior written consent of the author and/or a relevant reference to the report	The fauna and flora report cannot be used as a stand-alone report in the application for an Environmental Authorisation.

by the inclusion of an appropriately detailed citation. Any recommendations, statements, or conclusions drawn from or based on this report must cite or reference this report. Whenever such recommendations, statements or conclusions form part of the main report relating to the current investigation, this report must be included in its entirety.	

5. Details of Specialist

The following is a list of Digby Wells' staff who was involved in the Fauna and Flora Environmental Impact Assessment:

- **Stephen Burton** is the Ecology and Atmospheric Sciences Divisional Manager at Digby Wells. He received a Bachelor of Science in Zoology and Entomology and an Honours degree in Zoology from the University of Natal. He has also received his MSc in Zoology through the University of KwaZulu-Natal. Stephen is an ecologist with fields of interest in wetlands, fauna, and flora. In his 14-year career he has undertaken numerous wetland delineations and functional assessments, faunal assessments, wetland offset and rehabilitation assessments and audits, as well as project management of various environmental impact assessment and water use license projects. He has also worked extensively with wetland rehabilitation implementation projects for large scale developments. He has published a variety of journal articles and presented at various South African and international conferences, and is a registered Professional Natural Scientist with the South African Council for Natural Scientific Professionals (SACNASP).
- **Lisa Hester** holds the position of Ecologist at Digby Wells Environmental in South Africa. She obtained her BSc Honour's degree in Ecology and Conservation from the University of Witwatersrand in South Africa. Her dissertation topic involved an in-depth ecological survey of the Croc River Mountain Conservancy in Nelspruit. Since completion of her studies, Lisa has worked on numerous fauna and flora biomonitoring reports both locally and internationally (including Australia). Working on a multitude of surveys in various locations has allowed Lisa to engage upon a multi-faceted professional forum. Various scopes of work involving, ecological baseline assessments, ecological rehabilitation, wetland assessments, nest-box installations, environmental impact assessments, protected species surveys, bat surveys, species relocation and vegetation reports consists of her repertoire of work.

6. Methodology

This section presents the detailed methodology undertaken during the infield assessment and during the assessment of all impacts related to the project in terms of fauna and flora (Terrestrial Biodiversity).

6.1. Desktop Gap Analysis

The desktop review involved compiling relevant information for the greater study area from reliable and recognised resources, including historical studies and assessments. The aim of the desktop study was to identify the current biodiversity and ecosystem status through various databases including the following:

- Mucina and Rutherford (2012), expected vegetation type and community structure;
- South African National Botanical Institute (SANBI), Pretoria Computerised Information System) PRECIS List's, potential species in the proposed development area/site area according to the QDS;
- Potentially occurring avifaunal species through South African Bird Atlas Project (SABAP2), BirdLife South Africa Area (IBA) Directory (Barnes, 1998) and The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor et al., 2015);
- Potentially occurring mammal species through The Mammals of the Southern African Subregion (Skinner & Chimimba , 2005), the Animal Demography Unit Virtual Museum (http://vmus.adu.org.za/), and The 2016 Red List of Mammals of South Africa, Lesotho and Swaziland (ww.ewt.org.za) (Child, M. F., et al.,2017);
- Potentially occurring herpetofauna species list through the SARCA (sarca.adu.org); A Guide to the Reptiles of Southern Africa (Graham, 2013); Atlas and Red List of Reptiles of South Africa, Lesotho and Swaziland (Bates et al., 2014), A Complete Guide to the Frogs of Southern Africa (Du Preez & Carruthers, 2009); Atlas and Red Data Book of Frogs of South Africa, Lesotho and Swaziland (Minter, 2004); and
- Mpumalanga Provincial legislation, potential Red Data Listed species and their current status.

6.1.1. Species Conservation Status Repository

6.1.1.1. Red Data

Red Data Books or RDBs, are lists of threatened plants and animals specific to a certain region. They are a vital source of information in guiding conservation decisions and have guided the literature review of this study. South Africa has produced 5 RDBs dealing with each of the following: birds, land mammals, fish (freshwater and estuarine only), reptiles and amphibians, and butterflies.

The conservation status of a plant or animal species is described by the following terms:

- EXTINCT: a species for which there is a historical record, but which no longer exists in the area under review.
- ENDANGERED a species in danger of extinction, and whose survival is unlikely if the factors causing its decline to continue.

- VULNERABLE a species which it is believed will move into the endangered category if the factors causing its decline to continue.
- RARE a species with small populations, which are not yet vulnerable or endangered, but which are at risk.

The term **THREATENED** is commonly used as a collective description for species which are endangered vulnerable or rare.

Some species are **ENDEMIC,** i.e., they are restricted to one region and occur nowhere else. A threatened endemic is a conservation priority.

Of special concern were protected plant and animal species. Listed species of flora and fauna are regarded as species whose representation in the wild has declined to such an extent that drastic action is needed to ensure their survival. Under anthropogenic pressure, the number of these species has reached levels where preservation management is needed, and conservation management will no longer be effective. The listing of these species under either International Union for the Conservation of Nature (IUCN) or CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), is regarded as a valuable starting point to initiate legally sanctioned management practices to bring the numbers of these species back to within acceptable numbers.

6.1.1.2. IUCN

The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on plants and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered, and Vulnerable). The IUCN Red List also includes information on:

- Plants and animals that are categorized as Extinct or Extinct in the Wild;
- Taxa that cannot be evaluated because of insufficient information (i.e., are Data Deficient); and
- Plants and animals that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e., are Near Threatened).

The figure below shows the Current IUCN Red List categories. These categories include Critically Endangered (CR), Endangered (EN), and Vulnerable (VU), which are collectively known as the Threatened category, Conservation Dependent (CD), Near Threatened (NT), and Least Concern (LC) which are collectively known as Lower Risk.

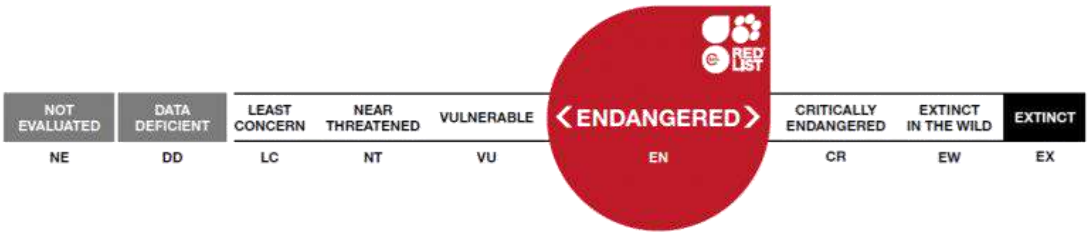

Figure 6-1: IUCN categories

Abbreviations and descriptions of each IUCN category are summarized in Table 6-1 below.

Plants and animals that have been evaluated to have a low risk of extinction are classified as Least Concern (IUCN.org).

Table 6-1: Description of IUCN Categories

IUCN Category	Abbreviation	Description
Extinct	EX	No surviving individuals of the species
Extinct In The Wild	EW	Known only to survive in captivity, or as a naturalized population outside its historic range.
Critically Endangered	CR	At a very high risk of extinction.
Endangered	EN	High risk of extinction in the wild.
Vulnerable	VU	High risk of endangerment in the wild.
Near Threatened	NT	Likely to become endangered in the near future.
Least Concern	LC	Lowest risk. Does not qualify for a more at-risk category
Data Deficient	DD	Not enough data to make an assessment of its risk of extinction.
Not evaluated	NE	Has not yet been evaluated against the criteria.

6.1.1.3. CITES

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival (CITES.org).

CITES works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by the Convention has to be authorized through a licensing system. Each Party to the Convention

must designate one or more Management Authorities in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species (CITES.org). Specimens are divided into the following appendices according to the restriction on trade.

Appendices I, II and III:

- Appendix I includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
- Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.
- Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade. Changes to Appendix III follow a distinct procedure from changes to Appendices I and II, as each Party is entitled to make unilateral amendments to it.

6.1.1.4. TOPS Regulations

The Threatened or Protected Species Regulations 152 of 2007 ("TOPS Regulations") and the Lists of Critically Endangered, Endangered, Vulnerable and Protected Species (TOPS Lists) were published in 2007, in terms of the NEM:BA (South Africa, 2007(a) and (b)) and have been amended since then. These regulations through NEM:BA Chapter 4 provides for the protection and sustainable use of listed Threatened or Protected Species (TOPS) species. NEM:BA restricts activities that may be carried out in respect of Threatened or Protected Species (TOPS).

6.2. Field Investigations

Dry season infield fauna and flora assessments took place during Wet season infield fauna assessments took place during April 2021 Camera traps and Sherman traps were set out in locations where high faunal activity was observed and expected. During the field survey, the area was surveyed for the various fauna assemblages and floral species. The methodology of the fauna and flora assessment is described below.

6.2.1. Flora

A walkthrough of the site was undertaken to assess the vegetation. The survey searched for protected and listed plant species and declared Alien Invasive Plants (AIPs), with the overall aim to produce a full species list of all plant species present.

6.2.2. Mammals

A walkthrough of the site was done during the site survey whereby mammal species were identified by visual sightings as well as using spoor, droppings and roosting sights and available habitat. Camera traps and Sherman traps were set up in various locations where

high faunal activity was observed and expected. Mammals were identified using the Smithers' Mammals of the Southern African field guide (Smithers, 2000).

6.2.3. Birds (Avifauna)

Data regarding the distribution of bird species was obtained from the Quarter Degree Square (QDS) using the information available from the South African Bird Atlas Project 2 (SABAP2). Concurrently with the mammal survey, the principal ornithological field survey technique was used to record bird species present. Opportunistic sightings were recorded during the site survey.

Because the primary purpose of this work was to establish the presence of species, no distance or time limit was set, and hence any species seen or heard anywhere within the general vicinity of the proposed project site was recorded. Visual identification was used to confirm calls of the less common species. Bird species were confirmed using the Sasol photographic field guide (Ryan, 2009)

Assessment of the conservation status of species recorded focused on the various categories of Globally Threatened Species (IUCN 2019), birds listed by NEMBA and the Eskom Red Data Book of Birds (Taylor MR, 2015).

6.2.4. Reptiles and Frogs

Comprehensive amphibian surveys can only be undertaken by nocturnal surveys throughout the wet season. This was beyond the current scope of the assessment and the area was surveyed diurnally for possible habitat for amphibian species. Direct / opportunistic observations were completed along trails or paths within the project area. Any herpetofauna species seen or heard along such paths or trails within the Project Area were identified and recorded. Another method used was to examine refuges using visual scanning of terrains to record smaller herpetofauna species which often conceal themselves under rocks and in fallen logs, rotten tree stumps, in leaf litter, rodent burrows, ponds, old termite mounds, etc. Du Preez, *et al*. (2009) was used to confirm identification where necessary. Assessment of the conservation status of species recorded focused on the various categories of Globally Threatened Species (IUCN 2019) and listed by NEM:BA.

6.2.5. Invertebrates (Spiders, Scorpions, Beetles and Butterflies)

A list of visually identified and observed invertebrate species was compiled during the field survey. However, due to their cryptic nature and habits, varied stages of life cycles, seasonal and temporal fluctuations within the environment, it is unlikely that all invertebrate species will have been recorded during the site assessment period. Nevertheless, the data gathered during the general invertebrate assessment along with the habitat analysis provided an accurate indication of which invertebrate species are likely to occur in the study area. A sweep net was used to capture and identify invertebrates. The focus of this assessment was on protected species as this would narrow the field considerably. Assessment of the conservation

status of species recorded focused on the various categories of Globally Threatened Species (IUCN 2019) and inverts listed by the NEMBA.

6.2.6. Species of Conservational Concern Assessment

The term Species of Conservation Concern (SCC) in the context of this report refers to all RD (Red Data) and IUCN (International Union for the Conservation of Nature) listed fauna and flora species, as well as protected species of relevance to the project.:

- Critically Endangered (CR): A taxon is Critically Endangered when it is considered to be facing an extremely high risk of extinction in the wild (IUCN, 2019).
- Endangered (EN): A taxon is Endangered when it is considered to be facing a very high risk of extinction in the wild (IUCN, 2019).
- Vulnerable (VU): A taxon is Vulnerable when the best available evidence indicates it to be facing a high risk of extinction in the wild (IUCN, 2019).
- Near Threatened (NT): A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future (IUCN, 2010).

7. Findings and Discussion

The findings of the desktop and field assessment are summarised below.

7.1. Desktop Assessment Findings

7.1.1. Flora

7.1.1.1. Red Data Floral Assessment

Based on the Red Data plant species search for the QDS 2629AB, no flora species of conservation concern (SCC) occur in this particular QDS and historical studies done in the vicinity of the project area indicate that no floral SCC that is listed as protected under the Mpumalanga Nature Conservation Act and SANBI TSP occur in the project area. Orange River Lily (*Crinum bulbispermum*) was deemed to have an increased Probability of Occurrence (POC), most likely occurring within the valley bottom wetlands during the faunal and floral ecological assessment as part of the environmental assessment and authorisation process for the construction of a water pipeline from the Dorsfontein West to the Dorsfontein East Mine (Cloete, 2016).

Figure 7-1: Red Data flora species that could potentially occur in the project area (Orange River Lily (*Crinum bulbispermum*)

7.1.1.2. Regional vegetation

According to Mucina and Rutherford (2012), the proposed Dorsfontein East Project area is located in an area classified as Eastern Highveld Grassland (Gm12) as visually depicted in Figure 7-2

7.1.1.2.1. Eastern Highveld Grassland (Mapping Unit Gm12)

The Eastern Highveld Grassland also known is distributed within the Mpumalanga and Gauteng Provinces of South Africa on the plains between Belfast in the east and the eastern side of Johannesburg in the west, extending southwards to Bethal, Ermelo, and west of Piet Retief (Mucina and Rutherford 2006). The altitude varies between 1 520 and 1 780 m, but also as low as 1 300m.

The Eastern Highveld Grassland occurs in high rainfall areas on leached soils. The soils of this Eastern Highveld Grassland consist of yellow sandy soils of the Ba (30%) and Bb (65%) land types found on shale and sandstone of the Karoo Supergroup. It generally occurs on slightly to moderately undulating plains, including some low hills and pan depressions and

consist of short, dense grassland, dominated by the usual Highveld grass composition (*Aristida, Digitaria, Eragrostis, Themeda, Tristachya,* to name a few.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (Mucina & Rutherford; 2006). Woody species include *Senegalia caffra, Celtis africana, Diospyros lycioides subsp. lycioides, Parinari capensis, Protea caffra,* and *Rhus magalismontana*.

The Eastern Highveld grassland is classified as an endangered vegetation type (Rouget *et al*. 2004; Ferrar, Lötter, and Parks Agency 2007; Mucina *et al*. 2014) due to mining activities within the provinces (see **Error! Reference source not found.**), with a conservation target of 24% (Rouget *et al*. 2004). Approximately 44% of the Eastern Highveld Grassland has been transformed, primarily by cultivation, plantations, mining, urbanization, and building of dams (Mucina & Rutherford; 2006). The conservation status of this vegetation type is very poor and is now largely ploughed, with natural vegetation restricted to patchy remnants, which are often heavily grazed. Cultivation may have had a more extensive impact, indicated by land-cover data. Only a very small fraction is conserved in statutory reserves (Nooitgedacht Dam and Jericho Dam Nature Reserves) and in private reserves (Holkranse, Kransbank, Morgenstond). No serious alien invasions are reported, but *Acacia mearnsii* or Black Wattle can become dominant in disturbed areas. Erosion is very low (Mucina and Rutherford 2012).

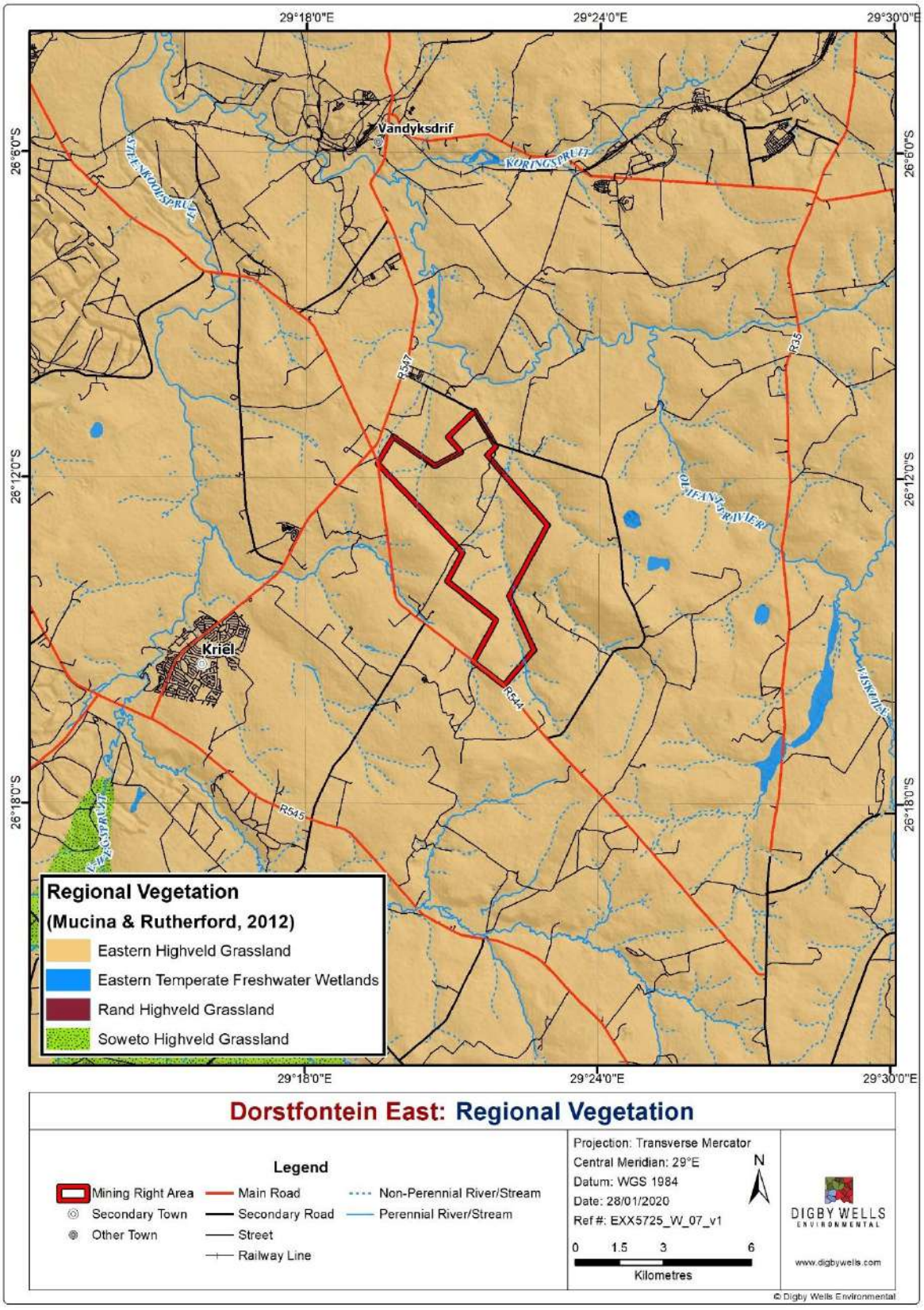

Figure 7-2: Regional Vegetation Types

7.1.2. Fauna

7.1.2.1. Mammals

Based on the results of a search of historical records for the QDS 2629AB on the Demography Unit (formerly the Avian Demography Unit), or ADU online database (MammalMAP, 2019) and field records from historical studies (Cloete, 2016), a total of 17 mammal species may potentially be present in the project area, four of which are SCC including *Felis nigripes* (Black-footed Cat) (Vulnerable), *Leptailurus serval* (Serval) (Near Threatened), *Otomys auratus* (Southern African Vlei Rat) (Near Threatened) and *Crocidura mariquensis* (Swamp Musk Shrew)(Near Threatened). A list of these 17 species is provided in Table 7-1.

Table 7-1: Mammal species that could potentially occur on-site based on historical records for the immediate region of the project area

Family	Scientific Name	Common name	Category
Felidae	*Felis nigripes*	Black-footed Cat	Vulnerable (2016)
Felidae	*Leptailurus serval*	Serval	Near Threatened (2016)
Muridae	*Gerbilliscus brantsii*	Highveld Gerbil	Least Concern (2016)
Muridae	*Mastomys coucha*	Southern African Multimammate mouse	Least Concern (2016)
Muridae	*Mus (Nannomys) minutoides*	Southern African Pygmy Mouse	Least Concern
Muridae	*Otomys auratus*	Southern African Vlei Rat	Near Threatened (2016)
Muridae	*Rhabdomys pumilio*	Xeric Four-striped Grass Rat	Least Concern (2016)
Mustelidae	*Hydrictis maculicollis*	Spotted-necked Otter	Least Concern (IUCN 2008)
Nesomyidae	*Dendromus mystacalis*	Chestnut African Climbing Mouse	Least Concern (2016)
Soricidae	*Crocidura mariquensis*	Swamp Musk Shrew	Near Threatened (2016)

Family	Scientific Name	Common name	Category
Soricidae	*Myosorex varius*	Forest Shrew	Least Concern (2016)
Herpestidae	*Atilax paludinosus*	Water mongoose	Least Concern (2016)
Canidae	*Canis mesomelas*	Black-backed jackal	Least Concern (2016)
Muridae	*Aethomys chrysophilus*	Red vlei rat	Least Concern (2016)
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern (2016)
Muridae	*Mus minutoides*	Pygmy mouse	Least Concern (2016)
Leporidae	*Lepus saxatilis*	Scrub hare	Least Concern (2019)

7.1.2.2. Herpetofauna

Based on the results of a search of historical records for the QDS 2629 AB on the Animal Demography Unit (formerly the Avian Demography Unit), or ADU online database (FrogMAP,2019; ReptileMAP, 2019) and field records from historical studies (Cloete, 2016), a total of 24 herpetofauna species may potentially be present in the project area, four of which are SCC. None of these species is listed as Red Data species. A list of these species is provided in Table 7-2.

Table 7-2: Herpetofauna species that could potentially occur on-site based on historical records for the immediate region of the project area

Family	Scientific name	Common name	Category
Colubridae	*Crotaphopeltis hotamboeia*	Red-lipped Snake	Least Concern (SARCA 2014)
Elapidae	*Naja mossambica*	Mozambique Spitting Cobra	Least Concern (SARCA 2014)
Gekkonidae	*Lygodactylus ocellatus*	Spotted Dwarf Gecko	Least Concern (SARCA 2014)
Gekkonidae	*Pachydactylus affinis*	Transvaal Gecko	Least Concern (SARCA 2014)

Family	Scientific name	Common name	Category
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	Least Concern (SARCA 2014)
Lamprophiidae	*Boaedon capensis*	Brown House Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Lycodonomorphus inornatus*	Olive House Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Lycodonomorphus rufulus*	Brown Water Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Lycophidion capense capense*	Cape Wolf Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Psammophylax rhombeatus*	Spotted Grass Snake	Least Concern (SARCA 2014)
Leptotyphlopidae	*Leptotyphlops scutifrons conjunctus*	Eastern Thread Snake	-
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	Least Concern (SARCA 2014)
Typhlopidae	*Afrotyphlops bibronii*	Bibron's Blind Snake	Least Concern (SARCA 2014)
Viperidae	*Causus rhombeatus*	Rhombic Night Adder	Least Concern (SARCA 2014)
Bufonidae	*Amietophrynus gutturalis*	African common toad	Least Concern
Bufonidae	*Cacosternum boettgeri*	Boettger's dainty frog	Least Concern
Hyperoliidae	*Kassina senegalensis*	Senegal running frog	Least Concern
Phrynobatrachidae	*Phrynobatrachus natalensis*	Natal dwarf puddle frog	Least Concern

Family	Scientific name	Common name	Category
Pyxicephalidae	*Amietia angolensis*	Angola river frog	Least Concern
Bufonidae	*Schismaderma carens*	African red toad	Least Concern
Pyxicephalidae	*Strongylopus fasciatus*	Striped stream frog	Least Concern
Hyperoliidae	*Semnodactylus wealii*	Weale's running frog	Least Concern
Pipidae	*Xenopus laevis*	African clawed frog	Least Concern
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bullfrog	Least Concern

7.1.2.3. Birds (Avifauna)

Provided in Appendix B is the list of 235 avifauna species that have been recorded or deemed to have an increased POC in the vicinity of the project area. This list includes species recorded during past ecological studies (Cloete, 2016) as well as those that have been recorded SABAP 2 observers in the pentads 2610_2915 and 2610_2920. This list includes a high number of typical “Highveld” assemblage of avifauna that can be potentially encountered in and around the project area. Furthermore, it includes a list of species that are listed as SCC globally or in South Africa or both in certain cases.

7.1.2.4. Invertebrates

7.1.2.4.1. Lepidoptera

A total of six butterfly species which were historically present in the 2629AB QDS may potentially occur in the project area, however, the numbers may be low due to a lack of suitable habitat and/or disturbance. These species are listed in Table 7-3, none of which are SCC species.

Table 7-3: Butterfly species that could potentially occur on-site based on historical records for the immediate region of the project area

Family	Scientific Name	Common Name	Category
Hesperiidae	*Metisella meninx*	Marsh sylph	Least Concern (SABCA 2013)
Lycaenidae	*Zizeeria knysna knysna*	African grass blue	Least Concern (SABCA 2013)
Nymphalidae	*Junonia hierta cebrene*	Yellow pansy	Least Concern (SABCA 2013)
Nymphalidae	*Telchinia rahira rahira*	Marsh acraea	Least Concern (SABCA 2013)
Nymphalidae	*Vanessa cardui*	Painted lady	Least Concern (SABCA 2013)
Pieridae	*Eurema brigitta brigitta*	Broad-bordered grass yellow	Least Concern (SABCA 2013)

7.1.2.4.2. Arachnida

The Arachnida include all terrestrial chelicerate and represent a monophyletic group, also called a clade, which means that they consist of a stem species and all its descendant groups. Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside is present in the project area and In South Africa, spiders occur in abundance on commercial crops (Dippenaar-Schoeman 1976; Dippenaar-Schoeman *et al*. 1999). A total of four scorpions and two spider species which were historically present in the 2629AB QDS may potentially occur in the project are, these are listed in Table 7-4

Table 7-4: Spider and scorpion species that could potentially occur on-site based on historical records for the immediate region of the project area

Family	Scientific name	Common name	Red list category
Buthidae	*Uroplectes triangulifer*	-	-
Hormuridae	*Cheloctonus jonesii*	-	-
Hormuridae	*Opistacanthus validus*	-	-
Buthidae	*Pseudolychas pegleri*	-	-
Theraphosidae	*Harpactira hamiltoni*	-	-

Family	Scientific name	Common name	Red list category
Theraphosidae	*Harpactira hamiltoni*	-	-

7.1.2.5. Species of Special Conservation Concern

According to the Red Data faunal species data from the ADU and historical records a total of 13 Red Data faunal species can be potentially encountered in and around the project area, this includes four mammal species and nine avifauna species, these are listed in Table 7-5.

Table 7-5: Red Data faunal species that could potentially occur on-site based on historical records for the immediate region of the project area

Scientific Name	Common Name	Global status	S.A status
Felis nigripes	Black-footed Cat	Vulnerable (2016)	LC
Leptailurus serval	Serval	Near Threatened (2016)	Near Threatened (2004)
Otomys auratus	Southern African Vlei Rat	Near Threatened (2016)	LC
Crocidura mariquensis	Swamp Musk Shrew	Near Threatened (2016)	Data deficient
Recurvirostra avosetta	Pied Avocet	LC	NT
Oxyura maccoa	Maccoa Duck	NT	LC
Tyto capensis	African Grass-owl	LC	VU
Eupodotis caerulescens	Blue Korhaan	NT	NT
Sagittarius serpentarius	Secretarybird Secretarybird	VU	NT
Phoenicopterus ruber	Greater Flamingo	LC	NT
Sagittarius serpentarius	Secretarybird Secretarybird	VU	NT
Phoenicopterus minor	Lesser Flamingo	NT	NT

Scientific Name	Common Name	Global status	S.A status
Tyto capensis	African Grass-owl	LC	VU

7.2. Baseline Environment

Please see the baseline environmental data in Table 7-6 below.

Table 7-6: Baseline Environment of the Dorstfontein East Mine Project Area

Characteristics of the Highveld Ecoregion (Kleynhans, Thirion, & Moolman, 2005)		**Plant Species Characteristic of the Eastern Highveld Grasslands (Mucina & Rutherford, 2012) (**Figure 7-2**)**	
Terrain Morphology	Plains; Low Relief; Plains; Moderate Relief; Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to high Relief Closed Hills. Mountains; Moderate and High Relief.	Graminoid Species	*Aristida aequiglumis, A. congesta, A. junciformis subsp. galpinii, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus, Eragrostis chloromelas, E. capensis, E. curvula, E. gummiflua, E. patentissima, E. plana, E. racemosa, E. sclerantha, Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Setaria sphacelata, Sporobolus africanus, S. pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix, T. rehmannii, Alloteropsis semialata* subsp. *eckloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides.*
Vegetation Types	Mixed Bushveld (limited); Rocky Highveld Grassland; Dry Sandy Highveld Grassland; Dry Clay Highveld Grassland; Moist Cool Highveld Grassland; Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Patches Afromontane Forest (very limited).	Herb Species	*Berkheya setifera, Haplocarpha scaposa, Justicia anagalloides, Pelargonium luridum, Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Euryops gilfillanii, E. transvaalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides* subsp. *latifolia, Selago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata.*
Altitude (m.a.m.s.l.) (modifying)	1 100-2 100, 2 100-2 300 (very limited)	Geophytic Herb Species	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidula* var. *pilosissima, Ledebouria ovatifolia.*
Mean Annual Precipitation (MAP) (mm) (Secondary)	400 to 1 000	Succulent Herb Species	*Aloe ecklonis.*
Coefficient of Variation (% MAP)	<20 to 35	Low Shrub Species	*Anthospermum rigidum* subsp. *pumilum, Seriphium plumosum.*
Rainfall Seasonality	Early to late summer	Status	Vulnerable.

7.3. In-Field Findings

This section discusses, in detail, the findings of the flora and fauna assessment conducted by Digby Wells in April 2021. Due to access limitations and restrictions, the time of the survey was not conducted during the ideal flowering time (wet season from December to January) and various properties within the Project Area were inaccessible. Together, these limitations may have hindered species data collection as some flowering species would have been missed.

7.3.1. Vegetation Communities

The field investigation that was conducted in April 2021 concluded that the vegetation habitats within the Project Area include, grasslands, wetlands, and modified areas.

7.3.1.1. Wetland Systems

A large proportion of the project area constitutes wetlands. The wetland systems and associated drainage lines provide basis for the trophic chain as well as essential ecological corridors for faunal movement. Continuous biomonitoring of the wetlands is recommended to identify the deterioration factors and provide mitigation measures to prevent further degradation of the systems. There are five (5) Hydrogeomorphic (HGM) Units (wetlands) identified and described by the Digby Wells Wetland Report (DWE, 2021) are listed below as:

- Channelled Valley Bottom (CVB);
- Pan;
- Pan Seep;
- Seep; and
- Unchannelled Valley Bottom.

The location of the wetlands is depicted in Figure 7-3. Numerous faunal and floral species were encountered within the delineated wetlands. The CVB wetland in the eastern portion of the Project Area had evidence of high faunal activity.

Wetlands are highly sensitive habitats due to their levels of biodiversity and sensitivity to disturbances, they are highly ecologically important as they host numerous faunal assemblages and habitat for floral species.

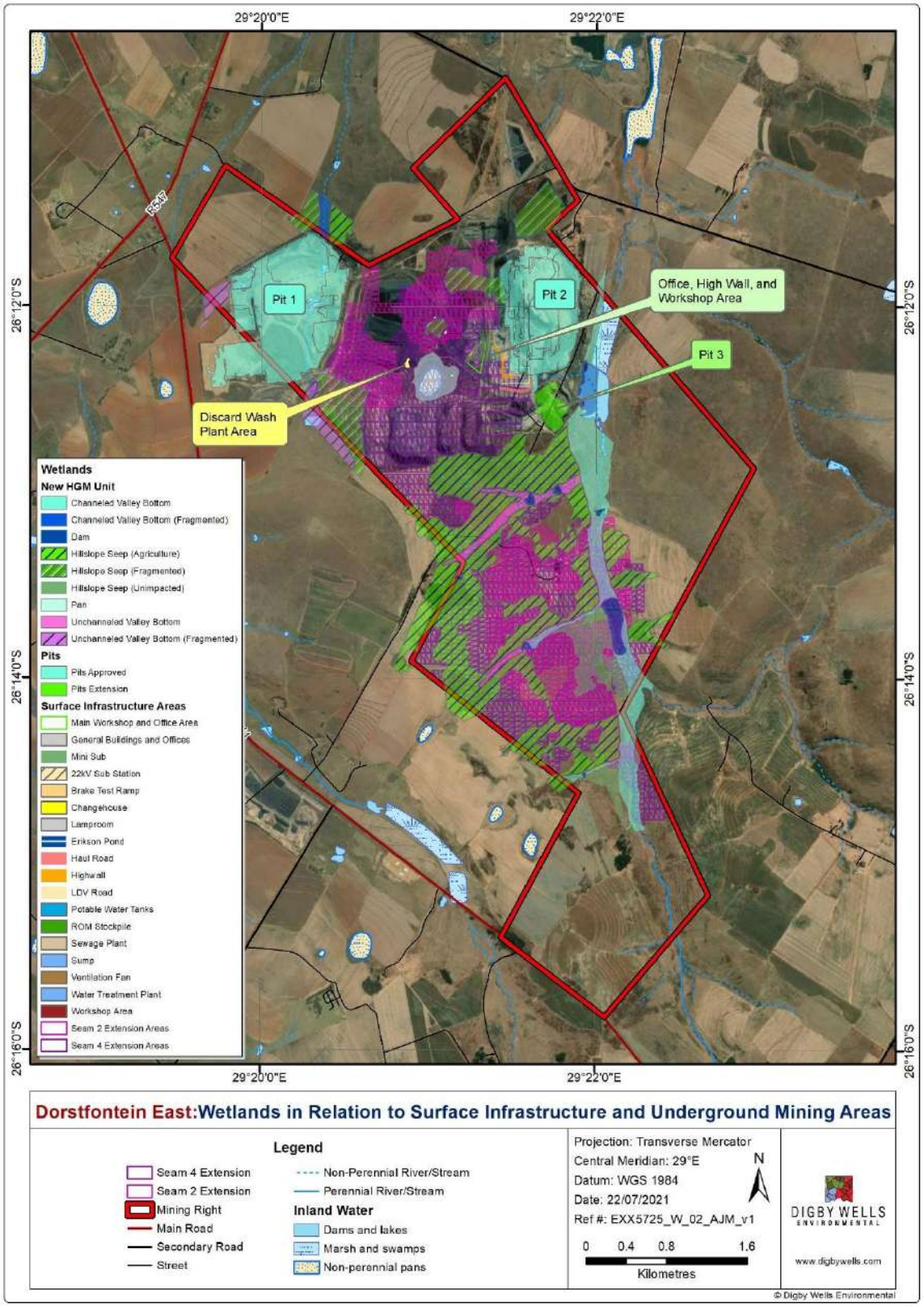

Figure 7-3: Wetland delineations within the DECM

7.3.1.2. Transformed Habitat

For the purpose of this report, transformed land refers to areas that have been changed or disturbed to such an extent that all-natural habitats, biota and ecosystem functions have been fragmented or lost. The transformed areas within the Project Area were predominantly due to the agricultural practises and cultivation of maize/corn (*Zea mays*) and soybean (*Glycine max*) which constitutes the majority of the western portion of the study area. The current land use practices have completely altered the landscape and has permitted AIP proliferation and loss of sensitive habitats, such as wetlands and the existing natural grassland, namely the Eastern Highveld Grassland (Endangered) (Mucina & Rutherford, 2012).

7.3.1.3. Grassland

As majority of the Project Area has been subjected to anthropogenic (agriculture) activities, the remaining grasslands are broadly defined as Secondary grasslands. Secondary grasslands are those that have undergone extensive modification and a fundamental shift from their original state (such as cultivated areas) but have then been allowed to return to a 'grassland' state and left to fallow, allowing a few grassland species to pioneer. Although secondary grasslands may superficially look like primary grasslands, they differ markedly with respect to species composition, vegetation structure, ecological functioning, and the ecosystem services they deliver (SANBI, 2013).

Secondary Grassland	
Photographic representation	 Typical secondary grassland area within the study site

Description of area	The secondary grasslands are distinguishable from the primary grasslands in their notable depleted diversity. They generally miss resprouting species and do not respond in the same way as natural grasslands to fire disturbances. They also have a much lower below-ground root biomass compared to the high below-ground root biomass of natural grasslands. The impacts associated with ploughing disturbances can be observed both above and below the ground (Zaloumis, 2013).
Current condition	The secondary grasslands had evidence of loosened topsoil, previous ploughing and AIPs. The dominance of *Serphium plumosum* is indicative of overgrazed grasslands (see image above). Previously burnt grasslands showed signs of soil erosion as they have a lower establishment of plants to hold the soil intact when faced with high levels of water runoff. Forb species composition was very low and graminoid homogeneity was high in comparison to primary grasslands.
Species of Conservation Concern	No floral SCC were encountered in the secondary grasslands
Common species	Dominant grasses included *Eragrostis curvula, Eragrostis gummiflua,* and *Themeda triandra.* Pioneering forbs and AIPs included *Conyza bonariensis* (AIP)*, Gomphocarpus fruticosus, Pseudognaphalium luteoalbum* and *Solanum pandiforme* (AIP).
Images	 Secondary grassland adjacent to Maize field

7.3.1.4. Exotics

Previous natural grasslands have been altered and/or transformed and have been replaced by pioneering AIP shrubs, trees and forbs. The table below (Table 7-7) lists all AIPs recorded and their respective NEM:BA Status Category.

South Africa has seen a rise of alien species by 15%, increasing from 1,637 to 1,880 (of which a third are declared invasive). According to the report of the Status of Biological Invasions and Management in South Africa, the current estimates suggest the ecological cost of invasive species to be more than R6.5 billion each year (Creecy, 2021). The main costs associated with losses are the decline in ecosystem services such as water, grazing potential and agricultural crop loss. Invasive trees (AIPs) induce high risks associated with the water table. It is said that invasive trees have been known to use up 3-5% of South Africa's surface water runoff each year. Invasive trees have also known to increase the risk and intensity of veld fires, with a 15% more fuel burnt in invaded areas (Creecy, 2021). The economic impact from the loss of biodiversity is linked to the collapse of ecosystem services such as the provision of freshwater and grazing. Currently, if AIPs are not controlled, around 70% of grazing lands will be impacted. This will decline the natural rangelands for livestock production, thereby threatening rural livelihoods and food production.

Table 7-7: AIPs recorded in the Project Area

Species	Category[1]
*Acacia mearnsii**	2
Amaranthus viridus	Invasive
Bidens pilosa	Invasive
*Campuloclinium macrocephalum**	1b
Chenopodium alba	Invasive
*Cirsium vulgare**	1b
Cosmos bipinnatus	Invasive
Conyza bonariensis	Invasive
*Datura stramonium**	1b
*Equisetum hyemale**	1a
*Eucalyptus camaldulensis**	1b
Oenothera rosea	Invasive
Paspalum notatum	Invasive
*Persicaria capitata**	1b

[1] *In accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Alien and Invasive Species List, 2020

Species	Category[1]
*Persicaria lapathifolia**	Invasive
*Portulaca quadrifida**	Invasive
*Pseudognaphalium luteoalbum**	Invasive
Richardia brasiliensis	Invasive
*Schkuhria pinnata**	Invasive
*Solanum panduriforme**	Invasive
*Solanum sisymbriifolium**	1b
*Sonchus oleraceus**	Invasive
Tagetes minuta	Invasive
*Tragopogon dubis**	Invasive
*Verbena bonariensis**	1b
*Verbena officinalis**	Invasive
*Veronica anagallis-aquatica**	Invasive

7.3.2. Fauna

This section represents the results from the field survey conducted during April 2021.

7.3.2.1. Mammals

A total of ten (10) mammals were recorded during the infield assessments. The mammal species were encountered and observed throughout the Project Area within the various habitat units. Various mammals of the Herpestidae (Mongoose) family were observed throughout the numerous wetlands. Tracks of a Water Mongoose were observed throughout the numerous CVB wetlands. Numerous sightings of Scrub Hare were recorded throughout the Project Area. Numerous Aardvark burrows were observed in the seep areas, and adjacent to CVB that flows through the eastern portion of the site. Porcupine, Water Mongoose, and Serval were observed through tracks associated with muddy areas of the CVB. Serval is listed as Near Threatened according to the Regional Red List Assessment of the IUCN. A list of all mammals recorded in the Project Area is presented in Table 7-8 below.

Servals are found in many protected areas within South Africa and are included on CITES Appendix II and protected under national legislation (TOPS regulations) (SANBI, 2018). It is listed as Least Concern (LC) globally and Near Threatened (NT) nationally on the IUCN Red List. Effective conservation of Serval depends on the conservation of wetlands, particularly wetlands in fragmented landscapes. Wetlands form a micro habitat in a mosaic of farmland for several wetland-dependent species; they are reservoirs of small mammal populations that

are major dietary components of Servals. Consequently, if wetlands are protected in a mosaic of farmland use, the landscape may support the persistence of Serval populations.

Table 7-8: Mammals recorded in Project area

Family	Species	Common Name	Conservation status
Bovidae	*Sylvicapra grimmia*	Bush Duiker	LC
Felidae	***Leptailurus serval***	**Serval**	**NT**
Herpestidae	Atilax paludinosus	Water Mongoose	LC
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	LC
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	LC
Leporidae	*Lepus saxatilis*	Scrub Hare	LC
Muridae	*Otomys angoniensis*	Angoni Vlei Rat	LC
Muridae	*Rhabdomys pumilio*	Four-striped Grass Mouse	LC
Orycteropodidae	*Orycteropus afer*	Aardvark	LC
Sciuridae	*Xerus inauris*	Ground Squirrel	LC

7.3.2.2. Birds

Birds are viewed as good ecological indicators, as their presence or absence tends to represent conditions of a functioning ecosystem. The direct link between bird diversity and land cover portrays a direct indication of the habitats in the area of interest.

According to the SABAP2 database, over 140 species of birds have been identified in the area (see Appendix B). The majority of these birds are comprised of grassland and waterbird species. Sixty-two (62) birds were recorded during the field assessment in April 2021. It should be noted that April is not an ideal bird viewing frame as many wading birds may have been missed due to the late season observation. The identified birds are listed in

Table 7-9. below. Numerous pans were scattered throughout the project Area and hosted many waterfowl including Egyptian Geese, Grey Herons, Reed Cormorant, Yellow-billed Ducks, Red Knobbed Coots, Cormorants, Egrets, and Red-billed Teals. A Marsh Owl (*Asio capensis*) was identified within the study area (see Figure 7-4).

Figure 7-4: Marsh Owl flushed during site work

Table 7-9: Bird species recorded in the project area

Group	Common Name	Species Name	Conservation Status
Barbet	Crested	*Trachyphonus vaillantii*	LC
Bishop	Southern Red	*Euplectes orix*	LC
Bishop	Yellow-crowned	*Euplectes afer*	LC
Buzzard	Common	*Buteo buteo*	LC
Canary	Cape	*Serinus canicollis*	LC
Cisticola	Cloud	*Cisticola textrix*	LC
Cisticola	Lazy	*Cisticola aberrans*	LC
Cisticola	Wing-snapping	*Cisticola ayresii*	LC
Cisticola	Zitting	*Cisticola juncidis*	LC
Coot	Red-knobbed	*Fulica cristata*	LC
Cormorant	Reed	*Microcarbo africanus*	LC
Cormorant	White-breasted	*Phalacrocorax lucidus*	LC
Dove	Cape Turtle	*Streptopelia capicola*	LC
Dove	Laughing	*Spilopelia senegalensis*	LC
Dove	Red-eyed	*Streptopelia semitorquata*	LC
Duck	Yellow-billed	*Anas undulata*	LC

Group	Common Name	Species Name	Conservation Status
Egret	Western Cattle	*Bubulcus ibis*	LC
Fiscal	Southern	*Lanius collaris*	LC
Goose	Egyptian	*Alopochen aegyptiaca*	LC
Grassbird	Cape	*Sphenoeacus afer*	LC
Grebe	Little	*Tachybaptus ruficollis*	LC
Guineafowl	Helmeted	*Numida meleagris*	LC
Heron	Black-headed	*Ardea melanocephala*	LC
Heron	Grey	*Ardea cinerea*	LC
Ibis	Hadada	*Bostrychia hagedash*	LC
Kite	Black-winged	*Elanus caeruleus*	LC
Lapwing	African Wattled	*Vanellus senegallus*	LC
Lapwing	Blacksmith	*Vanellus armatus*	LC
Lapwing	Crowned	*Vanellus coronatus*	LC
Lark	Red-capped	*Calandrella cinerea*	LC
Longclaw	Cape	*Macronyx capensis*	LC
Martin	Banded	*Riparia cincta*	LC
Martin	Brown-throated	*Riparia paludicola*	LC
Myna	Common	*Acridotheres tristis*	LC
Owl	Marsh	*Asio capensis*	LC
Pigeon	Speckled	*Columba guinea*	LC
Pipit	African	*Anthus cinnamomeus*	LC
Plover	Three-banded	*Charadrius tricollaris*	LC
Prinia	Tawny-flanked	*Prinia subflava*	LC
Quelea	Red-billed	*Quelea quelea*	LC
Robin-Chat	Cape	*Cossypha caffra*	LC
Sandpiper	Marsh	*Tringa stagnatilis*	LC
Shoveler	Cape	*Spatula smithii*	LC
Sparrow	House	*Passer domesticus*	LC
Spurfowl	Swainson's	*Pternistis swainsonii*	LC
Starling	Pied	*Lamprotornis bicolor*	LC
Stilt	Black-winged	*Himantopus himantopus*	LC
Stonechat	African	*Saxicola torquatus*	LC
Swallow	Barn	*Hirundo rustica*	LC

Group	Common Name	Species Name	Conservation Status
Swallow	Greater Striped	*Cecropis cucullata*	LC
Swift	Little	*Apus affinis*	LC
Thick-knee	Spotted	*Burhinus capensis*	LC
Wagtail	Cape	*Motacilla capensis*	LC
Waxbill	Common	*Estrilda astrild*	LC
Weaver	Cape	*Ploceus capensis*	LC
Weaver	Southern Masked	*Ploceus velatus*	LC
Weaver	Thick-billed	*Amblyospiza albifrons*	LC
Wheatear	Capped	*Oenanthe pileata*	LC
Whydah	Pin-tailed	*Vidua macroura*	LC
Widowbird	Fan-tailed	*Euplectes axillaris*	LC
Widowbird	Long-tailed	*Euplectes progne*	LC
Widowbird	White-winged	*Euplectes albonotatus*	LC

7.3.2.3. Herpetofauna

Herpertofauna is defined as reptiles and amphibians inhabiting a given area. Reptiles are ectothermic (cold-blooded) meaning they are organisms that control body temperature through external means. As a result, reptiles are dependent on environmental heat sources.

According to Carruthers (2001), a number of factors influence the distribution of amphibians, but because amphibians have porous skin they generally prosper in warm and damp habitats. The presence of suitable habitat within the Project area (wetland habitat) provides a number of different species of amphibians.

During the field assessment, three (3) amphibian species were identified within the wetland, and pans, via its call and by direct sightings. The Delalande's River Frog (*Amietia delalandii*), Bubbling Kassina (*Kassina senegalensis*) and the Boettger's Caco (*Cacosternum boettgeri*) (all Least Concern) were recorded within the wetlands.

Reptiles are notoriously difficult to comprehensively detect during short field surveys, due to many species in this group naturally occurring at low densities and being inherently illusive. One (1) species of reptile were identified, namely Speckled Rock Skink (*Trachylepsis punctatissima*). The Skink was encountered basking on the outcrops of the sandstone sheaths. The remaining grassland and wetland habitats provide both hunting sites and shelter for herpetofauna, primarily amphibians colonizing the wetlands which in turn attracts reptile predators.

The observed species diversity for both reptiles and amphibians was considerably low.

7.3.2.4. Invertebrates

Invertebrates are the main components of faunal diversity in grasslands, playing substantial roles in ecosystem processes including nutrient cycling and pollination. Grassland invertebrate communities are heavily dependent on plant diversity and production within a given system (Barnett and Facey, 2016). During the field assessment in April 2021, a total of nineteen (19) invertebrates were identified and are listed in Table 7-10 below. Various species of the Nymphalidae family were recorded despite the survey being conducted during Autumn.

Table 7-10: Invertebrate species recorded

Family	Species	Common name	Conservation status
Acrididae	*Locustana pardalina*	Brown Locust	LC
Carabidae	*Lophyra sp*	Tiger Beetles	LC
Coccinellidae	*Harmonia axyridis*	Asian Lady Beetle	LC
Coenagrionidae	*Africallagma glaucum*	Swamp Bluet	LC
Coenagrionidae	*Africallagma sapphirinum*	Saphire Bluet	LC
Coreidae	*Cletus sp.*	Leaffooted bug	LC
Crambidae	*Spoladea recurvalis*	Beet Webworm	LC
Libellulidae	Urothemis assignata	Red Basker	LC
Libellulidae	*Trithemis strictica*	Jaunty Dropwing	LC
Lycosidae	*Hogna spenceri*	Wolf Spider	LC
Melyridae	*Astylus atromaculatus*	Spotted Maize Beetle	LC
Nymphalidae	*Byblia ilithyia*	Spotted Joker	LC
Nymphalidae	*Hypolimnas misippus*	Diadem	LC
Nymphalidae	*Vanessa cardui*	Painted Lady	LC
Pentatomidae	*Nezara viridula*	Green Vegetable Bug	LC
Platycnemididae	*Elattoneura glauca*	Common Threadtail	LC
Syrphidae	*Allagrapta fuscotibialis*	Hoverfly	LC
Tettigoniidae	*Conocephalu caudalis*	Meadow Katydid	LC
Tingidae	*Plerochila australis*	Olive Lace Bug	LC

8. Sensitivity Analysis

The sensitivity analysis takes into account all of the desktop data (Mpumalanga C-Plan, Threatened Ecosystems, IBAs and the NPAES), as well as the field data gathered during the site visits. The outcome of this assessment depicts sensitivity ranging from low to high in the Project Area. High sensitivity was assigned to the Wetland habitats as they provide habitat for SCC and their irreplaceability as unique biodiversity features. The drainage and wetland

systems are associated with a high ecological sensitivity as they provide refugia and habitat for numerous faunal SCC, promote movement of faunal species and act as corridors and also provide vital ecosystem services. Low sensitivity was assigned to the transformed areas as they have been previously heavily degraded and are proliferated with AIPs.

It is recommended that areas of high sensitivity be actively conserved throughout the life of the proposed Project, as well as after decommissioning and closure.

No impact is proposed to occur on any sensitive areas, as the proposed infrastructure is planned to be constructed entirely within the existing mine footprint.

9. Impact Assessment

The fauna and flora impacts were assessed for the three phases of the project life, the construction, operational and decommissioning phases. The impacts were based on the impact's magnitude as well as the receiver's sensitivity, concluding an impact significance rating which identifies the most important impacts that require management.

The impacts that will potentially affect the fauna and flora of the project area are:

- Sensitive areas such as the Wetlands may be impacted. There is a risk of water contamination, loss of water quality and quantity and loss of unique and irreplaceable habitats. Contaminated water will affect the surrounding areas, and decrease the overall functioning of the ecosystem;
- The current land use (agriculture and cattle grazing) may be negatively impacted due to the mining and infrastructure. This will result in a loss of grazing which in turn will negatively impact the local economy; and
- Any vegetation clearance and removal of topsoil may deplete the soil fertility and encourage AIP proliferation and erosion, further degrading the land and the services it provides.
- Subsidence of areas directly overlaying the proposed underground mining areas. This will potentially cause loss of vegetation areas, as well as impact any fauna that are making use of the area during any collapses.

Methodology used for the impact assessment is represented in Appendix C.

9.1. Construction Phase

Activities during the Construction Phase that may have potential impacts on the vegetation communities, biodiversity and ecosystem function are listed in Table 9-1.

Table 9-1: Interactions and Impacts of Activity

Interaction	Impact
Diesel storage and explosives magazine	• Potential spillage of hydrocarbons (diesel/fuel) thus contaminating the soil and surrounding water; and • Increased vehicle movement.
Construction of infrastructure, and ventilation Shafts.	• Increased faunal casualties; and • Changes to the landscape, causing ponding and undulating topographies.
Increased use of access road and haul roads	• Dust pollution, soil erosion, compaction, sedimentation and AIP proliferation and faunal casualties; • Increased vehicle movement promoting potential faunal causalities; and • Increased compaction and sedimentation.
Stockpiling of soils, rock dump and discard dump establishment.	• Compaction of soils; • Low vegetation growth. If stockpiles unvegetated, potential erosion and spontaneous combustion and • Increased run off and erosion.

9.1.1. Impact Description

The construction of surface infrastructure within the Project Area will take place within the existing disturbance footprint, and thus no vegetation clearance is predicted. However, the construction phase will see increased haul road activity, which will potentially impact faunal species on site, through animal/ vehicle collisions, an increased risk of hydrocarbon spills, and potential dust pollution and haul road degradation, which could all affect the area immediately surrounding the access routes, and haul roads. In addition, the impacts mentioned above could also alter the soil fertility, and increase the risk of roadside vegetation being colonised by fast growing AIPs. This impact can be greatly reduced with the correct implementation of an AIP Eradication Plan. This plan is a multi-phased approach that is stipulated under NEM:BA; Alien and Invasive Species Regulations (2020) (GNR 1003) as published in the Government Gazette 43726 of 18 September 2020 – effective from 18 October 2020.

9.1.1.1. Management Objectives

Management objective for the construction phase will include the avoidance of hydrocarbon spills, the reduction of haul road related dust impacts, and the reduction of animal,/vehicle interactions, and how to mitigate these impacts .

9.1.1.2. Management Actions

- An AIP Eradication Plan to preserve remaining natural habitat and prevent alien plant infestations. Such a strategy will entail the identification of areas where easy propagation of invasive species may occur, this generally occurs where the vegetation

has been damaged and the top soil has been impacted. Thereafter specific eradication measures can be prescribed for the species present.

- Dust suppression techniques should be implemented on all access and haul roads.
- Toolbox talks regarding vehicle speed limits should be regularly implemented, as well as defensive driving to reduce the probability of vehicle/animal interactions.
- All vehicles operating on the site should be regularly checked for hydrocarbon leaks, and all refuelling and servicing should be undertaken within bunded designated areas to avoid hydrocarbons reaching the surrounding environment.
- Once construction is complete, the environmental officer must ensure the construction areas are rehabilitated to an acceptable standard to accomplish the aim of the rehabilitated area. Open and steep areas are prone to erosion and these must be marked and attended to before the following wet season starts.
- Rehabilitation of disturbed areas should take place within a month of construction. All bare patches of soil should be vegetated, preferably with pioneer species which will colonise open and disturbed areas relatively quickly and prevent erosion and alien vegetation establishing.

Illegal waste dumping, including building waste and rubble, should be prohibited. Such illegal dumping sites are prone to alien vegetation recruitment. The environmental manager must ensure that after each construction area is free of excess spoil and rubble piles.

9.1.1.3. Impact Ratings

Impacts associated with the construction phase are presented below in Table 9-2.

Table 9-2: Construction Phase Interactions, and Impacts of Activity Rating

Activity, and Interaction: Diesel storage and explosives magazine.			
• Potential spillage of hydrocarbons (diesel/fuel) thus contaminating the soil and surrounding water; and • Increased vehicle movement causing potential spills.			
Prior Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impact of hydrocarbon spills will remain as long as the mine is in operation, although reduced during the decommissioning phase	Minor -52
Extent	4	The risk of hydrocarbon spills could affect the greater catchment, and thus the municipal area.	
Severity	4	Serious loss of the biodiversity of the greater catchment, limiting ecosystem functioning and services	

Probability	4	It is probable that hydrocarbon spills will occur without appropriate mitigation.	
Nature	Negative		
Mitigation measures			
• All vehicles operating on the site should be regularly checked for hydrocarbon leaks; and • All refuelling and servicing should be undertaken within bunded designated areas to avoid hydrocarbons reaching the surrounding environment.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impact of hydrocarbon spills will remain as long as the mine is in operation, although reduced during the decommissioning phase	Negligible -32
Extent	1	Mitigation will allow the potential impact to be reduced to within a small portion of the mining operation.	
Intensity	2	minor loss, and/or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning.	
Probability	4	It is probable that hydrocarbon spills will occur even with appropriate mitigation.	
Nature	Negative		
Activity, and Interaction: Construction of infrastructure, and ventilation Shafts.			
• Increased faunal casualties; and • Changes to the landscape, causing ponding and undulating topographies.			
Prior Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impact of increased faunal casualties and topographic changes will likely last the entire project life.	Minor -40
Extent	2	The impact will be limited to the site and immediate surroundings.	
Severity	3	The severity of the impact is likely to be moderate.	
Probability	4	It is probable that the impact will occur.	
Nature	Negative		
Mitigation measures			

• Toolbox talks regarding vehicle speed limits should be regularly implemented; and • Training with regards to defensive driving to reduce the probability of vehicle/animal interactions.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impact of increased faunal casualties and topographic changes will likely last the entire project life.	Negligible -20
Extent	2	The impact will be limited to the site and immediate surroundings.	
Intensity	3	The severity of the impact is likely to be moderate.	
Probability	2	With mitigation, the probability of the impact is reduced to rare or improbable.	
Nature	Negative		
Activity, and Interaction: Increased use of access road and haul roads			
• Dust pollution, soil erosion, compaction, sedimentation and AIP proliferation and faunal casualties; • Increased vehicle movement promoting potential faunal causalities; and • Increased compaction and sedimentation.			
Prior Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impact of increased use of access and haul roads will last the life of the project.	Minor -44
Extent	3	The impact will impact the local area.	
Severity	3	If not mitigated moderate loss will occur to the low to moderate sensitive environment.	
Probability	4	It is probable that the impact will occur.	
Nature	Negative		
Mitigation measures			

- An AIP Eradication Plan to preserve remaining natural habitat and prevent alien plant infestations. Such a strategy will entail the identification of areas where easy propagation of invasive species may occur, this generally occurs where the vegetation has been damaged and the top soil has been impacted. Thereafter specific eradication measures can be prescribed for the species present;
- Dust suppression techniques should be implemented on all access and haul roads;
- Toolbox talks regarding vehicle speed limits should be regularly implemented; and
- Training with regards to defensive driving to reduce the probability of vehicle/animal interactions.

Post-Mitigation

Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impacts will occur during the life of the project.	Negligible -20
Extent	2	The impact will be limited to the site and immediate surroundings.	
Intensity	3	The severity of the impact is likely to be moderate.	
Probability	2	With mitigation, the probability of the impact is reduced to rare or improbable.	
Nature	Negative		

Activity, and Interaction: Stockpiling of soils, rock dump and discard dump establishment

- Compaction of soils;
- Low vegetation growth. If stockpiles unvegetated, potential erosion and spontaneous combustion and
- Increased run off and erosion.

Prior Mitigation

Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impacts will cease after the operational life span.	Minor -44
Extent	3	Local, extending as far as the development site area.	
Severity	3	Moderate loss and/or damage to the fauna and flora of the environment.	
Probability	4	There is a <50% probability that the impacts will occur.	
Nature	Negative		

Mitigation measures

• AIPs should be continuously monitored and controlled throughout the life of the mine; and thereafter, with the establishment of an AIP Eradication Plan; • Once construction is complete, the environmental officer must ensure the construction areas are rehabilitated to an acceptable standard to accomplish the aim of the rehabilitated area. Open and steep areas are prone to erosion and these must be marked and attended to before the following wet season starts; • Rehabilitation of disturbed areas should take place within a month of construction. All bare patches of soil should be vegetated, preferably with pioneer species which will colonise open and disturbed areas relatively quickly and prevent erosion and alien vegetation establishing; • No harvesting of floral or poaching of faunal species may take place by the construction employees; and • No dirty water may be disposed of In the immediate environment.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	3	The impact can be reversed with minimal management.	Negligible -24
Extent	2	Limited to the site and its immediate surroundings	
Intensity	3	Moderate loss and/or damage to the fauna and flora of the environment.	
Probability	3	There is a <25% probability that the impacts will occur, therefore unlikely.	
Nature	Negative		

9.2. Operational Phase

Activities during the Operational Phase that may have potential impacts on the vegetation communities, biodiversity and ecosystem function are listed in Table 9-3.

Table 9-3: Operational Phases Interactions and Impacts

Interaction	Impact
Underground blasting and operation of the underground workings	• Subsidence of areas that have been destabilised by underground workings; • Potential contamination of underground water and air; and • Increased risk of erosion.

Interaction	Impact
Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.	• Habitat disturbances and increased soil erosion, soil contamination and compaction. • Removal of soil and vegetation, increased faunal casualties (roadkill); • Increased erosion and sedimentation decreasing vegetation cover; • Dust pollution, and AIP proliferation; • Increased vehicle movement in the area, increasing soil compaction, and runoff potential; and • Unexpected changes in the topography and overall habitats.
Infrastructure area, including stockpile areas and the discard dump	• AIP proliferation; • Animal/vehicle casualties and poaching; and • Erosion and sedimentation from the stockpiling and discards dumps.
Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste;	• Contamination of soil, water and surrounding areas / habitats (pan vegetation) from Hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).

9.2.1. Impact Description

There may be a direct impact on animal life, as haul roads will be utilised during this phase and there will be an increase in roadkill. Continuous project activities during the operational phase will increase dust production and if not mitigated will have negative impacts on the surrounding vegetation and habitats.

The nature of the mine risks the possibility of land subsidence. This has a knock-on effect on a number of other factors such as water quality, air quality and heavy metal contamination. All measures must be taken to prevent the severe environmental impacts that follow with land subsidence.

9.2.1.1. Management Objectives

Management objectives during the operational phase will concentrate on minimising the effect of haul roads, and infrastructure maintenance on the vegetation directly surrounding the working site, and preventing the loss of vegetation and/or habitat due to subsidence caused by underground mining.

9.2.1.2. Management Actions

Management actions to mitigate the impacts described can be summarised as follows:

- Monitoring of alien invasive sprawl during the operation is recommended;
- Ensure no loss of faunal SCC by activating anti-poaching units that will be incorporated during the mine life cycle;

- Adhere to mine regulatory protocols for commuting within the Project Area, i.e.: obeying speed limits;

- Keep site clearing to a minimum, and restrict vehicle movement outside of dedicated areas; and
- Monitor dust pollution.

9.2.1.3. Impact Ratings

The operational phase impacts are rated in Table 9-4.

Table 9-4: Operational Phase Interactions, and Impacts of Activity Rating

Activity, and Interaction: Underground blasting and operation of the underground workings.			
• Subsidence of areas that have been destabilised by underground workings; • Potential contamination of underground water and air; and • Increased risk of erosion.			
Prior Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	6	The impact is potentially irreversible and may remain after the life of the project	Minor -52
Extent	3	Underground workings can lead to extensive damage within the local area.	
Severity	4	Potential for serious loss or damage to biodiversity of moderate sensitivity, such as the wetlands on site.	
Probability	4	It is probable that subsidence could occur due to the underground activities.	
Nature	Negative		
Mitigation measures			

- Consider areas with high flood areas and install regulated buffer zones to prevent mine inundation for the underground workings;
- Adhere to all management and mitigation measures as prescribed within other specialist reports.
- Undertake a subsidence risk assessment study to determine areas of high risk for subsidence and demarcate these areas after mining has taken place to minimise the risk if collapse for faunal species, as well as allow for the search and rescue of SCC flora that may be affected by the subsidence.
- Avoidance of underground mining activities where high subsidence probability intersect with high sensitivity (CVB wetland) habitat.
- Prevent impacts from reaching downstream water resources by ensuring installation and proper functioning of stormwater systems and drains to prevent contaminated water entering the natural environment. This will be prudent in this development, since petroleum and other hydrocarbons associated with the trucks and vehicle-based activities are likely to be spilled in the environment if not managed well. Please refer to the Digby Wells Hydropedology Report (2021) for measures regarding this matter.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	6	The impact is potentially irreversible and may remain after the life of the project	Minor -44
Extent	2	The extent of the impact will remain limited within the development site area.	
Intensity	3	Moderate loss and damage to low sensitivity areas if mitigation is not adhered to.	
Probability	4	It is probable that subsidence could occur due to the underground activities.	
Nature	Negative		

Activity, and Interaction: Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.

- Habitat disturbances and increased soil erosion, soil contamination and compaction.
- Increased faunal casualties (roadkill);
- Increased erosion and sedimentation decreasing vegetation cover;
- Dust pollution, and AIP proliferation;
- Ensure maintenance of infrastructure to prevent any spillages thus preventing contamination of the soil;
- Increased vehicle movement in the area, increasing soil compaction, and runoff potential; and
- Unexpected changes in the topography and overall habitats

Prior Mitigation

Dimension	Rating	Motivation	Significance
Duration	5	The impact of increased faunal casualties and topographic changes will likely last the entire project life.	Minor -40
Extent	2	The impact will be limited to the site and immediate surroundings.	
Severity	3	The severity of the impact is likely to be moderate.	
Probability	4	It is probable that the impact will occur.	
Nature	Negative		

Mitigation measures

- Monitoring of the vegetation communities present must be completed every 2 years to document to impacts of the edge effect and fragmentation;
- Adhere to mine health and safety protocol regarding speed limits. Install signage of faunal and floral sensitive areas to prevent unnecessary damage to areas out of the demarcated areas;
- Monitoring of alien invasive sprawl during the operation is recommended as the surrounding vegetation is relatively intact and free from alien invasive plants;
- Ensure maintenance of infrastructure to prevent any spillages thus preventing contamination of the soil; and
- Vegetate stockpiles to prevent soil loss, organic material loss, erosion, and sedimentation.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	5	The impact of increased faunal casualties and topographic changes will likely last the entire project life.	Negligible -20
Extent	2	The impact will be limited to the site and immediate surroundings.	

Intensity	3	The severity of the impact is likely to be moderate.	
Probability	2	With mitigation, the probability of the impact is reduced to rare or improbable.	
Nature	Negative		
Activity, and Interaction: Increased use of access road and haul roads			
• Dust pollution, soil erosion, compaction, sedimentation and AIP proliferation and faunal casualties; • Increased vehicle movement promoting potential faunal causalities; and • Increased compaction and sedimentation.			
Prior Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impact of increased use of access and haul roads will last the life of the project.	Minor -44
Extent	3	The impact will impact the local area.	
Severity	3	If not mitigated moderate loss will occur to the low to moderate sensitive environment.	
Probability	4	It is probable that the impact will occur.	
Nature	Negative		
Mitigation measures			
• An AIP Eradication Plan to preserve remaining natural habitat and prevent alien plant infestations. Such a strategy will entail the identification of areas where easy propagation of invasive species may occur, this generally occurs where the vegetation has been damaged and the top soil has been impacted. Thereafter specific eradication measures can be prescribed for the species present; • Dust suppression techniques should be implemented on all access and haul roads; • Toolbox talks regarding vehicle speed limits should be regularly implemented; and • Training with regards to defensive driving to reduce the probability of vehicle/animal interactions.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impacts will occur during the life of the project.	Negligible -20
Extent	2	The impact will be limited to the site and immediate surroundings.	
Intensity	3	The severity of the impact is likely to be moderate.	

Probability	2	With mitigation, the probability of the impact is reduced to rare or improbable.	
Nature	Negative		
Activity, and Interaction: Diesel storage and explosives magazine.			
• Potential spillage of hydrocarbons (diesel/fuel) thus contaminating the soil and surrounding water; and • Increased vehicle movement causing potential spills.			
Prior Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impact of hydrocarbon spills will remain as long as the mine is in operation, although reduced during the decommissioning phase	Minor -52
Extent	4	The risk of hydrocarbon spills could affect the greater catchment, and thus the municipal area.	
Severity	4	Serious loss of the biodiversity of the greater catchment, limiting ecosystem functioning and services	
Probability	4	It is probable that hydrocarbon spills will occur without appropriate mitigation.	
Nature	Negative		
Mitigation measures			
• All vehicles operating on the site should be regularly checked for hydrocarbon leaks; and • All refuelling and servicing should be undertaken within bunded designated areas to avoid hydrocarbons reaching the surrounding environment.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impact of hydrocarbon spills will remain as long as the mine is in operation, although reduced during the decommissioning phase	Negligible -32
Extent	1	Mitigation will allow the potential impact to be reduced to within a small portion of the mining operation.	
Intensity	2	minor loss, and/or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning.	

Probability	4	It is probable that hydrocarbon spills will occur even with appropriate mitigation.	
Nature	Negative		

9.3. Decommissioning Phase

Activities during the decommissioning phase that may have potential impacts on the vegetation communities, biodiversity and ecosystem function are listed in Table 9-5Table 9-5.

Table 9-5: Interactions and Impacts of Activity

Interaction	Impact
Demolition and removal of infrastructure	• Disturbance of soils, and subsequent erosion by wind, and water; • Increased vehicle movement in the area, increasing soil erosion and habitat destruction; • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds; • AIP proliferation; and • Changes in topography and landscape.
Post-closure monitoring and rehabilitation	• Exposure of soils, and subsequent compaction, erosion, and sedimentation; • Soil compaction, and increased runoff potential due to vehicle movement during rehabilitation programs; • Loss of organic material, and vegetation cover; and • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of soil.
Closure of the underground mine	• Potential risk for land subsidence, preluding to topography changes, underground water contamination and change to faunal habitats.

9.3.1. Impact Description

The decommissioning phase will enable the rehabilitation of the removed indigenous vegetation and Red Listed species. The removal of any infrastructure or machinery may also take place, whereby these will be dismantled and trucked away.

9.3.1.1. Management Objectives

The objective for this phase will be to maximise the success of the rehabilitation that will take place after infrastructure is removed and the closure of the underground mine has commenced, and to furthermore reduce any impacts that may occur during this phase.

9.3.1.2. Management Actions

Decommissioning of the infrastructure will be predominantly a rehabilitation activity. These areas will be sloped and revegetated with indigenous plant species that represent the vegetation types and communities identified.

In order for the decommissioning to be a positive impact, the removal of the infrastructure must be completed so as to not harm or negatively impact surrounding intact vegetation. The aim will be to ensure the disturbed footprint areas are vegetated and that erosion through runoff and wind does not occur. Efforts will be maximised if rehabilitation is completed before the wet season sets in to make use of the rainfall to assist in plant growth.

9.3.1.3. Impact Ratings

The decommissioning phase impacts are listed in Table 9-6 below.

Table 9-6: Decommissioning Phase Interactions, and Impacts of Activity Rating

Activity, and Interaction: Demolition and removal of infrastructure			
• Disturbance of soils, and subsequent erosion by wind and water; • Increased vehicle movement in the area, increasing soil erosion and habitat destruction; • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds; • AIP proliferation; and • Changes in topography and landscape.			
Prior Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impact will cease after the operational life span and can be reversed with sufficient management	Minor -44
Extent	3	Local, extending as far as the development site area.	
Severity	3	Moderate effects to the surrounding environment.	
Probability	4	There is a <50% probability the impacts will occur.	

Nature	Negative		
Mitigation measures			
• Continue with concurrent Rehabilitation, begin with stockpiles, bare grounds and dumps, implement rehabilitation measures; • Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible to prevent AIP sprawl; • Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged; and • Only designated access routes are to be used to reduce any unnecessary compaction.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	2	The impact will be less than a year if rehabilitation measures are implemented correctly.	Negligible -24
Extent	2	The impact will be limited to the site due to the implementation of mitigation measures.	
Intensity	2	Minor effects on the biological or physical environment. Environmental damage can be rehabilitated internally with/ without the help of external consultants.	
Probability	4	There is a <50% probability the impacts will occur.	
Nature	Negative		
Activity, and Interaction: Post-closure monitoring and rehabilitation			
• Minimal negative impacts on the environment; • Activities involve the rehabilitation processes of reprofiling the soils and re-vegetation thereafter; • Impacts include the possibility of erosion and sedimentation; • Proliferation of AIPs; and • Change in the habitat and species composition.			
Prior Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**

Duration	4	The impacts caused during the rehabilitation activities will have a long-lasting effect if not managed.	Minor -50
Extent	1	Limited to isolated sections of the Project Area.	
Severity	5	These impacts have serious implications to the revival of the disturbed areas.	
Probability	5	Probability of <65% as these are the commonly observed impacts for the rehabilitation phase.	
Nature	Negative		

Mitigation measures

- During the decommissioning phase, rehabilitation must start as soon as possible and preferably in the growing season (October to February) to ensure adequate plant recruitment;
- Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible;
- Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged; and
- Only designated access routes are to be used to reduce any unnecessary compaction.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	6	The impact will be less than a year if rehabilitation measures are implemented correctly	Positive Impact 66
Extent	3	The impact will be limited to the site due to the implementation of mitigation measures	
Intensity	2	Minor effects on the biological or physical environment. Environmental damage can be rehabilitated internally with/ without the help of external consultants.	
Probability	6	The impact can occur and as probability of <80%	
Nature	Positive		

Activity, and Interaction: Closure of the underground mine.			
• Potential risk for land subsidence, preluding to topography changes, underground water contamination and change to faunal habitats. • Change in the land topography and species composition.			
Prior Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	6	The impact will remain for some time after the life of the Project.	Minor -56
Extent	3	Local, extending only as far as the development site area	
Severity	5	Serious loss or damage to highly sensitive environments.	
Probability	4	There is a <50% probability that the impact may occur	
Nature	Negative		
Mitigation measures			
• Ensure mitigations measures to prevent subsidence are enforced and maintained throughout the decommissioning phase.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	4	Long term impact yet can be reversed with management.	Negligible -33
Extent	3	Local, extending only as far as the development site area.	
Intensity	4	Serious loss and/or damage to	
Probability	3	There is a <25% probability that the impact may occur.	
Nature	Negative		

9.4. Cumulative Impacts

It is necessary to consider the impacts that the future development will have from a wide-ranging perspective, by considering land-use and transformation of the natural habitat in surrounding areas. Cumulative impacts are assessed by considering past, present and anticipated changes to the biodiversity. Roads, other mining activity and agricultural activity in the area contribute to this regard. The proposed project is localised in extent but could affect The Project Area resides in the Endangered Eastern Highveld Grassland vegetation type which is currently poorly protected. The cumulative loss of the vegetation type as well as the SCC within it should be considered proactively. The primary impacts will include fragmentation and edge effects, isolating pockets of vegetation decreasing movement and corridors for wildlife and threatened species.

Secondary cumulative impacts will include increased accessibility to the site and the resulting increase in development and resource dependence. Ideally, a strategic environmental plan for the area should be developed and adhered to. This should include the conservation of important areas as well as the provision of corridors for faunal movement.

9.5. Unplanned and Low Risk Events

Major unplanned risks are associated with infrastructure malfunctioning and contamination of surrounding ground and ground water. Potentially hazardous substances can contaminate the area via accidental spillage or leakage. It is imperative that the requirements of South African legislation are met for minimisation of pollution. These are described in Table 9-7 below.

Table 9-7: Unplanned Events and Associated Mitigation Measures

Unplanned Risk	Mitigation Measures
Leaking or spillage of hazardous substances from pipelines and waste storage	• If a spill occurs, it is to be cleaned up immediately (Drizit/Zupazorbtype spill kits) and consequently reported to the authorities; • All infrastructure carrying or transporting such substances is to be checked frequently and maintained; and • Ensure all staff are adequately informed and safety measures are in place for such instances.
Hydrocarbon spillage from vehicles	• If leak occurs from vehicle, place drip trays below the leak; • All vehicles are to be serviced on concrete areas and off site; and • Machines must be parked upon hard parking surfaces and checked daily for leaks.

Unplanned Risk	Mitigation Measures
Infrastructure malfunction leading towards dirty water spillage or spontaneous combustion	• All infrastructure, machinery and associated setups are to be serviced and checked throughout the project life cycle; • All staff are to be informed about potential hazards and consequently prepared for malfunctioning; • Protocols are to be induced at every phase of the project life cycle; and • If such hazards were to incur, the appropriate authorities are to be notified and the incident recorded.
Excess dust pollution	• Excess dust in construction sites is mitigated via various methods and are site specific. The recommended methods for this site would be spraying of water, mulch from the removed vegetation and tackifiers and soil stabilisers that don't harden the soils.

10. Environmental Management Programme

The objective of an Environmental Management Programme (EMPr) is to present mitigations (a) to manage undue or reasonably avoidable adverse impacts associated with the development of the project and (b) to enhance potential positives.

Mitigation measures will sometimes be built into the base of a project and should be considered as part of the "pre-mitigation" scenario; additional mitigation must be recommended if the impact assessment indicates it is necessary.

The key objectives are EMPrs are to give mitigation measures to:

- Identify the actual environmental, socio-economic and public health impacts of the project and check if the observed impacts are within the levels predicted in the EIA;
- Determine that mitigation measures or other conditions attached to project approval (e.g. by legislation) are properly implemented and work effectively;
- Adapt the measures and conditions attached to project approval in the light of new information or take action to manage unanticipated impacts if necessary; and
- Gauge if predicted benefits of the project are being achieved and maximized; and gain information for improving similar projects and ESIA practice in the future.

The EMPr is described in Table 10-1 below

Table 10-1: Environmental Management Programme

Activities		Potential Impacts	Mitigation Measure	Mitigation Type	The period for implementation
Construction Phase	• Diesel storage and explosives magazine • Construction of infrastructure, and ventilation Shafts. • Increased use of access road and haul roads • Stockpiling of soils and rock dump.	• Potential spillage of hydrocarbons (diesel/fuel) thus contaminating the soil and surrounding water; and • Increased vehicle movement. • Increased faunal casualties; and • Changes to the landscape, causing ponding and undulating topographies. • Dust pollution, soil erosion, compaction, sedimentation and AIP proliferation and faunal casualties; • Increased vehicle movement promoting potential faunal causalities; and • Increased compaction and sedimentation. • Compaction of soils; • Low vegetation growth. If stockpiles unvegetated, potential erosion • Increased run off and erosion.	• All vehicles operating on the site should be regularly checked for hydrocarbon leaks; • Drip trays should be used during vehicle checks; • All refuelling and servicing should be undertaken within bunded designated areas to avoid hydrocarbons reaching the surrounding environment; • Toolbox talks regarding vehicle speed limits should be regularly implemented; • Training with regards to defensive driving to reduce the probability of vehicle/animal interactions; • An AIP Eradication Plan to preserve remaining natural habitat and prevent alien plant infestations. Such a strategy will entail the identification of areas where easy propagation of invasive species may occur, this generally occurs where the vegetation has been damaged and the top soil has been impacted. Thereafter specific eradication measures can be prescribed for the species present; and • Dust suppression techniques should be implemented on all access and haul roads.	***Modify, remedy, control, or stop*** Concurrent rehabilitation through the life of mine	Life of Construction Phase

Operational Phase	• Underground blasting and operation of the underground workings • Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas. • Infrastructure area, including stockpile areas and the discard dump • Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste.	• Subsidence of areas that have been destabilised by underground workings; • Potential contamination of underground water and air; and • Increased risk of erosion. • Habitat disturbances and increased soil erosion, soil contamination and compaction. • Removal of soil and vegetation, increased faunal casualties (roadkill); • Increased erosion and sedimentation decreasing vegetation cover; • Dust pollution, and AIP proliferation; • Increased vehicle movement in the area, increasing soil compaction, and runoff potential; and • Unexpected changes in the topography and overall habitats. • AIP proliferation; • Animal/vehicle casualties and poaching; and • Erosion and sedimentation from the stockpiling and discards dumps. • Contamination of soil, water and surrounding areas / habitats (pan vegetation) from Hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).	• Consider areas with high flood areas and install regulated buffer zones to prevent mine inundation for the underground workings; • Adhere to all management and mitigation measures as prescribed within other specialist reports. • Undertake a subsidence risk assessment study to determine areas of high risk for subsidence and demarcate these areas after mining has taken place to minimise the risk if collapse for faunal species, as well as allow for the search and rescue of SCC flora that may be affected by the subsidence. • Avoidance of underground mining activities where high subsidence probability intersect with high sensitivity (CVB wetland) habitat. • Prevent impacts from reaching downstream water resources by ensuring installation and proper functioning of stormwater systems and drains to prevent contaminated water entering the natural environment. This will be prudent in this development, since petroleum and other hydrocarbons associated with the trucks and vehicle-based activities are likely to be spilled in the environment if not managed well. Please refer to the Digby Wells Hydropedology Report (2021) for measures regarding this matter. • Monitoring of the vegetation communities present must be completed every 2 years to document to impacts of the edge effect and fragmentation; • Adhere to mine health and safety protocol regarding speed limits; • Monitoring of alien invasive sprawl during the operation is recommended as the surrounding vegetation is relatively intact and free from alien invasive plants; • Vegetate stockpiles to prevent soil loss, organic material loss, erosion, and sedimentation. • An AIP Eradication Plan to preserve remaining natural habitat and prevent alien plant infestations. Such a strategy will entail the identification of areas where easy propagation of invasive species may occur, this generally occurs where the vegetation has been damaged and the top soil has been impacted. Thereafter specific eradication measures can be prescribed for the species present; • Dust suppression techniques should be implemented on all access and haul roads; • Toolbox talks regarding vehicle speed limits should be regularly implemented; and • Training with regards to defensive driving to reduce the probability of vehicle/animal interactions.	***Modify, remedy, control, or stop*** Concurrent rehabilitation through the life of mine	Life of Operational Phase

Activities		Potential Impacts	Mitigation Measure	Mitigation Type	The period for implementation
Decommissioning Phase	• Demolition and removal of infrastructure • Post-closure monitoring and rehabilitation • Closure of the underground mine	• Disturbance of soils, and subsequent erosion by wind, and water; • Increased vehicle movement in the area, increasing soil erosion and habitat destruction; • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds; • AIP proliferation; and • Changes in topography and landscape. • Exposure of soils, and subsequent compaction, erosion, and sedimentation; • Soil compaction, and increased runoff potential due to vehicle movement during rehabilitation programs; • Loss of organic material, and vegetation cover; and • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of soil. • Potential risk for land subsidence, preluding to topography changes, underground water contamination and change to faunal habitats.	• Continue with concurrent Rehabilitation, begin with stockpiles, bare grounds and dumps, implement rehabilitation measures; • Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible to prevent AIP sprawl; • Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged; • Only designated access routes are to be used to reduce any unnecessary compaction; • During the decommissioning phase, rehabilitation must start as soon as possible and preferably in the growing season (October to February) to ensure adequate plant recruitment; • Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged; • Only designated access routes are to be used to reduce any unnecessary compaction; and • Ensure mitigations measures to prevent subsidence are enforced and maintained throughout the decommissioning phase.	***Modify, remedy, control, or stop*** Concurrent rehabilitation through the life of mine	Life of Decommissioning Phase

11. Monitoring Programme

A monitoring programme is essential as a management tool to detect negative impacts and variations as they arise and ensure that the necessary mitigation measures are implemented together with the effectiveness of the management measures in place. Table 11-1 describes the monitoring plan that is to be implemented from the construction phase through to monitoring after decommissioning. The program includes each element, frequency of monitoring and the person responsible thereof.

Monitoring should be done in terms of:

- Appendix 6 of the NEMA EIA Regulations, 2014, (as amended);
- National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA);
- National Forest Act, 1998 (Act No. 84 of 1998) (NFA); and
- Mpumalanga Biodiversity Sector Plan (MBSP, 2014).

Table 11-1: Monitoring Plan

Monitoring Element	Comment	Frequency	Responsibility
Alien Invasive Management	During the operational phase the presence if AIPs should be detected and monitored every annually. An active programme of weed management, to control the presence and spread of invasive weeds, will need to be instituted so that encroaching weeds (from edge effects and fragmentation) are controlled by means appropriate to the species. This should run for the life of the mine and five years after rehabilitation.	Annually during the wet season (December to February) for the first five years after rehabilitation.	Environmental Officer
Vegetation Cover Monitoring	The natural vegetation cover established on the disturbed areas needs to be monitored annually for the first five years after rehabilitation has been carried out, to ensure that the rehabilitation work has been successful in terms of stabilising the newly formed surfaces (preventing air and water erosion from affecting those surfaces), and that the newly established vegetation cover is trending towards convergence with the original vegetation cover found on the areas prior to	Annually during the wet season for the first five years after rehabilitation.	Botanist / Flora Specialist

Monitoring Element	Comment	Frequency	Responsibility
	disturbance (and on adjacent undisturbed areas). Parameters to be followed during monitoring: • Plant species present/absent; • Weed species composition; • Species density (number of individuals); • Species frequency (number of times species is recorded); • Basal cover; and • Biomass for ground cover.		
Red Data listed fauna and flora	All protected and Red Data plant and animal species must be marked prior to any construction taking place.	annually	Field Specialist
Fauna monitoring	This will be closely linked to the flora monitoring to enable scientific conclusions and comparisons. To successfully monitor faunal and floral biodiversity with a Grassland biome, a solid baseline (pre-construction) will be established through the first round of monitoring. This needs to be supplemented with regular repeats to compile a reasonable comparison between the pre-construction faunal communities present and faunal communities found in the same areas during various stages of construction and operation of the proposed project. It is recommended that this monitoring be carried out through the life of the mine and concurrently during rehabilitation.	Monitored every 6 months from rehabilitation	Field Specialist

12. Stakeholder Engagement Comments Received

The consultation process affords Interested and Affected Parties (I&APs) opportunities to engage in the EIA process. The objectives of the Public Participation Process (PPP) include the following:

- To ensure that I&APs are informed about the Project;
- To provide I&APs with an opportunity to engage and provide comment on the Project;

- To draw on local knowledge by identifying environmental and social concerns associated with the Project;
- To involve I&APs in identifying methods in which concerns can be addressed;
- To verify that stakeholder comments have been accurately recorded; and
- To comply with the legal requirements.

The PPP has been completed in part, as a process separate to the Fauna and Flora Environmental Impact Assessment. No standalone consultation was undertaken as part of this assessment. Should any I&AP comments be submitted in relevance to fauna and flora during the PPP, these will be considered in the final EIA report.

Site surveys can often present an opportunity for informal consultation with specific stakeholders (usually farm owners, managers and employees). None were encountered during the wet season survey conducted for the study during April 2021.

13. Recommendations

The following actions are recommended to reduce adverse effects on the fauna and flora of the Project area (Table 13-1).

Table 13-1: Possible Impacts and Recommendations

Possible Impacts	Recommendations	Person Responsible
Loss of Fauna	• Toolbox talks regarding vehicle speed limits should be regularly implemented; and • Training with regards to defensive driving to reduce the probability of vehicle/animal interactions..	Biodiversity specialist, and Exxaro PM
Loss of Vegetation cover and Flora	• Monitoring of alien invasive sprawl during the operation is recommended as the surrounding vegetation is relatively intact and free from alien invasive plants; • Vegetate stockpiles to prevent soil loss, organic material loss, erosion, and sedimentation. • An AIP Eradication Plan to preserve remaining natural habitat and prevent alien plant infestations. Such a strategy will entail the identification of areas where easy propagation of invasive species may occur, this generally occurs where the vegetation has been damaged and the top soil has been impacted. Thereafter specific eradication measures can be prescribed for the species present;	Field Specialist, and Exxaro PM

Possible Impacts	Recommendations	Person Responsible
Habitat and landscape fragmentation	• A Subsidence Risk Assessment should be undertaken. • Ensure a livestock management plan is enforced to prevent further degradations. • After rehabilitation the area must be fenced, and animals (cattle) should be kept off the area until the vegetation is self-sustaining and established.	Geotechnical Specialist, Field Specialist, Communal Nursery and Exxaro PM

14. Reasoned Opinion Whether Project Should Proceed

Based on the baseline information, and impact assessment significance ratings, it is the opinion of the specialist that this Project is feasible and should be considered. However, the Project may potentially inflict irreversible damage to sensitive habitats such as Wetlands. These sensitive landscapes were found to host numerous faunal and floral SCC. However, it is highly recommended that concurrent rehabilitation, management and mitigation measures are correctly implemented to minimise all potential impacts (identified in Section 9 and 10) on the fauna and flora of the site.

Managing measures to minimise potential negative impacts as set out in Section **Error! Reference source not found.** should form part of the conditions throughout the development of the Project. Protected species will require permit applications, through the provincial or national government department, for the removal of protected species. It is also highly recommended that watercourses (wetlands and pans) be avoided and not impacted with application of the recommended mitigation measures prescribed the Digby Wells Wetland Report 2021 to any of the identified wetland systems that will be impacted by the Project.

Fauna and flora management measures and monitoring requirements as set out in this report should form part of the conditions of the ongoing activities of the mine.

15. Conclusion

Based on Mucina & Rutherford (2006) classification of South Africa's vegetation, the proposed Project is located in an area dominated by the vegetation type Eastern Highveld Grassland, which according to those authors, is regarded as Endangered. According to the MBSP, moderately modified, other natural and heavily modified areas are present within the Project Area. According to the SAPAD and NPAES, no protected areas occur within the Project Area.

A single season site survey was undertaken in April 2021 during the wet season. The following details were recorded:

- Much of the Project Area has been either transformed or degraded largely through historical crop production and other agricultural activities.

- Identified vegetation communities included Wetlands, Secondary Grasslands, and Transformed cultivated areas and areas of Alien Invasive Plant (AIP) proliferation. The Wetlands are seen as sensitive landscapes in the context of this ecological report.

The mining activities in the identified vegetation communities have had direct negative ecological impacts, most notably vegetation clearing, habitat loss and fragmentation as well as AIP proliferation..

The vegetation communities associated with the highest species richness was the Wetland communities. However, in the context of the Project Area all the remaining natural vegetation provides habitat for numerous faunal and floral species and therefore is of conservation significance. Recommendations and mitigation measures are provided in the Impact Assessment. Important recommendations include the following:

- Management and control of AIP proliferation throughout the life of the Project;
- A Subsidence Risk Assessment should be undertaken;
- Monitoring of alien invasive sprawl during the operation is recommended as the surrounding vegetation is relatively intact and free from alien invasive plants;
- Vegetate stockpiles to prevent soil loss, organic material loss, erosion, and sedimentation; and
- After rehabilitation the area must be fenced, where appropriate< and animals (cattle) should be kept off the area until the vegetation is self-sustaining and established.

This assessment provides mitigation measures, continuous monitoring measures, encourages concurrent rehabilitation and monitoring plan.

16. References

Animal Demographic Unit (ADU) Virtual Museum database (http://vmus.adu.org.za). Accessed 22

BirdLife International (2019) Important Bird Areas factsheet: Amersfoort - Bethal - Carolina District. Downloaded from http://www.birdlife.org on 28/08/2019/02/2019.

Bureau, W. (1986). Climate of South Africa: climate statistics up to 1984. Report No. WB40. Government Printer, Pretoria.

Barnes, Keith N. 1998. *The important bird areas of southern Africa*: BirdLife South Africa.

Bureau, Weather %J Report No. WB40. Government Printer, Pretoria. 1986. "Climate of South Africa: climate statistics up to 1984."

Carbutt, C, M Tau, A Stephens, and B %J Grassroots Escott. 2011. "The conservation status of temperate grasslands in southern Africa." 11 (1):17-23.

DEA. 2016. "National Protected Areas Expansion Strategy for South Africa 2016. ." In. Pretoria, South Africa. .

Driver, Amanda, Kerry J Sink, Jeanne L Nel, Stephen Holness, Lara Van Niekerk, Fahiema Daniels, Zuziwe Jonas, Prideel A Majiedt, Linda Harris, and Kristal Maze. 2012. "National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems."

Ferrar, AA, MC %J Mpumalanga Tourism Lötter, and Nelspruit Parks Agency. 2007. "Mpumalanga biodiversity conservation plan handbook."

Mucina, L, and MC %J Memoirs of the Botanical Survey of South Africa Rutherford. 2006. "The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19.,(South African National Biodiversity Institute: Pretoria, South Africa)."

Mucina, Ladislav, and Michael C Rutherford. 2012. "The vegetation of South Africa, Lesotho and Swaziland." In.: Strelitzia19.,(South African National Biodiversity Institute: Pretoria, South Africa).

Mucina, Ladislav, Michael C Rutherford, Leslie W Powrie, Adriaan Van Niekerk, and Johannes H Van der Merwe. 2014. *Vegetation field atlas of continental South Africa, Lesotho and Swaziland*: South African National Biodiversity Institute Pretoria.

Rouget, Mathieu, Belinda Reyers, Zuziwe Jonas, Philip Desmet, Amanda Driver, Kristal Maze, Benis Egoh, Richard M Cowling, L Mucina, and MC %J Technical report. Volume 1: Terrestrial component Rutherford. 2004. "South African National Spatial Biodiversity Assessment 2004."

Rutherford, MC %J Vegetation of southern Africa. 1997. "Categorization of biomes."91-8.

Rutherford, MC, and R Westfall. 1986. "Southern African biomes." In *Mem. Bot. Surv. S. Afr.*, 98. Government Press Pretoria.

Tourism, Mpumalanga %J MBSP Terrestrial Assessment. 2014. "Parks Agency." 2014.

Department of Environmental Affairs (DEA). (2011). National list of threatened ecosystems. General notice 1002 of 9 December 2011. Government Gazette No 34809.

Department of Environmental Affairs. (2014). Environmental impact assessment and management strategy for South Africa (Draft).

Driver A, Sink KJ, Nel JN, Holness S, Van Niekerk L, Daniels F, Jonas Z, Majiedt PA, Harris L, Maze K.(2012). National biodiversity assessment 2011: an assessment of South Africa's biodiversity and ecosystems. Synthesis report. Pretoria: South African National Biodiversity Institute and Department of Environmental Affairs.

Ferrar, A. A., & Lötter, M. C. (2007). Mpumalanga biodiversity conservation plan handbook. Mpumalanga Tourism & Parks Agency, Nelspruit.

FrogMAP. (2017). The Southern African Frog Atlas Project. Retrieved from http://vmus.adu.org.za/

IUCN. (2018). Retrieved from The IUCN Red List of Threatened Species: http://www.iucnredlist.org/

MammalMAP. (2016). Virtual Museum of African Mammals. Retrieved from http://vmus.adu.org.za/

McNeely, J. A. (Ed.). (2001). The great reshuffling: human dimensions of invasive alien species. IUCN.

MTPA. (2010). MBSP Landcover 2010 [Vector] 2010. Retrieved October 17, 2016, from Biodiversity GIS: http://bgis.sanbi.org/SpatialDataset/Detail/585

MTPA. (2014). MBSP Terrestrial Assessment 2014 [Vector] 2014. Retrieved October 17, 2016, from Biodiversity GIS: http://bgis.sanbi.org/SpatialDataset/Detail/589

Mucina, L, and MC %J Memoirs of the Botanical Survey of South Africa Rutherford. 2006. "The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19.,(South African National Biodiversity Institute: Pretoria, South Africa)."

Mucina, Ladislav, and Michael C Rutherford. 2012. "The vegetation of South Africa, Lesotho and Swaziland." In.: Strelitzia19.,(South African National Biodiversity Institute: Pretoria, South Africa).

Mucina, Ladislav, Michael C Rutherford, Leslie W Powrie, Adriaan Van Niekerk, and Johannes H Van der Merwe. 2014. *Vegetation field atlas of continental South Africa, Lesotho and Swaziland*: South African National Biodiversity Institute Pretoria.

New Plants of Southern Africa (NEWPOSA). http://newposa.sanbi.org. Accessed 22/02/2019.

Raimondo, D., Von Stade, L., Foden, W., Victor, J., Helme, N., Turner, R., . . . Manyama, P. (2009). Red List of South African Plants. Strelitzia 25:41-52. (D. Raimondo, L. Von Stade, W. Foden, J. Victor, N. Helme, R. Turner, . . . P. Manyama, Eds.) Pretoria: South African National Biodiversity Institute.

Raunkiaer C (1934) The life forms of plants and statistical plant geography. Clarendon, Oxford.

ReptileMap. (2016). The Southern African Reptile Atlas Project. Retrieved from http://vmus.adu.org.za/

Rutherford, M. C. & Westfall, R. H. (1986). Biomes of southern Africa-an objective categorization. Mem. Bot. Surv. South. Afr. 54: 1-98.

Rutherford, M. C. (1997). Categorization of biomes. Vegetation of southern Africa, 91-98.

Rouget, Mathieu, Belinda Reyers, Zuziwe Jonas, Philip Desmet, Amanda Driver, Kristal Maze, Benis Egoh, Richard M Cowling, L Mucina, and MC %J Technical report. Volume 1: Terrestrial component Rutherford. 2004. "South African National Spatial Biodiversity Assessment 2004."

Rutherford, MC %J Vegetation of southern Africa. 1997. "Categorization of biomes."91-8.

Rutherford, MC, and R Westfall. 1986. "Southern African biomes." In *Mem. Bot. Surv. S. Afr.*, 98. Government Press Pretoria.

Tourism, Mpumalanga %J MBSP Terrestrial Assessment. 2014. "Parks Agency." 2014.

SABAP2. (2016). Southern African Bird Atlas Project 2. Retrieved from http://sabap2.adu.org.za/

SACS (South African Committee for Stratigraphy) (1980). Stratigraphy of South Africa, Part 1 (Kent, L. E. Comp.). Lithostratigraphy of the Republic of South Africa, South West Africa/Namibia, and the Republics of Bophuthatswana, Transkei and Venda. Handbk. geol. Surv. s. Ali: 8, 690.

SANBI. (2013). Grassland Ecosystem Guidelines: landscape interpretation for planners and managers. (M. Cadman, C. de Villiers, R. Lechmere-Oertel, & D. McCulloch, Eds.) Pretoria: South African National Biodiversity Institute.

SANBI. (2016). Red List of South African Plants. Retrieved from http://redlist.sanbi.org/index.php.

SANBI BGIS - National Spatial Biodiversity Assessment. Accessed 22/02/2019

Skinner, J., & Chimimba, C. (2005). The mammals of the southern African subregion (3rd ed.). Cambridge: Cambridge University Press.

South Africa. (2011, December 9). National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection. Government Gazette 558(34809), 558(34809), pp. 1-544.

South Africa. (2015, March 31). National Environmental Management: Biodiversity Act: Threatened or Protected Species Regulations. Government Gazette 255(38600), pp. 1-288.

Appendix A: Floral Species Found in the Study Area

Family	Species Name	Growth Form
Amaranthaceae	*Amaranthus hybridus*	Forb
Rubiaceae	*Anthospermum rigidum*	Forb
Poaceae	*Aristida adscensionis*	Grass
Asteraceae	*Berkheya carlinopsis*	Forb
Asteraceae	*Berkheya setifera*	Forb
Asteraceae	*Bidens formosa*	Forb
Asteraceae	*Bidens pilosa*	Forb
Acanthaceae	*Chaetacanthus costatus*	Forb
Poaceae	*Chloris virgata*	Grass
Asteraceae	*Cirsium vulgare*	Forb
Asteraceae	*Conyza bonariensis*	Forb
Acanthaceae	*Crabbea acaulis*	Forb
Asteraceae	*Crepis hypochoeridea*	Forb
Poaceae	*Cynodon dactylon*	Grass
Solanaceae	*Datura stramonium*	Forb
Poaceae	*Digitaria species*	Grass
Poaceae	*Eleusine coracana*	Grass

Family	Species Name	Growth Form
Poaceae	*Eragrostis plana*	Grass
Asclepiadaceae	*Gomphocarpus fruticosus*	Shrub
Amaranthaceae	*Gomphrena celosioides*	Forb
Asteraceae	*Haplocarpha scaposa*	Forb
Poaceae	*Hyparrhenia hirta*	Grass
Asteraceae	*Lactuca capensis*	Forb
Poaceae	*Paspalum dilatatum*	Grass
Poaceae	*Pennisetum clandestinum*	Grass
Plantaginaceae	*Plantago longissima*	Forb
Asteraceae	*Pseudognaphalium luteo-album*	Forb
Asteraceae	*Schkuhria pinnata*	Forb
Solanaceae	*Solanum panduriforme*	Forb
Poaceae	*Sporobolus africanus*	Grass
Asteraceae	*Tagetes minuta*	Forb
Poaceae	*Tragus berteronianus*	Grass
Verbenaceae	*Verbena brasiliensis*	Forb
Asteraceae	*Xanthium spinosum*	Forb
Asteraceae	*Xanthium strumarium*	Forb
Cyperaceae	*Abildgaardia ovata*	Sedge
Poaceae	*Andropogon appendiculatus*	Grass
Poaceae	*Andropogon eucomus*	Grass

Family	Species Name	Growth Form
Poaceae	*Aristida bipartita*	Grass
Poaceae	*Brachiaria eruciformis*	Grass
Amaryllidaceae	*Crinum bulbispermum*	Geophyte
Scrophulariaceae	*Cycnium tubulosum*	Forb
Poaceae	*Cymbopogon excavatus*	Grass
Cyperaceae	*Cyperus esculentus*	Sedge
Cyperaceae	*Cyperus species*	Sedge
Scrophulariaceae	*Diclis species*	Forb
Poaceae	*Digitaria tricholaenoides*	Grass
Poaceae	*Eragrostis gummiflua*	Grass
Poaceae	*Eragrostis species*	Grass
Fabaceae	*Erythrina zeyheri*	Shrub
Iridaceae	*Gladiolus species*	Geophyte
Orchideaceae	*Habenaria chlorotica*	Geophyte
Asteraceae	*Haplocarpha lyrata*	Forb
Asteraceae	*Helichrysum aureonitens*	Forb
Asteraceae	*Helichrysum nudifolium*	Forb
Asteraceae	*Helichrysum rugulosum*	Forb
Poaceae	*Helictotrichon turgidulum*	Grass
Sterculiaceae	*Hermannia species*	Forb
Sterculiaceae	*Hermannia transvaalensis*	Forb

Family	Species Name	Growth Form
Poaceae	*Hyparrhenia anamesa*	Grass
Poaceae	*Imperata cylindrica*	Grass
Scrophulariaceae	*Jamesbrittenia aurantiaca*	Forb
Liliaceae	*Kniphofia species*	Forb
Cyperaceae	*Kyllinga alba*	Forb
Liliaceae	*Ledebouria ovalifolia*	Geophyte
Poaceae	*Leersia hexandra*	Grass
Lobeliaceae	*Lobelia erinus*	Forb
Lobeliaceae	*Monopsis decipiens*	Forb
Onagraceae	*Oenothera tetraptera*	Forb
Polygonaceae	*Oxygonum dregeanum*	Sedge
Poaceae	*Paspalum urvillei*	Grass
Apiaceae	*Peucedanum magalismontanum*	Forb
Dipsacaceae	*Scabiosa columbaria*	Forb
Asteraceae	*Senecio achilleifolius*	Forb
Asteraceae	*Senecio inornatus*	Forb
Poaceae	*Setaria nigrirostris*	Grass
Poaceae	*Setaria sphacelata*	Grass
Poaceae	*Themeda triandra*	Grass
Verbenaceae	*Verbena bonariensis*	Forb
Campanulaceae	*Wahlenbergia undulata*	Forb

Family	Species Name	Growth Form
Campanulaceae	*Wahlenbergia virgata*	Forb
Cuscutaceae	*Cuscuta campestris*	Climber
Poaceae	*Cymbopogon plurinodis*	Grass
Poaceae	*Digitaria ternata*	Grass
Poaceae	*Elionurus muticus*	Grass
Poaceae	*Eragrostis curvula*	Grass
Asteraceae	*Helichrysum pilosellum*	Forb
Hypoxidaceae	*Hypoxis rigidula*	Geophyte
Hypoxidaceae	*Hypoxis species*	Geophyte
Plantaginaceae	*Plantago lanceolata*	Forb
Fabaceae	*Rhynchosia species*	Forb
Asteraceae	*Schistostephium crataegifolium*	Forb
Poaceae	*Tristachya leucothrix*	Grass
Poaceae	*Urochloa panicoides*	Grass
Poaceae	*Arundinella nepalensis*	Grass
Cyperaceae	*Cyperus rupestris*	Sedge
Poaceae	*Hemarthria altissima*	Grass
Onagraceae	*Oenothera rosea*	Forb
Polygonaceae	*Persicaria lapathifolia*	Hydrophilic
Salicaceae	*Rumex species*	Forb
Dipsacaceae	*Salix babylonica*	Tree

Family	Species Name	Growth Form
Asteraceae	*Scabiosa columbaria*	Forb
Cyperaceae	*Schkuhria pinnata*	Forb
Asteraceae	*Schoenoplectus corymbosus*	Sedge
Poaceae	*Senecio achilleifolius*	Forb
Anacardiaceae	*Setaria nigrirostris*	Grass
Asteraceae	*Sium repandum*	Forb
Typhaceae	*Tagetes minuta*	Forb
Verbenaceae	*Typha capensis*	Hydrophilic
Scrophulariaceae	*Verbena brasiliensis*	Forb
Campanulaceae	*Veronica anagallis-aquatica*	Forb
Forb	*Wahlenbergia virgata*	Forb

Appendix B: Avifaunal Species Predicted within the Study Area

Scientific Name	Common Name	Global status	S.A status
Apalis thoracica	Bar-throated Apalis	LC	LC
Recurvirostra avosetta	Pied Avocet	LC	NT
Trachyphonus vaillantii	Crested Barbet	LC	LC
Euplectes orix	Southern Red Bishop	LC	LC
Euplectes afer	Yellow-crowned Bishop	LC	LC
Ixobrychus minutus	Little Bittern	LC	LC
Pycnonotus tricolor	Dark-capped Bulbul	-	LC
Crithagra atrogularis	Black-throated Canary	LC	LC
Serinus canicollis	Cape Canary	LC	LC
Crithagra flaviventris	Yellow Canary	LC	LC
Crithagra mozambicus	Yellow-fronted Canary	LC	LC
Myrmecocichla formicivora	Anteating Chat	LC	LC
Cisticola textrix	Cloud Cisticola	LC	LC
Cisticola tinniens	Levaillant's Cisticola	LC	LC
Cisticola ayresii	Wing-snapping Cisticola	LC	LC
Cisticola juncidis	Zitting Cisticola	LC	LC

Scientific Name	Common Name	Global status	S.A status
Hirundo spilodera	South African Cliff-swallow	LC	LC
Fulica cristata	Red-knobbed Coot	LC	LC
Phalacrocorax africanus	Reed Cormorant	LC	LC
Phalacrocorax carbo	White-breasted Cormorant	LC	LC
Corvus albus	Pied Crow	LC	LC
Chrysococcyx caprius	Diderick Cuckoo	LC	LC
Anhinga rufa	African Darter	LC	LC
Streptopelia senegalensis	Laughing Dove	LC	LC
Streptopelia semitorquata	Red-eyed Dove	LC	LC
Columba livia	Rock Dove	LC	LC
Thalassornis leuconotus	White-backed Duck	LC	LC
Dendrocygna viduata	White-faced Duck	LC	LC
Anas undulata	Yellow-billed Duck	LC	LC
Bubulcus ibis	Cattle Egret	LC	LC
Egretta alba	Great Egret	LC	LC
Egretta garzetta	Little Egret	LC	LC
Egretta intermedia	Yellow-billed Egret	LC	LC

Scientific Name	Common Name	Global status	S.A status
Falco amurensis	Amur Falcon	LC	LC
Lanius collaris	Common (Southern) Fiscal	LC	LC
Phoenicopterus ruber	Greater Flamingo	LC	LC
Muscicapa striata	Spotted Flycatcher	LC	LC
Scleroptila levaillantoides	Orange River Francolin	LC	LC
Scleroptila levaillantii	Red-winged Francolin	LC	LC
Alopochen aegyptiacus	Egyptian Goose	LC	LC
Plectropterus gambensis	Spur-winged Goose	LC	LC
Tyto capensis	African Grass-owl	LC	VU
Sphenoeacus afer	Cape Grassbird	LC	LC
Tachybaptus ruficollis	Little Grebe	LC	LC
Numida meleagris	Helmeted Guineafowl	LC	LC
Larus cirrocephalus	Grey-headed Gull	LC	LC
Circus pygargus	Montagu's Harrier	LC	LC
Egretta ardesiaca	Black Heron	LC	LC
Ardea melanocephala	Black-headed Heron	LC	LC
Ardea cinerea	Grey Heron	LC	LC
Ardea purpurea	Purple Heron	LC	LC
Ardeola ralloides	Squacco Heron	LC	LC

Scientific Name	Common Name	Global status	S.A status
Delichon urbicum	Common House-martin	LC	LC
Threskiornis aethiopicus	African Sacred Ibis	LC	LC
Plegadis falcinellus	Glossy Ibis	LC	LC
Bostrychia hagedash	Hadeda Ibis	LC	LC
Actophilornis africanus	African Jacana	LC	LC
Falco rupicoloides	Greater Kestrel	LC	LC
Falco rupicolus	Rock Kestrel	-	LC
Megaceryle maxima	Giant Kingfisher	LC	LC
Ceryle rudis	Pied Kingfisher	LC	LC
Elanus caeruleus	Black-shouldered Kite	LC	LC
Eupodotis caerulescens	Blue Korhaan	NT	NT
Vanellus senegallus	African Wattled Lapwing	LC	LC
Vanellus armatus	Blacksmith Lapwing	LC	LC
Vanellus coronatus	Crowned Lapwing	LC	LC
Mirafra fasciolata	Eastern Clapper Lark	-	LC
Spizocorys conirostris	Pink-billed Lark	LC	LC
Calandrella cinerea	Red-capped Lark	LC	LC
Mirafra africana	Rufous-naped Lark	-	LC
Chersomanes albofasciata	Spike-heeled Lark	LC	LC

Scientific Name	Common Name	Global status	S.A status
Macronyx capensis	Cape Longclaw	LC	LC
Riparia paludicola	Brown-throated Martin	LC	LC
Ploceus velatus	Southern Masked-weaver	LC	LC
Gallinula chloropus	Common Moorhen	LC	LC
Acridotheres tristis	Common Myna	LC	Invasive
Asio capensis	Marsh Owl	LC	LC
Columba guinea	Speckled Pigeon	LC	LC
Anthus cinnamomeus	African Pipit	LC	LC
Charadrius tricollaris	Three-banded Plover	LC	LC
Netta erythrophthalma	Southern Pochard	LC	LC
Prinia flavicans	Black-chested Prinia	LC	LC
Prinia subflava	Tawny-flanked Prinia	LC	LC
Coturnix coturnix	Common Quail	LC	LC
Ortygospiza atricollis	African Quailfinch	LC	LC
Quelea quelea	Red-billed Quelea	LC	LC
Rallus caerulescens	African Rail	LC	LC
Acrocephalus baeticatus	African Reed-warbler	-	LC
Cossypha caffra	Cape Robin-chat	LC	LC
Bradypterus baboecala	Little Rush-warbler	LC	LC

Scientific Name	Common Name	Global status	S.A status
Tringa stagnatilis	Marsh Sandpiper	LC	LC
Sagittarius serpentarius	Secretarybird Secretarybird	VU	NT
Tadorna cana	South African Shelduck	LC	LC
Anas smithii	Cape Shoveler	LC	LC
Gallinago nigripennis	African Snipe	LC	LC
Passer melanurus	Cape Sparrow	LC	LC
Passer domesticus	House Sparrow	LC	Alien
Platalea alba	African Spoonbill	LC	LC
Pternistis swainsonii	Swainson's Spurfowl	LC	LC
Spreo bicolor	Pied Starling	LC	LC
Himantopus himantopus	Black-winged Stilt	LC	LC
Calidris minuta	Little Stint	LC	LC
Saxicola torquatus	African Stonechat	LC	LC
Hirundo rustica	Barn Swallow	LC	LC
Hirundo cucullata	Greater Striped Swallow	LC	LC
Hirundo albigularis	White-throated Swallow	LC	LC
Acrocephalus gracilirostris	Lesser Swamp-warbler	LC	LC
Porphyrio madagascariensis	African Purple Swamphen	LC	LC

Scientific Name	Common Name	Global status	S.A status
Apus horus	Horus Swift	LC	LC
Apus affinis	Little Swift	LC	LC
Apus caffer	White-rumped Swift	LC	LC
Anas erythrorhyncha	Red-billed Teal	LC	LC
Chlidonias hybrida	Whiskered Tern	LC	LC
Streptopelia capicola	Cape Turtle-dove	LC	LC
Motacilla capensis	Cape Wagtail	LC	LC
Phylloscopus trochilus	Willow Warbler	LC	LC
Estrilda astrild	Common Waxbill	LC	LC
Amandava subflava	Orange-breasted Waxbill	LC	LC
Oenanthe pileata	Capped Wheatear	LC	LC
Zosterops virens	Cape White-eye	LC	LC
Vidua macroura	Pin-tailed Whydah	LC	LC
Euplectes axillaris	Fan-tailed Widowbird	LC	LC
Euplectes progne	Long-tailed Widowbird	LC	LC
Euplectes albonotatus	White-winged Widowbird	LC	LC
Phoeniculus purpureus	Green Wood-hoopoe	LC	LC
Jynx ruficollis	Red-throated Wryneck	LC	LC
Recurvirostra avosetta	Pied Avocet	LC	LC

Scientific Name	Common Name	Global status	S.A status
Trachyphonus vaillantii	Crested Barbet	LC	LC
Euplectes orix	Southern Red Bishop	LC	LC
Euplectes afer	Yellow-crowned Bishop	LC	LC
Pycnonotus tricolor	Dark-capped Bulbul	LC	LC
Buteo vulpinus	Steppe Buzzard	LC	LC
Crithagra atrogularis	Black-throated Canary	LC	LC
Crithagra flaviventris	Yellow Canary	LC	LC
Myrmecocichla formicivora	Anteating Chat	LC	LC
Cisticola textrix	Cloud Cisticola	LC	LC
Cisticola tinniens	Levaillant's Cisticola	LC	LC
Cisticola ayresii	Wing-snapping Cisticola	LC	LC
Cisticola juncidis	Zitting Cisticola	LC	LC
Hirundo spilodera	South African Cliff-swallow	LC	LC
Fulica cristata	Red-knobbed Coot	LC	LC
Phalacrocorax africanus	Reed Cormorant	LC	LC
Phalacrocorax carbo	White-breasted Cormorant	LC	LC
Chrysococcyx caprius	Diderick Cuckoo	LC	LC

Scientific Name	Common Name	Global status	S.A status
Streptopelia senegalensis	Laughing Dove	LC	LC
Streptopelia semitorquata	Red-eyed Dove	LC	LC
Columba livia	Rock Dove	LC	LC
Dendrocygna viduata	White-faced Duck	LC	LC
Anas undulata	Yellow-billed Duck	LC	LC
Bubulcus ibis	Cattle Egret	LC	LC
Egretta alba	Great Egret	LC	LC
Egretta garzetta	Little Egret	LC	LC
Mesophoyx intermedia	Yellow-billed Egret	LC	LC
Falco amurensis	Amur Falcon	LC	LC
Amadina erythrocephala	Red-headed Finch	LC	LC
Lanius collaris	Common (Southern) Fiscal	LC	LC
Phoenicopterus minor	Lesser Flamingo	NT	NT
Muscicapa striata	Spotted Flycatcher	LC	LC
Alopochen aegyptiacus	Egyptian Goose	LC	LC
Plectropterus gambensis	Spur-winged Goose	LC	LC
Tyto capensis	African Grass-owl	LC	VU
Tachybaptus ruficollis	Little Grebe	LC	LC

Scientific Name	Common Name	Global status	S.A status
Tringa nebularia	Common Greenshank	LC	LC
Numida meleagris	Helmeted Guineafowl	LC	LC
Larus cirrocephalus	Grey-headed Gull	LC	LC
Scopus umbretta	Hamerkop Hamerkop	LC	LC
Ardea melanocephala	Black-headed Heron	LC	LC
Ardea cinerea	Grey Heron	LC	LC
Ardea purpurea	Purple Heron	LC	LC
Upupa africana	African Hoopoe	-	LC
Threskiornis aethiopicus	African Sacred Ibis	LC	LC
Plegadis falcinellus	Glossy Ibis	LC	LC
Bostrychia hagedash	Hadeda Ibis	LC	LC
Alcedo cristata	Malachite Kingfisher	LC	LC
Elanus caeruleus	Black-shouldered Kite	LC	LC
Vanellus senegallus	African Wattled Lapwing	LC	LC
Vanellus armatus	Blacksmith Lapwing	LC	LC
Vanellus coronatus	Crowned Lapwing	LC	LC
Calandrella cinerea	Red-capped Lark	LC	LC
Chersomanes albofasciata	Spike-heeled Lark	LC	LC
Macronyx capensis	Cape Longclaw	LC	LC

Scientific Name	Common Name	Global status	S.A status
Riparia cincta	Banded Martin	LC	LC
Riparia paludicola	Brown-throated Martin	LC	LC
Ploceus velatus	Southern Masked-weaver	LC	LC
Gallinula chloropus	Common Moorhen	LC	LC
Urocolius indicus	Red-faced Mousebird	LC	LC
Acridotheres tristis	Common Myna	LC	Invasive
Asio capensis	Marsh Owl	LC	LC
Cypsiurus parvus	African Palm-swift	LC	LC
Columba guinea	Speckled Pigeon	LC	LC
Anthus cinnamomeus	African Pipit	LC	LC
Charadrius tricollaris	Three-banded Plover	LC	LC
Netta erythrophthalma	Southern Pochard	LC	LC
Prinia flavicans	Black-chested Prinia	LC	LC
Prinia subflava	Tawny-flanked Prinia	LC	LC
Coturnix coturnix	Common Quail	LC	LC
Ortygospiza atricollis	African Quailfinch	LC	LC
Cossypha caffra	Cape Robin-chat	LC	LC
Philomachus pugnax	Ruff Ruff	LC	LC
Actitis hypoleucos	Common Sandpiper	LC	LC
Tringa glareola	Wood Sandpiper	LC	LC

Scientific Name	Common Name	Global status	S.A status
Anas smithii	Cape Shoveler	LC	LC
Gallinago nigripennis	African Snipe	LC	LC
Passer melanurus	Cape Sparrow	LC	LC
Passer domesticus	House Sparrow	LC	Alien
Platalea alba	African Spoonbill	LC	LC
Pternistis swainsonii	Swainson's Spurfowl	LC	LC
Lamprotornis nitens	Cape Glossy Starling	LC	LC
Spreo bicolor	Pied Starling	LC	LC
Himantopus himantopus	Black-winged Stilt	LC	LC
Calidris minuta	Little Stint	LC	LC
Saxicola torquatus	African Stonechat	LC	LC
Chalcomitra amethystina	Amethyst Sunbird	LC	LC
Hirundo rustica	Barn Swallow	LC	LC
Hirundo cucullata	Greater Striped Swallow	LC	LC
Hirundo albigularis	White-throated Swallow	LC	LC
Apus affinis	Little Swift	LC	LC
Apus caffer	White-rumped Swift	LC	LC
Anas capensis	Cape Teal	LC	LC
Anas erythrorhyncha	Red-billed Teal	LC	LC

Scientific Name	Common Name	Global status	S.A status
Chlidonias hybrida	Whiskered Tern	LC	LC
Turdus smithi	Karoo Thrush	-	LC
Streptopelia capicola	Cape Turtle-dove	LC	LC
Motacilla capensis	Cape Wagtail	LC	LC
Estrilda astrild	Common Waxbill	LC	LC
Amandava subflava	Orange-breasted Waxbill	LC	LC
Oenanthe monticola	Mountain Wheatear	LC	LC
Zosterops virens	Cape White-eye	-	LC
Vidua macroura	Pin-tailed Whydah	LC	LC
Euplectes axillaris	Fan-tailed Widowbird	LC	LC
Euplectes progne	Long-tailed Widowbird	LC	LC
Euplectes albonotatus	White-winged Widowbird	LC	LC

DIGBY WELLS
ENVIRONMENTAL

Appendix C: Impact Assessment Methodology

Impact Assessment Methodology

Details of the impact assessment methodology used to determine the significance of impacts to fauna and flora is provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts.

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven as indicated in **Error! Reference source not found.**. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts. Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this Impact Assessment Report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in **Error! Reference source not found.**, which is extracted from **Error! Reference source not found.**. The description of the significance ratings is discussed in **Error! Reference source not found.**. It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Impact Assessment Parameter Ratings

Rating	Intensity/ Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
7	Irreplaceable loss or damage to biological or physical resources or highly sensitive environments. Irreplaceable damage to highly sensitive cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or moderate to highly sensitive environments. Irreplaceable damage to cultural/social resources of moderate to highly sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

Rating	Intensity/ Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
5	Serious loss and/or damage to physical or biological resources or highly sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or moderately sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/ Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources of low to moderately sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor loss and/or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/ Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	Minimal to no loss and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Probability/Consequence Matrix

Probability \ Significance	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Consequence

DIGBY WELLS
ENVIRONMENTAL

Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a significant and usually a long-term change to the (natural and / or social) environment and result in major changes.	Moderate (negative) (-)

Score	Description	Rating
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)