PROPOSED WILD COAST SPECIAL ECONOMIC ZONE MTHATHA, KING SABATA DALINDYEBO LOCAL MUNICIPALITY, EASTERN CAPE

Terrestrial Ecological Assessment Report

Version: 0.1

DRAFT FOR COMMENT

Date: 12th July 2018

Eco-Pulse Environmental Consulting Services

Report No: EP341-03

Prepared for: WSP: Environment & Energy, Africa
Building C, Knightsbridge
33 Sloane Street, Bryanston 2191, South Africa
Ms. Ashlea Strong (Principal Consultant)
T +27 11 361 1392
M +27 82 786 7819
Email: Ashlea.Strong@wsp.com

Prepared by: Eco-Pulse Environmental Consulting Services
1 Mallory Road, Hilton, 3245, South Africa
Mr. Adam Teixeira-Leite *Pr.Sci.Nat. (Senior Wetland/Terrestrial Ecologist)*
Tel: 031 2666 700
Mobile: 082 310 6769
E-mail: ateixeira@eco-pulse.co.za

Suggested report citation:

Eco-Pulse Consulting. 2018. Proposed Wild Coast SEZ, Eastern Cape. ***Terrestrial Ecological Assessment Report***. Unpublished report prepared by Eco-Pulse Environmental Consulting Services for WSP. Report No. EP341-03. Version 0.1 (DRAFT). 12th July 2018

SPECIALIST ASSESSMENT REPORT DETAILS AND DECLARATION OF INDEPENDENCE

This is to certify that the following specialist vegetation assessment report has been prepared has been prepared independently of any influence or prejudice as may be specified by the Department of Environmental Affairs (DEA).

Document Title:	***Terrestrial Ecological Habitat Impact Assessment Report*** for the proposed Wild Coast Special Economic Zone (SEZ)
Report Number:	EP341-02
Version Number:	0.1 (DRAFT)
Date:	12th July 2018
Report prepared by:	**Mr Brian Mafela** (BSc. Hons. Forest Resources & Wildlife Management) Candidate Natural Scientist (*Cand. Sci. Nat.*) (Ecological Science) SACNASP Registration Number: 100214/15
	Mr Adam Teixeira-Leite (BSc. Hons. Environmental Science) Professional Natural Scientist (*Pr. Sci. Nat.*) (Ecological Science) SACNASP Registration Number: 400332/13
Sign-off:	 **Mr Adam Teixeira-Leite** *Pr.Sci.Nat.*
Client:	WSP (on behalf of Coega Development Corporation [CDC])

I, **Adam Teixeira-Leite**, hereby declare that this report has been prepared independently of any influence or prejudice as may be specified by the Department of Environmental Affairs (DEA).

Signed: _____ Date: 12th July 2018

DETAILS OF PROJECT TEAM

The relevant experience of specialist team members from Eco-Pulse Consulting involved in the assessment and compilation of this report are briefly summarized below. *Curriculum Vitae's* of the specialist team are available on request.

Specialist	Role	Details
Adam Teixeira-Leite *Pr.Sci.Nat*. Senior Scientist	Project leader, Co-Author and Internal reviewer	Adam is a Senior Environmental Scientist at Eco-Pulse with a BSc. Honours degree in *Environmental Science: Earth Sciences*. He is a registered Professional Natural Scientist (Pr. Sci. Nat.) in the 'Ecological Sciences' field of practice with SACNASP, with over 10 years' experience, having worked extensively on numerous specialist ecological assessment projects, both for wetland/aquatic and terrestrial (grasslands and forests) habitats and ecosystems in KZN, the Free State, Gauteng, Eastern Cape, Western Cape and Lesotho. He is also experienced in undertaking alien plant surveys and developing ecological rehabilitation and management plans and programmes.
Brian Mafela *Cand.Sci.Nat*. Environmental Scientist	Fieldwork & Lead author	Brian Mafela is an Environmental Scientist at Eco-Pulse with a BSc. Honours degree in Forest Resources and Wildlife Management. Brian is a registered Candidate Natural Scientist (*Cand. Sci. Nat*.) with over 6 years' experience in undertaking EIA processes, wetland and riparian assessments, vegetation assessments, identifying and evaluating impacts of developments on the environment and providing Best Management Practice (BMP) mitigation measures.

Eco-Pulse would like to acknowledge and thank **Mr. David Styles** (Specialist Botanist) who was consulted for specialist input as part of the botanical field assessment. David is a recognised botanist in South Africa who has worked extensively along the east coast of South Africa (KZN and Eastern Cape) and is very experienced with identifying plant species. David Styles accompanied Brian Mafela during the field work to identify the plant species encountered and provide a short description of the identified vegetation communities and plant species.

EXECUTIVE SUMMARY

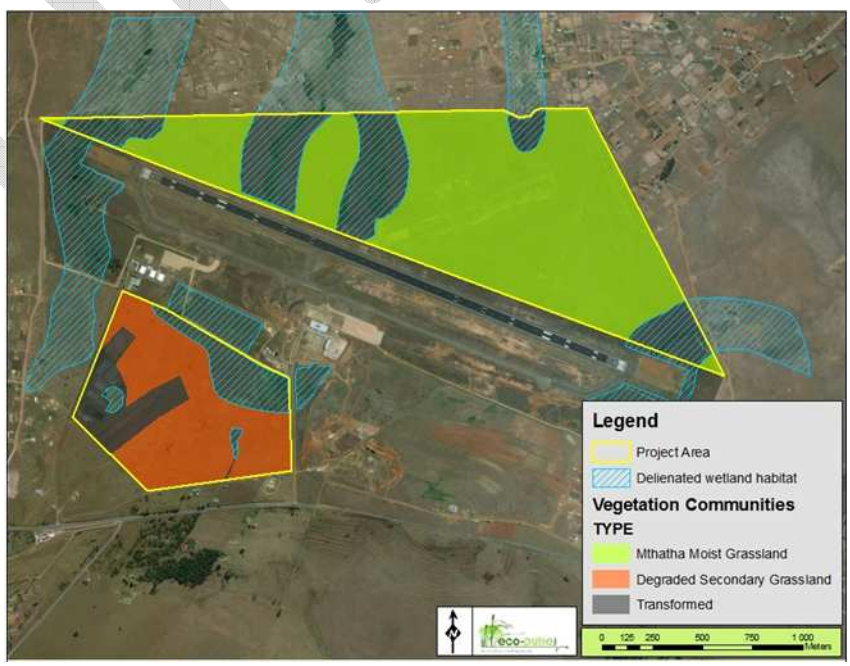
The Coega Development Corporation (CDC) intends to develop Phase 1 of the Wild Coast Special Economic Zone (ECSEZ), located immediately adjacent to the existing Mthatha Airport north-west of Mthatha town in the Eastern Cape Province of South Africa. The intended development will be for agricultural land use and a 'mixed-use' type development comprising: hotel & conferencing, commercial space, industrial land use and intensive agriculture & business process outsourcing.

In order to inform the Environmental Impact Assessment (EIA) for the planned development, a **terrestrial ecological baseline and habitat/biodiversity impact assessment** was undertaken by Eco-Pulse Consulting to satisfy the requirements of the Department of Environmental Affairs (DEA) and the National Environmental Management Act No. 107 (and NEMA EIA regulations) of 1998

This report sets out the findings of the Specialist Terrestrial Ecological Impact Assessment undertaken between March and July 2018. The main findings of this report have been summarized below as follows:

Baseline Assessment:

1. Two terrestrial vegetation communities were identified for the site and surrounding area (shown mapped below), including:
   a. **Slightly Modified Primary Mthatha Moist Grassland**: considered to be predominantly intact and of 'moderately-high' EIS (ecological importance/sensitivity) and found exclusively on the northern property and accounting for roughly 141 hectares (ha) of the property;
   b. **Degraded Secondary Grassland**: considered to be in a degraded/seriously modified condition and of 'Low' EIS and found exclusively on the southern property and accounting for roughly 45 hectares (ha) of the property.



2. Protected plants occurring on the site appeared to be restricted to the southern property where two individuals of the species *Gladiolus ecklonii* were identified in the field.

3. A desktop faunal Potential Occurrence Assessment (POA) was undertaken for the study area and habitat for species was ground-truthed in the field in March 2018. The findings of the fauna POC assessment indicate:

   a. The lack of species-specific habitat for most of the mammals, reptiles and amphibians greatly reduces the likelihood of their occurrence at the site.
   b. The likelihood of occurrence of many of these species is further reduced by their proximity to human activities. Larger mammal species have either been eradicated or have moved away from the area due to high levels of human and domesticated livestock disturbance associated with human occupation in the area as well as increased grazing pressure.
   c. Small mammal species are also extremely vulnerable to human impacts, poaching as well as dogs and feral cats. It is therefore quite unlikely that the development site itself constitutes significant habitat for any species of threatened mammal species as well as for mammal species in general.
   d. Various endemic species of reptiles could potentially utilise the site, but are unlikely to persist in great numbers. All reptile species are sensitive to major habitat alteration and fragmentation. As a result of human presence in the area coupled with livestock grazing disturbances, alterations to the original reptilian fauna are expected to have already occurred.
   e. Amphibian species of conservation concern are unlikely to be present at the site or within the surrounding wetland/aquatic habitats due to the lack of sutable habtiat provided for key species.
   f. Grassland habitat lost is unlikely to support populations of nesting/breeding bird species of conservation importance. A pair of **Grey-Crowned Crane** (VU) was observed by the ecologists from Eco-Pulse in 2012 within the moist grassland adjacent to the wetlands on the site in the northern section of the project area and probably exploit the site as the area is fenced and less vulnerable to predators.

Recommended Management Objectives & Recommendations:

4. According to the Eastern Cape Biodiversity Conservation Plan (ECBCP) (Hayes *et al*., 2007; Berliner & Desmet, 2007) the development site has been identified as a ***Terrestrial Critical Biodiversity Area (CBA) level 1 2 (T2)***, which captures sections of near-natural landscape and the (potential) presence of representative 'Endangered' vegetation types (i.e. Primary Mthatha Moist Grassland occurring on the northern property) identified through the systematic conservation assessment. For terrestrial CBA areas, the desired state should be to '***maintain biodiversity in near-natural state with minimal loss of ecosystem integrity and no transformation of natural habitat should be permitted'.***

Ecological Impacts & Mitigation:

5. The most significant ecological impact likely to be associated with the proposed development pertains to the **potential permanent transformation and loss of a substantial amount of primary Mthatha Moist Grassland vegetation and habitat (~141 ha**) occurring on the northern property where agricultural development is proposed. Further transformation of this 'endangered' vegetation type may compromise the ability to meet conservation targets set for this vegetation type at the National and Provincial level and the impact is considered to be of **'high' significance.**

6. Whilst initial measures aimed at the avoidance of impacts in accordance with the 'mitigation hierarchy' come highly recommended (as per Chapter 6 of this report), where avoidance of impacts leading to the transformation of the primary grassland vegetation and habitat at the site of the proposed agricultural development on the northern property will not be practically possible, impacts associated with the transformation of the grassland vegetation and habitat should warrant the need for a suitable **'Biodiversity Offset'** as a means of compensating for the irreplaceable loss of primary Mthatha Moist Grassland. *Biodiversity Offsets as a means of impact mitigation are covered under **Chapter 7** of this report*.

7. Based on the desktop POC assessment for fauna (wildlife) undertaken, the probability of the site being important for hosting Red data listed/threatened populations or even individuals is considered to be relatively low. **Overall, the development is expected to have a low impact on faunal species of conservation concern.**

Biodiversity Offset Requirements:

8. In the context of the study area and proposed development, should the current development plan be authorised by the relevant environmental authorities based on the development motivation, this will result in the permanent loss of an estimated **141 ha of 'endangered' primary Mthatha Moist Grassland vegetation** and habitat which initially would be considered to be of **'high' impact significance** and should warrant the consideration of a biodiversity offset as a means of compensating for the permanent loss of grassland vegetation and habitat (i.e. residual impacts).

   The need and desirability of biodiversity offsets will still need to be confirmed by the regulating authority. The extent of the area to target for an offset (based on losses, threat status of the vegetation type and ecosystem conservation ratios/multipliers), together with the mechanisms and cost implications for doing so, will also need to be investigated once confirmation for the need for an offset has been obtained from the regulating authorities.

   An appropriate **Biodiversity Offset Plan** would need to be developed under this scenario if approved by the relevant environmental authorities (the development of such a plan is beyond the scope of work of this appointment). The offset plan would need to confirm

offset targets for residual grassland vegetation and habitat losses, identify suitable offset receiving areas and outline the process for the establishment, governance and management of the offset in collaboration with the assessing environmental and conservation authorities at the national and provincial levels of Government.

Other Requirements:

9. Provincially protected plants occurring on the site appear to be restricted to the southern property where two individuals of the species *Gladiolus ecklonii* were identified in the field. Prior to commencement of construction activities, a qualified botanist should be appointed to visit the site during the flowering season / growing season to identify and count any other protected plants that may occur within the grasslands and wetland on the site (these may have been dormant / not flowering during the site assessment conducted by Eco-Pulse in March 2018). A protected plant rescue and translocation plan must be compiled and permit applications for the translocation of protected plants must be submitted to the Department of Economic Development, Tourism and Environmental Affairs. This is in accordance with the Transkei Environmental Conservation Decree (No. 9 of 1992) is applicable since Mthatha used to fall within the historic Transkei Sate. Once permits have been obtained, all protected plants must be translocated to a temporary facility (nursery) for holding until later use in landscaping at the site.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF TERMS

Conservation	The safeguarding of biodiversity and its processes (often referred to as Biodiversity Conservation).
Ecosystem	An ecosystem is essentially a working natural system, maintained by internal ecological processes, relationships and interactions between the biotic (plants & animals) and the non-living or abiotic environment (e.g. soil, atmosphere). Ecosystems can operate at different scales, from very small (e.g. a small wetland pan) to large landscapes (e.g. an entire water catchment area).
Ecosystem Goods and Services	The goods and benefits people obtain from natural ecosystems. Various different types of ecosystems provide a range of ecosystem goods and services. Aquatic ecosystems such as rivers and wetlands provide goods such as forage for livestock grazing or sedges for craft production and services such as pollutant trapping and flood attenuation. They also provide habitat for a range of aquatic biota.
Erosion (gully)	Erosion is the process by which soil and rock are removed from the Earth's surface by natural processes such as wind or water flow, and then transported and deposited in other locations. While erosion is a natural process, human activities have dramatically increased the rate at which erosion is occurring globally. Erosion gullies are erosive channels formed by the action of concentrated surface runoff.
Function/functioning/ functional	Used here to describe natural systems working or operating in a healthy way, opposed to dysfunctional, which means working poorly or in an unhealthy way.
Habitat	The general features of an area inhabited by animal or plant which are essential to its survival (i.e. the natural "home" of a plant or animal species).
Indigenous	Naturally occurring or "native" to a broad area, such as South Africa in this context.
Invasive alien species	Invasive alien species means any non-indigenous plant or animal species whose establishment and spread outside of its natural range threatens natural ecosystems, habitats or other species or has the potential to threaten ecosystems, habitats or other species.
Mitigate/Mitigation	Mitigating impacts refers to reactive practical actions that minimize or reduce in situ impacts. Examples of mitigation include "changes to the scale, design, location, siting, process, sequencing, phasing, and management and/or monitoring of the proposed activity, as well as restoration or rehabilitation of sites". Mitigation actions can take place anywhere, as long as their effect is to reduce the effect on the site where change in ecological character is likely, or the values of the site are affected by those changes (Ramsar Convention, 2012).
Risk	A prediction of the likelihood and impact of an outcome; usually referring to the likelihood of a variation from the intended outcome.
Threat Status	Threat status (of a species or community type) is a simple but highly integrated indicator of vulnerability. It contains information about past loss (of numbers and / or habitat), the number and intensity of threats, and current prospects as indicated by recent population growth or decline. Any one of these metrics could be used to measure vulnerability. One much used example of a threat status classification system is the IUCN Red List of Threatened Species (BBOP, 2009).
Threatened ecosystem	In the context of this document, refers to Critically Endangered, Endangered and Vulnerable ecosystems.
Transformation (habitat loss)	Refers to the destruction and clearing an area of its indigenous vegetation, resulting in loss of natural habitat. In many instances, this can and has led to the partial or complete breakdown of natural ecological processes.

LIST OF ABBREVIATIONS/ACRONYMS

CBA	Critical Biodiversity Area
CR	Critically Endangered (threat status)
DEA	Department of Environmental Affairs (formerly DEAT)
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment: EIA regulations promulgated under section 24(5) of NEMA
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GPS	Global Positioning System
IAPs	Invasive Alien Plants
NEMA	National Environmental Management Act No.107 of 1998
SANBI	South African National Biodiversity Institute
VU	Vulnerable (threat status)

1 INTRODUCTION

1.1 Project Locality and Description

The Coega Development Corporation (CDC) intends to develop the Wild Coast Special Economic Zone (SEZ), located immediately adjacent to the existing Mthatha Airport north-west of Mthatha town (Figure 1) in the Eastern Cape Province of South Africa. Given the economic development potential and agricultural focused advantages the region offers, and using input received during the stakeholder's consultation, developmental priorities were identified for phase 1 of the development.

Figure 1 Google Earth™ map showing the location of proposed Wild Coast SEZ at Mthatha Airport within the King Sabata Dalindyebo Local Municipality, Eastern Cape.

Based on available information received, the CDC is seeking Environmental Authorisation (EA) for Phase 1 of a broader concept, namely the industrial-commercial type development within the Mthatha Airport precinct. The two properties to be developed are shown outlined in 'yellow' in Figure 2:

- The **Phase 1: 'North'** property is 183 ha in extent and is located on the farm to the immediate north of the existing Mthatha Airport runway. *The intended development will be for agricultural land use on the majority (164ha) of this property.*
- The **Phase 1: 'South'** property is 72 ha in extent and is located on the farm to the immediate south of the existing Mthatha Airport building. *The intended development will be for a 'mixed-use' type development comprising: hotel & conferencing, commercial space, industrial land use and intensive agriculture & business process outsourcing.*

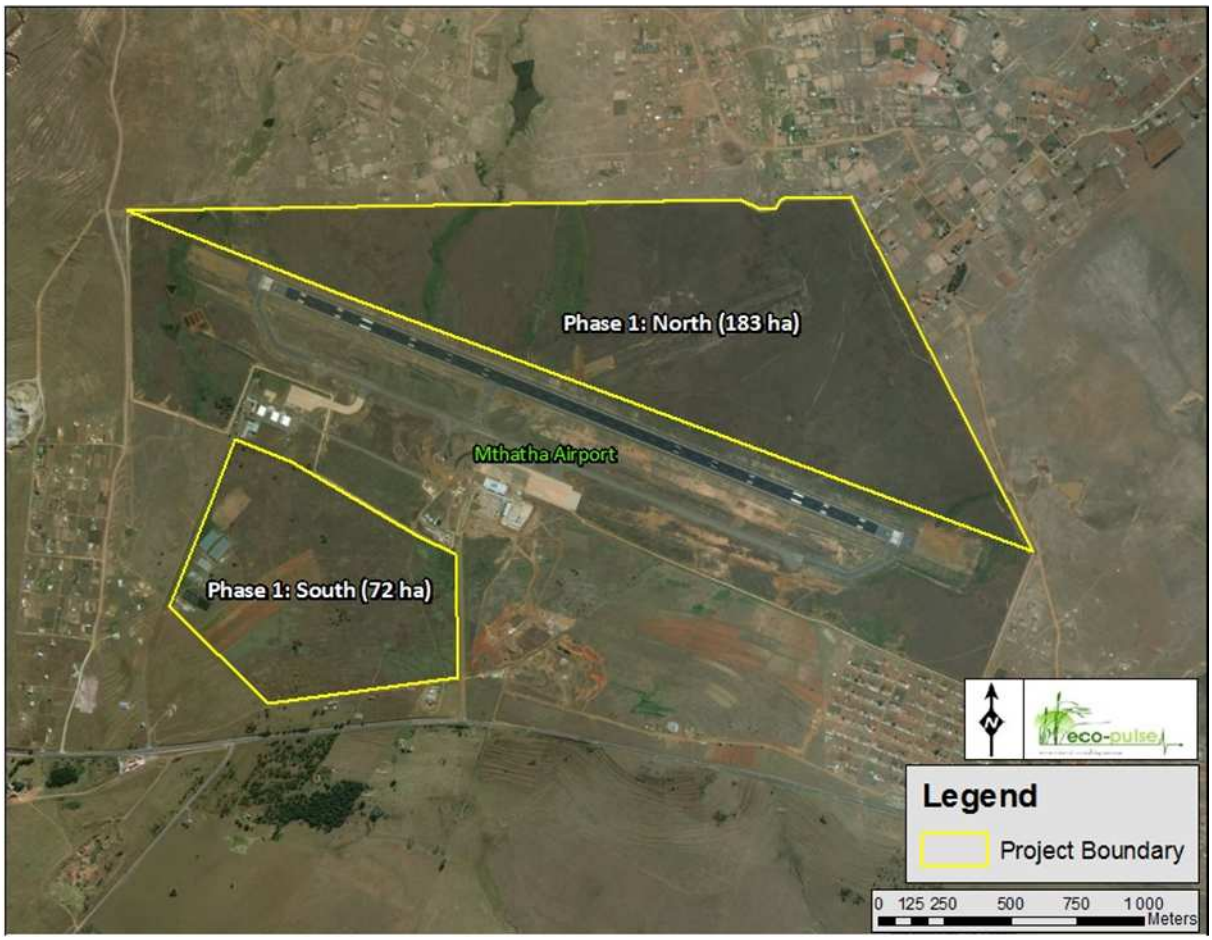


Figure 2 Map showing the northern and southern land portions associated with the Phase 1 development.

1.2 Scope of Work

The terrestrial ecological assessment was undertaken in accordance with the following scope of works:

1. Desktop level mapping of untransformed terrestrial habitat and vegetation.
2. Review of any documented and available studies/information for the site and surrounding areas.
3. Contextualization of the study area in terms of important biophysical characteristics and conservation planning using available spatial datasets and conservation plans including:
    i. National Vegetation Types (Mucina & Rutherford, 2006);
    ii. Available faunal species records/atlases for the study area;
    iii. Plants of Southern Africa (POSA) database records for the study area (SANBI); and
    iv. Eastern Cape Biodiversity Conservation Plan (Hayes et al., 2007).
4. Desktop assessment of the floral and faunal species of conservation concern that may occur within the development footprint based on available species records for the region (e.g. POSA database, SABAP2, Red Data Lists, etc.).
5. Undertaking a site walkover and field survey of the development zone to record necessary information required to assess vegetation condition and the ecological importance and

sensitivity (EIS) of mapped untransformed grassland communities as well as habitat suitability for key species such as Crowned Cranes:

i. Field survey of vegetation and habitat along transects across the untransformed terrestrial (grassland) habitat types within the study area (included species identification and status, relative abundance of different species, identification of pioneer and alien plant species and description of habitat and vegetation type and ecological condition rating).
ii. Identification and mapping of the geographic location of any terrestrial species of conservation concern (rare/protected plants) noted during the site assessment.
iii. Basic day-time survey to further validate the potential occurrence of fauna of conservation concern potentially occurring in the area (where possible) using visual observations of species as well as evidence of their occurrence on the site (e.g. burrows, nests, excavations, animal tracks, etc.).

6. Undertaking an assessment of the condition of the vegetation communities based on key variables including species composition, vegetation structure and the presence of ruderal, pioneer and invasive alien species.
7. Undertaking an assessment of the ecological importance and sensitivity of vegetation types based on key criteria such as threat status, presence of red data species or suitability to support key species of conservation significance, habitat condition, etc.
8. Identification and mapping of the geographic location of all plant/animal species of conservation concern (i.e. threatened or protected plants/trees) recorded during the site survey.
9. Compilation of plant species lists for the delineated vegetation communities.
10. Provision of an ecological sensitivity map for the site, including the location of sensitive habitat/vegetation types, protected plants and wildlife and any recommended terrestrial biodiversity buffer zones (development set-backs) with motivation to be provided.
11. Undertaking the identification, description and impact significance assessment for all potential construction and operational phase impacts of the development on terrestrial biodiversity.
12. Provision of planning and design mitigation / recommendations to avoid and/or minimise direct and indirect impacts where possible, including suitable biodiversity conservation buffer zones.
13. Provision of construction and operational phase mitigation measures to remediate potential impacts linked with the proposed development.
14. Discussion of any biodiversity offset requirements (where deemed relevant or desirable for the project).
15. Discussion of any permit/licensing requirements that may be relevant to the site (i.e. protected plant species permits).
16. Describe any assumptions, uncertainties or gaps in knowledge, as well as identifying the need for any future specialist inputs should these be deemed relevant to the project.

1.3 The Importance of Biodiversity and Conservation

The term 'biodiversity' is used to describe the wide variety of plant and animal species occurring in their natural environment or 'habitat'. Biodiversity encompasses not only all living things, but also the series of interactions that sustain them, which are termed 'ecological processes'. South Africa ranks as the third most biologically diverse country in the world, based on an index of species diversity and endemism, and is one of twelve (12) "mega-diverse" countries which collectively contain more than two-thirds of global biodiversity (Endangered Wildlife Trust and DEA *et al.,* 2013). South Africa's biodiversity is considered important for the following reasons:

- It provides an important basis for economic growth and development;
- Keeping our biodiversity intact is vital for ensuring the on-going provision of ecosystem services that are if benefit to society, including the provision of clean air, water, food, medicine and fibre;
- The role of biodiversity in combating climate change is also well recognised and further emphasises the key role that biodiversity management plays on a global scale (Driver *et al.,* 2012);
- It plays an important role in addressing South Africa's priorities of sustainable rural communities, service delivery and job creation; and
- Biodiversity forms the foundation of ecological infrastructure (ecosystems or habitats which deliver the ecosystem services that underpin economic and social development and are increasingly recognised as having market value).

We need to be mindful of the fact that without the integrity of our natural systems, there will be no sustained long-term economic growth or life (DEA *et al.,* 2013). Pressures and threats to biodiversity are increasing globally and the continuous decline in biodiversity loss may have damaging consequences in terms of local opportunity cost such as the production of clean water, carbon storage to counteract global warming, etc. The loss of biodiversity puts aspects of the economy, wellbeing and quality of life at risk, and reduces long-term socio-economic options for future generations. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, with the most important being the National Environmental Management: Biodiversity Act No. 10 of 2004 (NEM: BA). In terms of NEM: BA, sustainable development requires the consideration of all relevant factors including disturbance of ecosystems and loss of biodiversity, both of which should be avoided or, if that is not possible, should be minimized and remedied. Given the limited resources available for biodiversity management and conservation in South Africa, as well as the need for development, efforts to manage and conserve biodiversity need to be strategic, focused and support the notion of sustainable development.

1.4 Overview of Relevant Environmental Legislation

The link between ecological integrity of ecosystems and their continued provision of valuable ecosystem goods and services to burgeoning populations is well-recognised, both globally and nationally (Rivers-Moore *et al.,* 2007). A strong legislative framework which backs up South Africa's obligations to numerous international conservation agreements creates the necessary enabling legal

framework for the protection of the countries natural resources and ecosystems. Relevant environmental legislation pertaining to the protection and use of terrestrial ecosystems in South Africa has been included below:

South African Constitution 108 of 1996	This includes the right to have the environment protected through legislative or other means.
National Environmental Management Act 107 of 1998	This is a fundamentally important piece of legislation and effectively promotes sustainable development and entrenches principles such as the 'precautionary approach', 'polluter pays', and requires responsibility for impacts to be taken throughout the life cycle of a project.
Environmental Impact Assessment (EIA) Regulations	New regulations have been promulgated in terms of Chapter 5 of NEMA and were published on 4 December 2014 in Government Notice No. R. 32828. In addition, listing notices (GN 983-985) lists activities which are subject to an environmental assessment.
National Environmental Management: Biodiversity Act No. 10 of 2004	The intention of this Act is to protect species and ecosystems and promote the sustainable use of indigenous biological resources. It addresses aspects such as protection of threatened ecosystems and imposes a duty of care relating to listed invasive alien plants.
Conservation of Agricultural Resources Act 43 of 1967	The intention of this Act is to control the over-utilization of South Africa's natural agricultural resources, and to promote the conservation of soil and water resources and natural vegetation.

Other pieces of legislation that may also be of some relevance include:

- The National Forests Act No. 84 of 1998;
- The Natural Heritage Resources Act No. 25 of 1999;
- The National Environmental Management: Protected Areas Act No. 57 of 2003;
- Minerals and Petroleum Resources Development Act No. 28 of 2002;
- National Forests Act No. 84 of 1998 (NFA);
- Decree No. 9 (Environmental Conservation) of 1992.

2 APPROACH & METHODS

2.1 Approach to the Assessment

The proposed WCSEZ development constitutes Listed Activities which appear in Listing Notice 2 of the NEMA EIA Regulations (2014, as amended) and therefore is subject to a Scoping and Full EIA process. Eco-Pulse Environmental Consulting Services (referred to hereafter as "Eco-Pulse") was appointed by WSP to undertake the required Specialist Terrestrial Ecological Assessments to inform the Scoping and Full EIA process for the project. The assessment was subdivided into two distinct phases as follows:

- **Phase1: Scoping**. The scoping phase of the assessment entailed desktop investigations and the compilation of a scoping report which was prepared in January 2018. The intention of the scoping process was to identify key ecological issues to focus on during the EIA Phase of the project as well as establish Terms of Reference (plan of study) for the EIA Phase assessments. The ecological scoping report highlighted the presence and extent of key sensitive terrestrial ecosystems and sensitive vegetation/habitat/species. Furthermore it also highlighted significant impacts anticipated to key ecosystems.
- **Phase 2: Detailed EIA Phase**. This phase entailed undertaking a detailed Terrestrial Ecological Baseline and Impact Assessment with detailed impact mitigation and management, in order to comply with the minimum requirements of Appendix 6 of the NEMA: EIA Regulations (2014).

2.2 Methods

2.2.1 Field Survey

The field survey was undertaken over a 3-day period between 6 – 8 March 2018 (summer season). Mr David Styles, an experienced botanist, was present to assist with the identification of cryptic/rare plants and compile a brief vegetation description of the identified vegetation communities. The survey entailed a site walkover of key sections of the study area. Sampling was focused within the development property. The following information was collected in the field:

- Identification and recording of plant species to inform vegetation community species composition. Where plant species could not be identified, samples and photographs were taken to confirm at a later stage using available taxonomic keys and species identification guides.
- Qualitative species abundance.
- Location of any plant species of conservation concern.
- Observable onsite impacts.
- Distinct vegetation boundaries.
- Vegetation structure.
- Faunal habitat and visible signs of fauna (burrows, nests etc.)

Please note that sampling involved visual /qualitative assessments and no formal vegetation plots were undertaken. Furthermore, no formal faunal sampling or searches were undertaken and faunal features such as dens, spoor[1] and skat[2] were recorded where identified but were not specifically sought out. All sampling points were recorded using a handheld GPS device.

2.2.2 Species of Conservation Concern: Potential of Occurrence (POC) Assessment

Species of conservation concern refer to species of flora (plants) and fauna (animals) that have a high level of conservation importance in terms of preserving South Africa's high biological diversity and include threatened species that have been classified as 'at high risk of extinction in the wild'. If a subpopulation of a species of conservation concern is found to occur on a proposed development site, it would be one indicator that development activities could result in significant loss of biodiversity, bearing in mind that loss of subpopulations of these species will either increase their extinction risk or may in fact contribute to their extinction (see Figure 3). A description of the different SANBI categories of species of conservation concern is provided in Table 1, below.

Table 1. South African Red List Categories for species of conservation significance (after SANBI, on-line at http://redlist.sanbi.org/eiaguidelines.php).

INCREASING RISK OF EXTINCTION

Status	Category	Description
SPECIES OF CONSERVATION CONCERN	**Critically Endangered, Possibly Extinct (CR PE)**	Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered
	Critically Endangered (CR)	A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
	Endangered (EN)	A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
	Vulnerable (VU)	A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
	Near Threatened (NT)	A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable, and is therefore likely to become at risk of extinction in the near future.
	Critically Rare	A species is Critically Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
	Rare	A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria.
	Declining	A species is Declining when it does not meet or nearly meet any of the five IUCN criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline of the species.
	Data Deficient - Insufficient Information (DDD)	A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required and that future research could show that a threatened classification is appropriate.

[1] *Spoor is a track of an animal e.g. print made by hooves.*

[2] *Skat is animal droppings.*

Status	Category	Description
OTHER	**Data Deficient - Taxonomically Problematic (DDT)**	A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
	Least Concern (LC)	A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.
	Not Evaluated (NE)	A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status. However, some species included in Plants of southern Africa: an online checklist are species that do not qualify for national listing because they are naturalized exotics, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

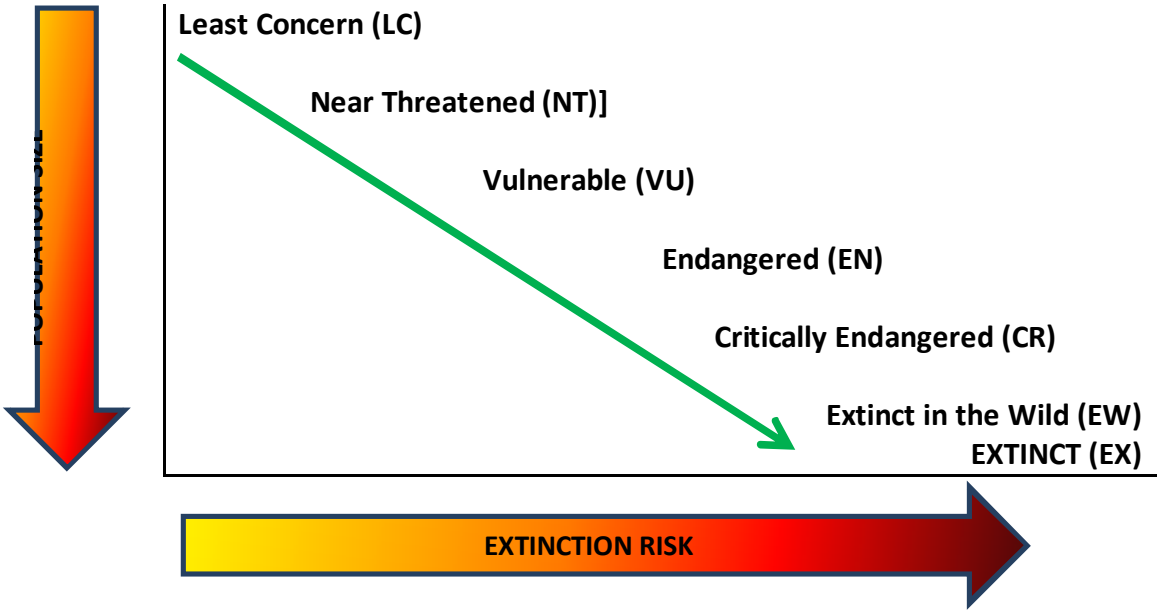


Figure 3 Graph showing the relationship between population size and extinction risk, distinguishing between the various species threat statuses (after SANBI, 2010).

A number of existing species databases, publications and field guides were used to assess the **Potential Occurrence (POC)** of Red Data (Threatened/Protected) flora and fauna species for the study area and development site, with following parameters were then used to assess the probability of occurrence:

1. **Species range**: Species often have specific geographical/altitudinal ranges in which they occur or are restricted to and the location of the project area in relation to these distributional ranges was evaluated based on available information.
2. **Habitat requirements**: Most Red Data animals have very specific habitat requirements/preferences and the presence/absence of these habitat characteristics in the study area was evaluated.

3. **Habitat status:** Often a high level of habitat degradation in a specific habitat will negate the presence of Red Species which are typically sensitive to disturbance; hence the status or ecological condition/suitability of available habitat in the area was assessed.
4. **Habitat connectivity**: Movement between areas for breeding and feeding forms an essential part of the life-cycle and persistence of many species. Isolated/patchy habitats are generally not well-suited for harboring threatened species; however, this is not always the case. Connectivity of the study area to surrounding habitat and the adequacy of these linkages were evaluated.

The habitat requirements/preferences for each plant/animal t species of conservation concern was thus reviewed (based on available literature) and was compared with the habitat occurring at the site (initially based on imagery which was then verified through site visits) in order to estimate the likelihood of these species occurring on the target property (as per the assessment matrix in Table 2, below).

Table 2. Generic matrix used for the estimation and rating of flora/fauna species potential occurrence based on known habitat requirements/preferences and ranges.

		SPECIES HABITAT REQUIREMENTS/PREFERENCES			
		Fully met	**Largely met**	**Partially met**	**Not met**
		Natural condition	**Fair condition**	**Poor-Fair condition**	**Poor condition/ Transformed**
SPECIES DISTRIBUTION/RANGE	**Habitat occurs within known species geographic/altitudinal range**	Highly probable	Possible	Unlikely	Highly unlikely or Improbable
	Habitat occurs on the edge of known species geographic/altitudinal range	Possible	Possible	Unlikely	Highly unlikely or Improbable
	Habitat occurs outside of known species geographic/altitudinal range	Unlikely	Unlikely	Highly unlikely or Improbable	Highly unlikely or Improbable

2.2.3 Assessment of Vegetation Community Ecological Condition

Vegetation communities / habitat units defined for the study area were assessed qualitatively in terms of their ecological condition. Ecological condition is defined as a measure of modification relative to a reference state in terms of species structure and composition. Table 3 below was used for providing a description and indicators of each ecological condition class.

Table 3. Description and indicators of Ecological Condition Classes.

Condition Class	Description	Indicators
Largely Intact	Unmodified, largely natural.	• High native flora composition (80 – 100%). • Structural characteristics resemble that of reference plant communities. • Low to no disturbances. • Low to no weed and / or IAP infestation.
Slightly Modified / Transitional	Habitats where natural disturbance regimes have changed resulting in a change to structural characteristics (e.g.	• Substantial increase in woody cover relative to reference communities. • High structural change.

Condition Class	Description	Indicators
	wooded grassland to a woodland community).	• Generally low to no disturbances. • Generally low to no weed and IAP infestation.
Moderately Modified	A moderate change in species composition and vegetation structure has occurred in response to anthropogenic impacts.	• Moderate native flora composition (50 – 80%). • Moderate change in structural characteristics (e.g. moderate increase / decrease in woody plants) resemble that of reference plant communities. • Moderate disturbances. • Moderate weed and / or IAP infestation.
Largely Modified / Degraded	A large to serious change in species composition and vegetation structure has occurred in response to anthropogenic impacts.	• Low native flora composition (0 – 50%). • Major change in structural characteristics relative to reference plant communities. • High disturbance. • Moderate to high weed and / or IAP infestation.
Seriously Modified / Secondary	A vegetation community that replaces original vegetation after severe disturbance (such as cultivation or clearing) or severe cumulative impacts such as overgrazing or over-burning over a long period of time.	• Vegetation comprised of few species, with one or a few dominant. • Moderate to high abundance of weeds and IAPs. • Contour ridges or other evidence of soil disturbance evident.
Transformed	Non-vegetated areas owing to past and present human activities. A few indigenous species may be present.	• Present cultivated lands (crops, forestry, etc.). • Developed land (Houses, Roads, etc.)

2.2.4 Assessment of Ecological Importance and Sensitivity (EIS)

Ecological Importance (EI) of a habitat type refers to the ability of the ecological entity to: (i) meet conservation targets for conservation important flora and faunal species i.e. biodiversity maintenance value; and (ii) provide for the maintenance of biodiversity features. The importance of each vegetation community was therefore based on (i) whether it is representative of threatened habitat (condition), (ii) whether it provides habitat for species of conservation concern, (iii) rarity, diversity and uniqueness of flora and habitat and (iv) its importance in terms of conservation planning.

Ecological Sensitivity (ES) refers to both the intensity and likelihood of change in key aspects as a result of changes to key ecosystem drivers. The more sensitive a habitat or ecosystem, the more likely and more intense the changes with a change in drivers. High sensitivity systems are those often characterised by with high diversity, specifically sensitive species (intolerant species), small patch size and/or low area to perimeter ratio and/or are located in areas sensitive to change e.g. located on highly erodible soils or steep slopes. In terms of species, sensitive species are those with narrow tolerance ranges and that cannot withstand elevated levels of disturbance. Low sensitivity systems are often those characterised by low diversity, high levels of modification and can withstand elevated disturbance regimes. Low sensitivity species are typically generalist and opportunistic species that have wide tolerances ranges.

Table 4. Generic matrix used for the estimation of habitat sensitivity and importance based on the joint consideration of habitat condition and threat status of the vegetation type.

		HABITAT/VEGETATION IMPORTANCE & SENSITIVITY				
		Natural	Good	Fair	Poor	Very Poor/ Transformed
VEGETATION THREAT STATUS	CRITICALLY ENDANGERED	High	High	High	Moderate	Low
	Endangered	High	High	Moderate	Moderate	Low
	Vulnerable	High	High	Moderate	Low	Low
	Near Threatened	Moderate	Moderate	Moderate	Low	Low
	Least Threatened	Moderate	Moderate	Low	Low	Very Low

Table 5. Descriptions of the EIS ratings used for terrestrial habitat.

EIS Rating	Description
High	Vegetation community with features are considered ecologically important and sensitive on a national or even international level.
Moderately-High	Vegetation community with features are considered to be ecologically important and sensitive at a regional scale.
Moderate	Vegetation community with features are considered to be ecologically important and sensitive at a local scale.
Moderately-Low	Vegetation community with features are regarded as somewhat ecologically important and sensitive at a local scale.
Low	Vegetation community with features that have a very low ecological importance and sensitivity at any scale.

2.2.5 Assessment of Ecological Impacts

Impact significance is defined broadly as a measure of the 'desirability, importance and acceptability of an impact to society' (Lawrence, 2007). The degree of significance depends upon two dimensions: the measurable characteristics of the impact (e.g. intensity, extent, duration) and the importance societies/communities place on the impact. Put another way, impact significance is the product of the value or importance of the resources, systems and/or components that will be impacted and the intensity or magnitude (degree and extent of change) of the impact on those resources, systems and/or components.

The significance of each impact was assessed in terms of the ultimate consequences (impacts to resources of known societal value). The three ultimate consequences considered were:

i. **Impacts to ecosystem conservation**: Ecosystem conservation targets are determined at national, provincial or local scales for known reference ecosystem and vegetation types, and for the purposes of this assessment, not meeting or hindering the meeting of conservation targets represents a significant societal impact. For this reason, impacts to ecosystem conservation is seen as an important ultimate consequence that contextualises the significance of impacts.

i. **Impacts to direct benefits to humans:** Impacts on direct benefits to humans relates primarily to a loss of grazing, and access to harvestable goods such as medicinal plants and fuelwood from previously accessible areas. The indirect effects of these impacts could negatively influence the health and/ or livelihoods of beneficiaries.

ii. **Impacts to species of conservation concern**: Like ecosystem conservation targets, such targets are also determined for biota. Impacts on populations of threatened biota is thus an important ultimate consequence that contextualises the significance of impacts.

Figure 4 below shows how all four impacts were interpreted in terms of three possible ultimate consequences.

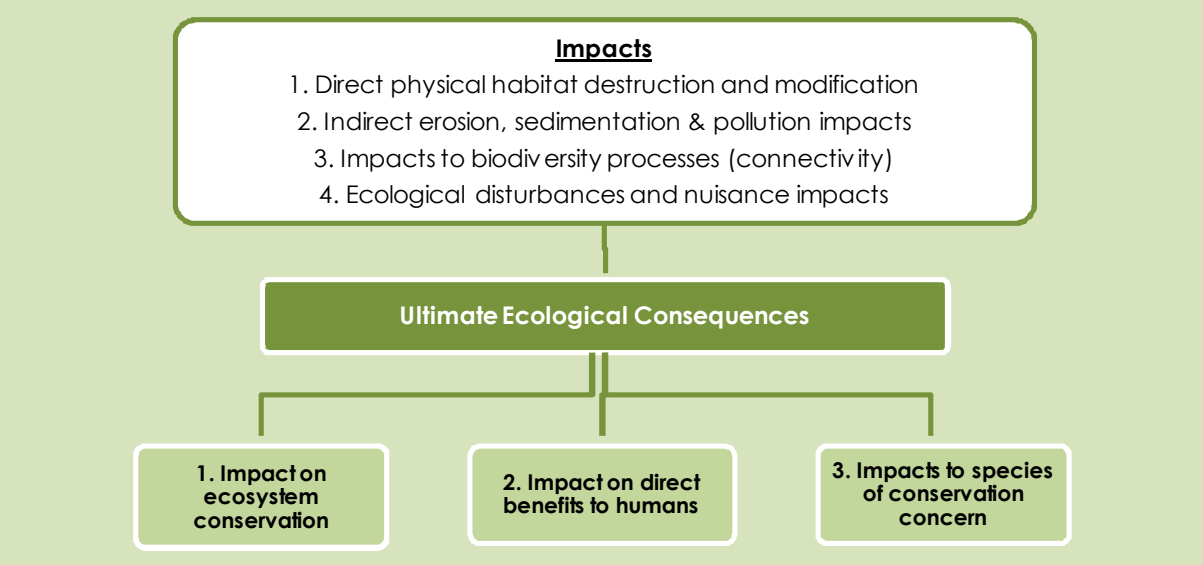


Figure 4 Conceptual diagram showing the approach to unpacking ecological impact significance.

The significance of the potential impacts of the proposed development on terrestrial habitat was assessed for the following scenarios:

i. **Realistic "poor mitigation" scenario** – this is a realistic worst case scenario involving the poor implementation of construction mitigation, bare minimum incorporation of recommended design mitigation, poor operational maintenance, and poor onsite rehabilitation.

ii. **Realistic "good" scenario** – this is a realistic best case scenario involving the effective implementation of construction mitigation, incorporation of the majority of design mitigation, good operational maintenance and successful rehabilitation. Please note that this realistic scenario does not assume that unrealistic mitigation measures will be implemented and/or measures known to have poor implementation success (>90% of the time) will be effectively implemented.

For the purposes of this assessment, the assessment of potential impacts was undertaken using an "Impact Assessment Methodology for EIAs" adopted by Eco-Pulse (2015). This assessment was informed by baseline information contained in this report relating to the sensitivity of habitats and potential occurrence of protected species as well as information on the proposed development provided by the client and experience in similar projects in South Africa. The approach adopted is to identify and predict all potential primary and secondary/indirect impacts resulting from an activity from origin (e.g.

catchment land hardening) to end point (e.g. loss of ecosystem services as a result of erosion). Thereafter, the approach is to rate intensity as the realistic worst case consequence (end-point / ultimate) of an activity (according to Table 6) and then assess the likelihood of this consequence occurring as well as the extent and duration of the impact.

Impact significance = (impact intensity + impact extent + impact duration) x impact likelihood.

This formula is based on the basic risk formula: **Risk = consequence x probability**

Table 6. Criteria and numerical values for rating environmental impacts.

Score	Rating	Description
Intensity (I) – defines the magnitude and importance of the impact		
16	**High**	Loss of human life. Deterioration in human health. High impacts to resources: · Critical / severe local scale (or larger) ecosystem modification/degradation and/or collapse. · Critical / severe local scale (or larger) modification (reduction in level) of ecosystem services and/or loss of ecosystem services. <u>Critical / severe ecosystem impact description:</u> Impact affects the continued viability of the systems/components and the quality, use, integrity and functionality of the systems/components permanently ceases and are irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation. · Extinction of habitat type or serious impact to future viability of a critically endangered habitat type. · Extinction of species or serious impact to survival of critically endangered species.
8	**Moderately-High**	· Loss of livelihoods. · Individual economic loss. Moderately-high impacts to resources: · Large local scale (or larger) ecosystem modification/degradation and/or collapse. · Large local scale (or larger) modification (reduction in level) of ecosystem services and/or loss of ecosystem services. <u>Large ecosystem impact description:</u> Impact affects the continued viability of the systems/components and the quality, use, integrity and functionality of the systems/components are severely impaired and may temporarily cease. High costs of rehabilitation and remediation, but possible. · Measurable reduction in extent of endangered and critically endangered habitat types. · Measurable reduction in endangered and critically endangered floral and faunal populations.

Score	Rating	Description
4	**Moderate**	Moderate impacts to resources: · Moderate local scale (or larger) ecosystem modification/degradation and/or collapse. · Moderate local scale (or larger) modification (reduction in level) of ecosystem services and/or loss of ecosystem services. <u>Moderate ecosystem impact description:</u> Impact alters the quality, use and integrity of the systems/components but the systems/ components still continue to function but in a moderately modified way (integrity and functionality impaired but major key processes/drivers somewhat intact / maintained). · Measurable reduction in vulnerable habitat types. · Measurable reduction in non-threatened habitat types resulting in an up-listing to threatened status. · Measurable reduction in near-threatened and vulnerable floral and faunal populations. · Measurable reduction in non-threatened floral and faunal populations resulting in an up-listing to threatened status.
2	**Moderately-Low**	Moderately-low impacts to resources: · Small but measurable local scale (or larger) ecosystem modification / degradation. · Small but measurable local scale (or larger) modification (reduction in level) of ecosystem services and/or loss of ecosystem services. <u>Small ecosystem impact description:</u> Impact alters the quality, use and integrity of the systems/components but the systems/ components still continue to function, although in a slightly modified way. Integrity, function and major key processes/drivers are slightly altered but are still intact / maintained. · Reduction in non-threatened endangered habitat types with no up-listing to threatened status. · Reduction in non-threatened floral and faunal populations with no up-listing to threatened status.
1	**Low**	Negative change to onsite characteristics but with no impact on: · Human life · Human health · Local resources, local ecosystem services and/or key ecosystem controlling variables · Threatened habitat conservation/representation · Threatened species survival
Extent (E) – relates to the extent of the Impact Intensity		
5	**Global**	The scale/extent of the impact is global/worldwide.
4	**National**	The scale/extent of the impact is applicable to the Republic of South Africa
3	**Regional**	Impact footprint includes the greater surrounding area within which the site is located (e.g. between 20-200km radius of the site).
2	**Local**	Impact footprint extends beyond the cadastral boundary of the site to include the areas adjacent and immediately surrounding the site (e.g. between a 0-20km radius of the site).
1	**Site**	Impact footprint remains within the cadastral boundary of the site.
Duration (D) – relates to the duration of the Impact Intensity		
5	**Permanent**	The impact will continue indefinitely and is irreversible.
4	**Long-term**	The impact and its effects will continue for a period in excess of 30 years. However, the impact is reversible with relevant and applicable mitigation and management actions.
3	**Medium-term**	The impact and its effects will last for 10-30 years. The impact is reversible with relevant and applicable mitigation and management actions.
2	**Medium-short**	The impact and its effects will continue or last for the period of a relatively long construction period and/or a limited recovery time after this construction period, thereafter it will be entirely negated (3 – 10 years). The impact is fully reversible.
1	**Short-term**	The impact and its effects will only last for as long as the construction period and will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 3 years). The impact is fully reversible.
Probability (P) – relates to the likelihood of the Impact Intensity		

Score	Rating	Description
1	**Definite**	More than 75% chance of occurrence. The impact is known to occur regularly under similar conditions and settings.
0.75	**Highly Probable**	The impact has a 41-75% chance of occurring and thus is likely to occur. The impact is known to occur sporadically in similar conditions and settings.
0.5	**Possible**	The impact has a 10-40% chance of occurring. This impact may/could occur and is known to occur in low frequencies under the similar conditions and settings.
0.2	**Unlikely**	The possibility of the impact occurring is low with less than 10% chance of occurring. The impact has not been known to occur under similar conditions and settings.
0.1	**Improbable**	The possibility of the impact occurring is negligible and only under exceptional circumstances.

Table 7. Impact significance categories and definitions.

Impact Significance	Impact Significance Score Range	Definition
High	**18 - 26**	Unacceptable and fatally flawed. Impact should be avoided and limited opportunity for offset/compensatory mitigation. The proposed activity should only be approved under special circumstances.
Moderately High	**13 – 17.9**	Generally unacceptable unless offset/compensated for by positive gains in other aspects of the environment that are of critically high importance (i.e. national or international importance only). Strict conditions and high levels of compliance and enforcement are required. The potential impact will affect a decision regarding the proposed activity require that the need and desirability for the project be clearly substantiated to justify the associated ecological risks.
Moderate	**8 – 12.9**	Impact has potential to be significant but is acceptable provided that there are strict conditions and high levels of compliance and enforcement. If there is reasonable doubt as to the successful implementation of the strict mitigation measures, the impact should be considered unacceptable. The potential impact should influence the decision regarding the proposed activity and requires a clear and substantiated need and desirability for the project to justify the risks.
Moderately Low	**5 – 7.9**	Acceptable with moderately-low to moderate risks provided that specific/generic mitigation applied and routine inspections undertaken. The potential impact may not have any meaningful influence on the decision regarding the proposed activity.
Low	**0 – 4.9**	The potential impact is very small or insignificant and should not have any meaningful influence on the decision regarding the proposed activity. Basic duty of care must be ensured.

A confidence rating was also given to the impacts rated in accordance with the table below:

Table 8. Confidence ratings used when assigning impact significance ratings.

Level of confidence	Contributing factors affecting confidence
Low	A low confidence level is attributed to a low-moderate level of available project information and somewhat limited data and/or understanding of the receiving environment.
Medium	The confidence level is medium, being based on specialist understanding and previous experience of the likelihood of impacts in the context of the development project with a relatively large amount of available project information and data related to the receiving environment.
High	The confidence level is high, being based on quantifiable information gathered in the field.

2.3 Assumptions, Limitations and Gaps in the Information Presented

The following limitations and assumptions apply to this assessment:

- This report deals exclusively with a defined area and the extent of terrestrial habitat/ecosystems in that area.
- The terrestrial ecological study focused on 'terrestrial' or dryland vegetation occurring within the study area. *Wetland/aquatic vegetation and habitats have not been included in this assessment and are dealt with separately in the Specialist Wetland Assessment Report (Eco-Pulse, 2018, Report No. EP341-02)*
- Information used to inform the assessment was limited to desktop data and GIS coverage's available for the province and district municipality at the time of the assessment.
- Sampling by its nature means that generally not all aspects of ecosystems can be assessed and identified.
- With ecology being dynamic and complex, there is the likelihood that some aspects (some of which may be important) may have been overlooked.
- A rapid site walkover assessment was used instead of formal vegetation plots and detailed vegetation/habitat sampling and analyses methods. Therefore comments on species abundance and dominance are based on the assessor's opinion based on field observations.
- Field assessment was undertaken in the summer/growing season (March 2018) and therefore winter flowering cryptic forbs may have been over-looked. The assessment therefore does not cover the full seasonal variation in conditions in the area of study.
- The location of individual specimens of protected plant species were recorded hand held GPS with an accuracy of 3 – 5m.
- Information on the threat status of plants species was informed largely by the SANBI Threatened Species Online database, which was assumed to be up to date and accurate at the time of compiling this report. Any changes made after the compilation of the report are therefore not covered.
- No detailed survey of fauna was conducted during this assessment. Any fauna documented in this report are based on site observations during a limited time spent in the field and do not reflect the overall faunal composition of the site. It is assumed that based on the nature of the project, that faunal impacts are likely to be limited.
- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological concerns arising from the vegetation field surveys and based on the assessor's working knowledge and experience with similar development projects.

3 DESKTOP ECOLOGICAL ANALYSIS

3.1 Regional & Local Biophysical Setting

A summary of key biophysical setting details of the study area and surrounds are presented in Table 9 below.

Table 9. Key biophysical setting details of the study area.

Biophysical Aspects	Desktop Biophysical Details	Source
Elevation a.m.s.l.	>700m (amsl)	Google Earth™
Mean annual precipitation (MAP)	679.1mm/annum	(Shulze, 1997)
Rainfall seasonality	Late-summer	(DWAF, 2007)
Mean annual temperature	16-20°C in July to 24-28°C in February	(DWAF, 2007)
Potential Evaporation (mm) Mean Annual A-pan Equivalent	1674.7 mm/annum	(Shulze, 1997)
Geology	Sedimentary units of the Tarkastad Subgroup (Beaufort Group): comprising red and greenish-grey mudstone and fine to medium grained sandstone	National Geology dataset

3.2 Conservation Context

Understanding the conservation context and importance of the study area and surrounds is important to inform decision-making regarding the management of terrestrial ecosystems, habitats and associated biodiversity in the area. In this regard, national, provincial and regional conservation planning information available was used to obtain an overview of the study site. Key conservation context details of the project site and surrounds have been summarised in Table 10, below.

Table 10. Key conservation context summary details for the study area.

NATIONAL LEVEL CONSERVATION PLANNING CONTEXT			
Conservation Planning Dataset	**Relevant Conservation Feature**	**Location in Relation to Project Site**	**Conservation Planning Status**
National Vegetation Types (Mucina & Rutherford, 2006)	Eastern Valley Bushveld (SVs6)	Untransformed vegetation within the portion north of Umthatha Airport	Least threatened, Nominally protected
Ecosystem Threat Status NBA 2011	Mthatha Moist Grassland (Gs 14)	Untransformed vegetation within the portion north and south of Umthatha Airport	**Endangered**
PROVINCIAL AND REGIONAL LEVEL CONSERVATION PLANNING CONTEXT			
Conservation Planning Dataset	**Relevant Conservation Feature**	**Location in Relation to Project Site**	**Conservation Planning Status**
EC Terrestrial Conservation Plan (Berliner and Desmet, 2007)	Untransformed/Intact terrestrial grassland	Site and surrounds	**Critical Biodiversity Area 1 (CBA 1) and CBA 2**

3.2.1 National Threatened Ecosystems & Vegetation Types

A national process has been undertaken to identify and list threatened ecosystems that are currently under threat of being transformed by other land uses. The first national list of threatened terrestrial ecosystems for South Africa was gazetted on 9 December 2011 (National Environmental Management: Biodiversity Act or NEMBA: National list of ecosystems that are threatened and in need of protection, December 2011). The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems (SANBI, 2011). The NEMBA provides for listing of threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. There are four main types of implications of listing ecosystems:

- Planning related implications which are linked to the requirement in the Biodiversity Act (Act 10 of 2004) for listed ecosystems to be taken into account in municipal IDPs and SDFs;
- Environmental authorisation implications in terms of NEMA and the EIA regulations;
- Proactive management implications in terms of the National Biodiversity Act; and
- Monitoring and reporting implications in terms of the Biodiversity Act.

According to the Threatened Ecosystem coverage for the country which was interrogated, the project area and planned development site is located within the **Eastern Valley Bushveld - SVs 6 (Least Threatened)** and **Mthatha Moist Grassland Gs 14 (Endangered)** (see Figure 5, below). The former vegetation type is characterised by semi-deciduous savanna woodland-thicket mosaic, often succulent and dominated by species of *Euphorbia* and *Aloe*; and the latter is characterised by a species-poor, sour, wiry grassland with *Eragrostis plana* and *Sporobolus africanus* but when in good condition is dominated by *Themeda triandra*.

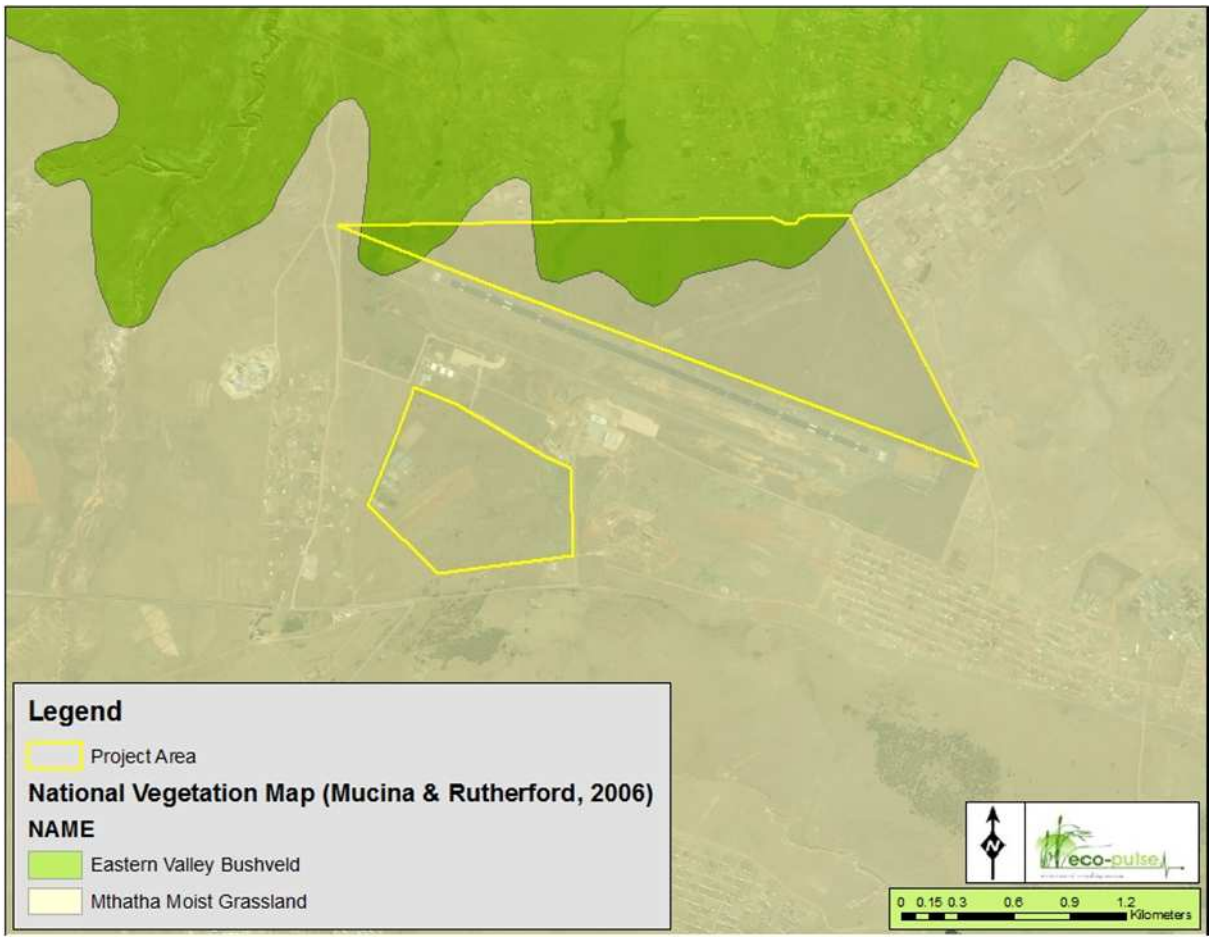


Figure 5 National vegetation map (Mucina & Rutherford, 2006) showing the project area and two (2) national vegetation types identified: Eastern Valley Bushveld (LT) and Mthatha Moist Grassland (EN).

3.2.2 Eastern Cape Biodiversity Conservation Plan (ECBCP)

The Eastern Cape Biodiversity Conservation Plan (ECBCP) (Hayes *et al*., 2007; Berliner & Desmet, 2007) addresses the urgent need for integrative systematic conservation planning and capacity building for land-use decision making in the Eastern Cape. The ECBCP is a systematic conservation plan that identifies and spatially maps Critical Biodiversity Areas (CBAs) required for biodiversity persistence and to inform protected area planning and rural land-use planning in the Province. For successful implementation of the ECBCP, the CBAs need to be incorporated at all levels of spatial development planning.

The ECBCP maps the site as a ***Terrestrial Critical Biodiversity Area (CBA) level 1* 2 (T2)** (Figure 6), which captures sections of near-natural landscape and the (potential) presence of representative 'Endangered' vegetation types (i.e. Mthatha Moist Grassland) identified through the systematic conservation assessment. The central portion of the northern project area has been mapped as a ***CBA at level 1*** and has further been identified as a potentially important **ecological corridor** for the movement of biota.

Associated land-use guidelines for CBA areas are in the form of Biodiversity Land Management Classes (BLMCs) which set out the desired ecological state that an area should be kept in to ensure biodiversity persistence. For terrestrial CBA areas, the desired state should be to '***maintain biodiversity in near-natural state with minimal loss of ecosystem integrity and no transformation of natural habitat should be permitted'.***

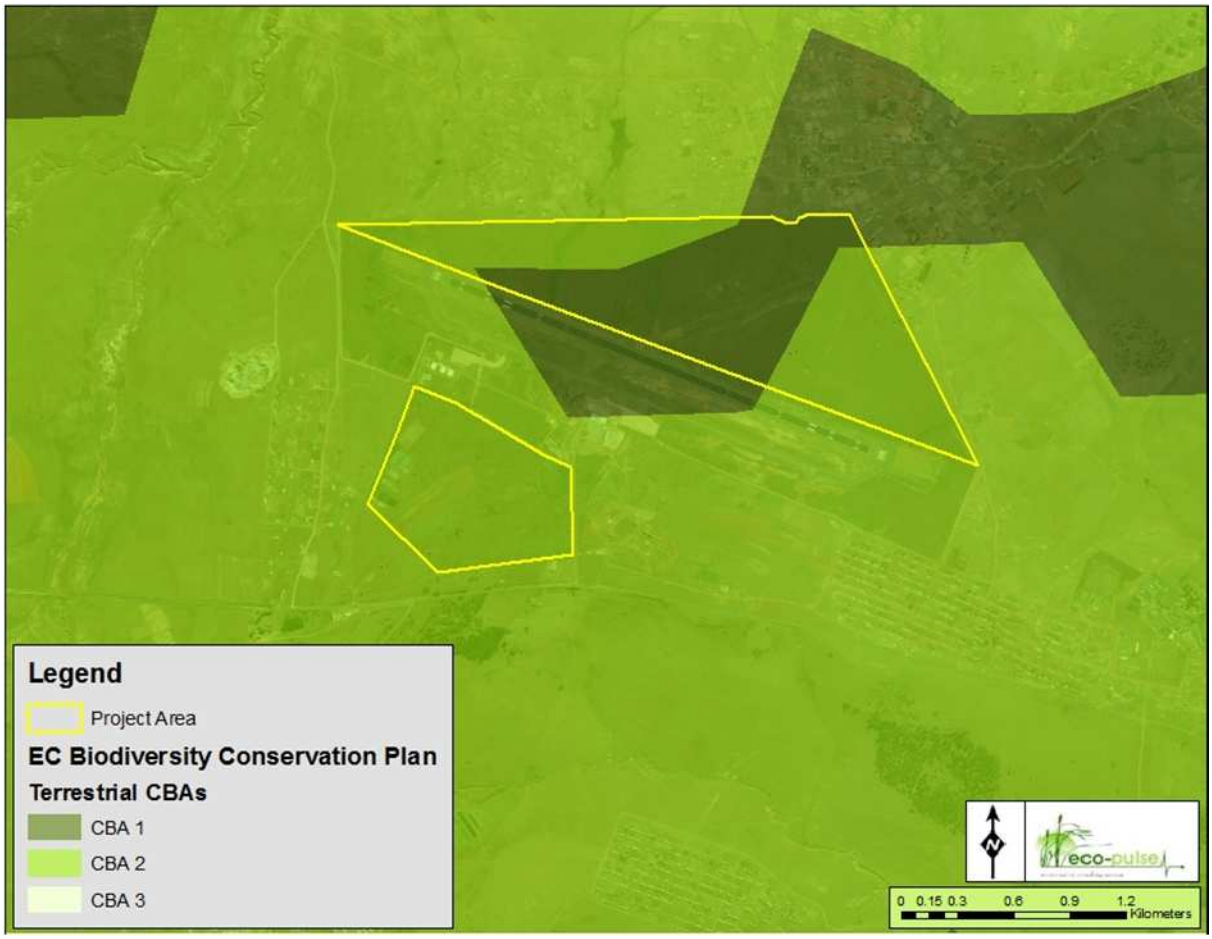


Figure 6 Map showing the location and extent of Terrestrial CBAs in relation to the proposed WCSEZ development identified according to the Eastern Cape Biodiversity Conservation Plan (Berliner & Desmet, 2007).

The ECBCP also identifies the portion of land to the north of the project area (surrounding Mthatha Dam) as a Provincial Protected Area: **Nduli Luchaba Nature Reserve** (see extent and location shown in Figure 6, below). This is an approximately 460ha provincial nature reserve which hosts a variety of wildlife, with a series of wetlands and grasslands that support rare and threatened cycads and a wide selection of birds including the rare 'Stanley's Bustard' (Vulnerable threat status) and many wetland birds (online source: http://www.mthathadam.co.za). There are no planned expansion areas for national protected areas mapped in the area around Mthatha in terms of the latest National Protected Areas Expansion Strategy (NPAES) spatial coverage (Figure 7).

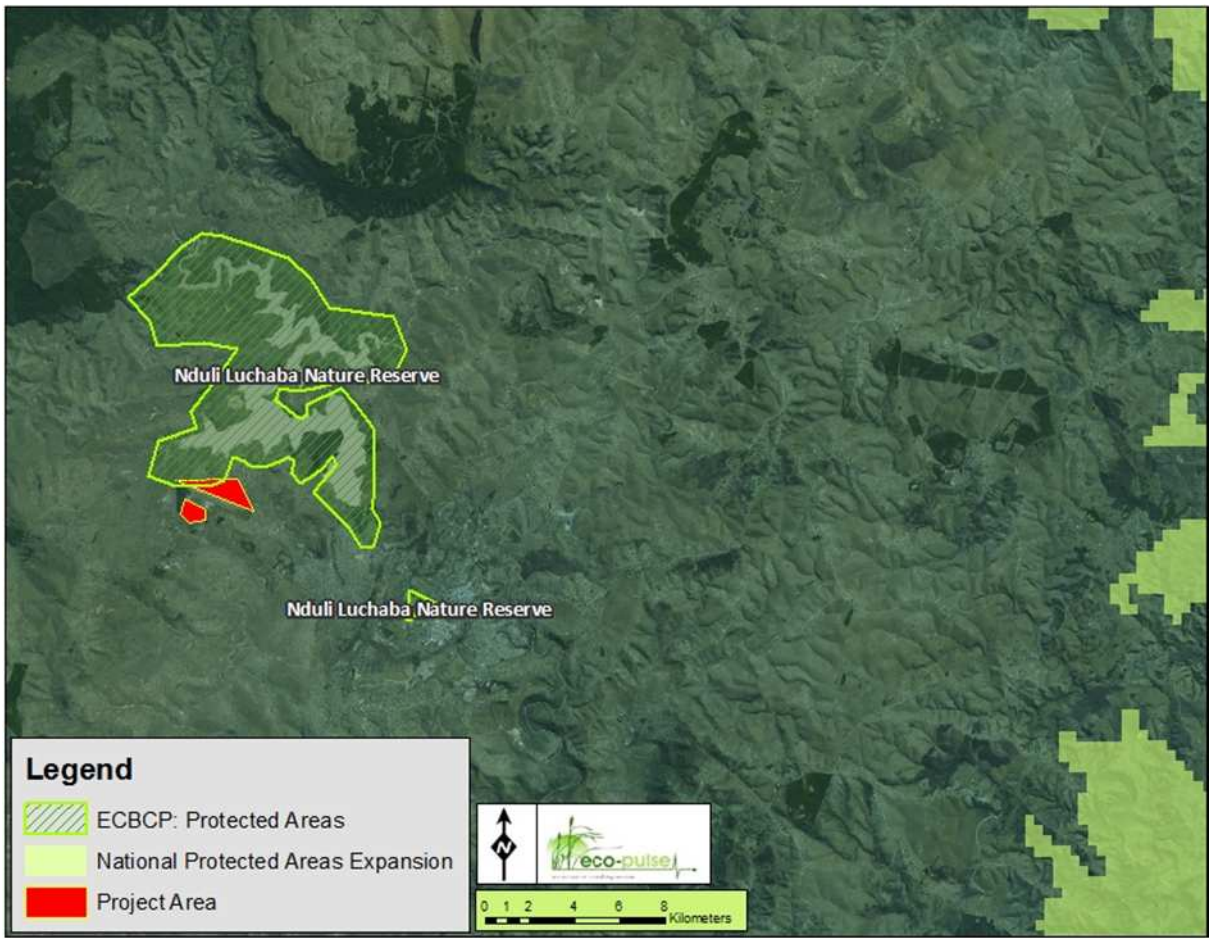


Figure 7 Map showing the location and extent of the 'Nduli Luchaba Nature Reserve' (Provincial Protected Area) in relation to the project area at Umthatha Airport (Source: Eastern Cape Biodiversity Conservation Plan - Berliner & Desmet, 2007).

3.2.3 Important Bird Areas (IBAs)

The Important Bird Areas (IBA) Programme is one of Bird Life International's most important conservation initiatives. The South African IBA Programme is coordinated by BirdLife South Africa, with the purpose being the identification and protection of a network of conservation sites, at a bio geographical scale, critical for the long-term viability of naturally-occurring bird populations. Important Bird Areas (Cape Vulture Colonies) have been identified within 50km of the project area (Figure 8) and are unlikely to be of significance to this project.

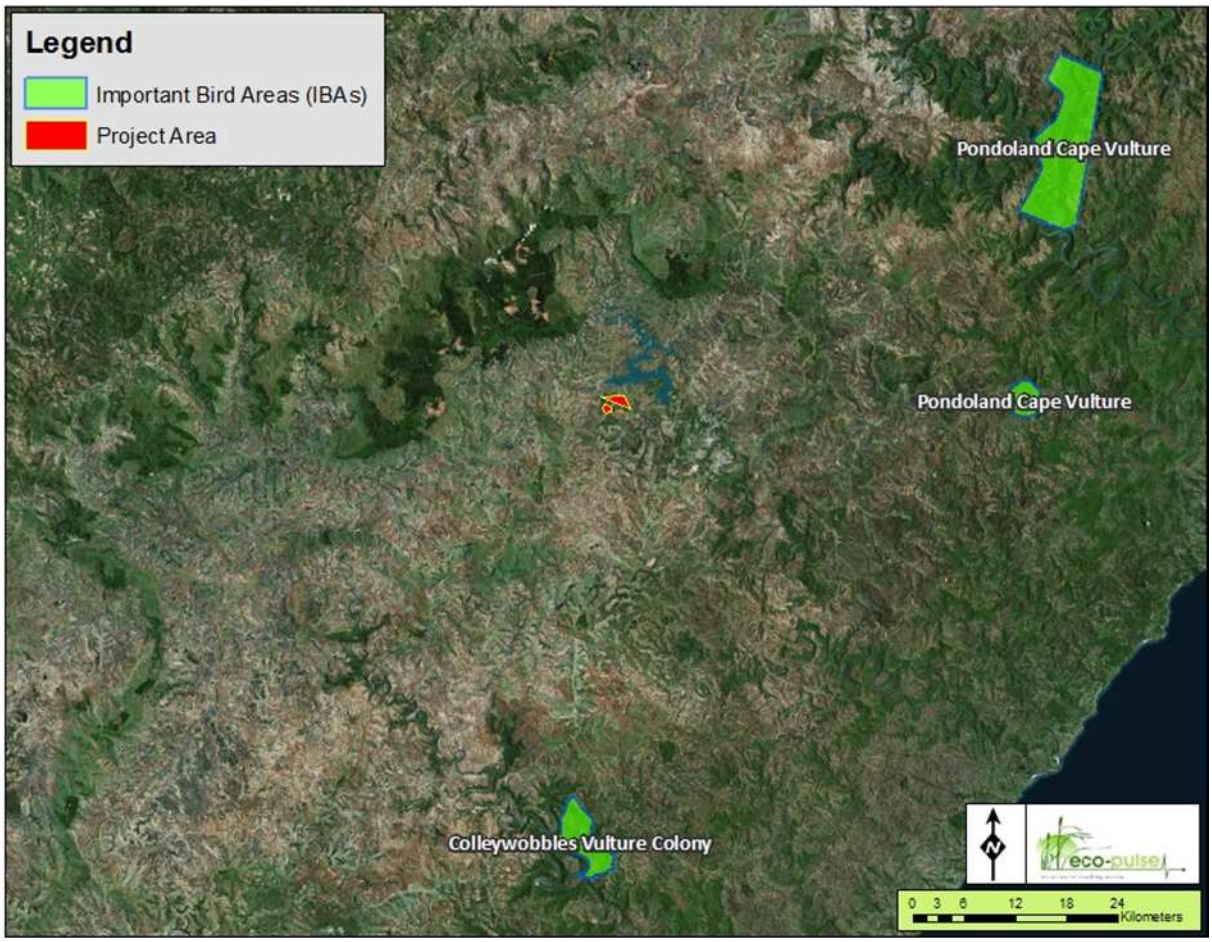


Figure 8 Map showing the location of Important Bird Areas (IBAs) in relation to the project area at Umthatha Airport (source: BirdLife South Africa).

3.2.4 Species of Conservation Concern: Potential Occurrence (POC)

Species of conservation concern refer to species of flora (plants) and fauna (animals) that have a high level of conservation importance in terms of preserving South Africa's high biological diversity and include threatened species that have been classified as 'at high risk of extinction in the wild'.

3.2.4.1 Flora POC

Interrogation of SANBI's online threatened species database for the quarter degree grid square 3128DA highlighted four (4) species for consideration (refer to Table 11, below). Of the species highlighted, only two (2) were identified as being 'possible' to potentially occur within remaining untransformed/intact grassland habitat in the project study area. ***The field survey did not identify any of these species occurring within the grassland habitat on the properties assessed.***

Table 11. Flora of conservation significance potentially occurring in the project area according to SANBI's POSA online database for the quarter degree 3128DA.

Species Name	Threat Status	Description	Major Ecosystem	Habitat Preferences	Potential Occurrence (POC)

Species Name	Threat	Description	Major	Habitat Preferences	Potential
Brachystelma caffrum[3]	**VU**	Perennial. Geophyte, succulent	Terrestrial	Moist grassland with a preference for dolerite outcrops. Altitudinal range: 300-1600m.	Possible
Impatiens flanaganiae[4]	**VU**	Perennial. Herb	Terrestrial	Scarp forest near waterfalls and seepage areas. Altitudinal range: 10-150m.	Highly Unlikely
Dioscorea brownii[5]	**EN**	Perennial. Geophyte, herb, succulent	Terrestrial	Tall mistbelt and moist montane grassland, on high ground along forest margins, in rich, red, dolerite soils. Altitudinal range: 650-1450m.	Unlikely
Crinum macowanii[6]	**DECL**	Perennial. Geophyte	Terrestrial	Mountain grassland and stony slopes in hard dry shale, gravely soil or sandy flats. Altitudinal range: 200-1650m.	Possible

Key to Species Threat Status: **EN** – Endangered **VU** – Vulnerable **DECL** – Declining

3.2.4.2 Fauna POC

Fauna of conservation significance for the study area were highlighted by investigating at a desktop level:

(i) Biodiversity features and known faunal species for the Eastern Cape region highlighted in the Eastern Cape Conservation Plan (Berliner & Desmet, 2007);
(ii) Species records found in the South African Bird Atlas Project (SABAP) database for the Region;
(iii) Available species records (ADU, 2013); and
(iv) Professional experience regarding rare/threatened amphibian species, reptiles and small mammals and their habitat requirements in eastern South Africa (KZN and EC).

A. Mammals

The potential occurrence of mammal species of conservation significance (i.e. Red data/Endangered species) was assessed based on available distribution records and habitat requirements for these species, with the outputs of the desktop POC survey summarised in Table 12. The lack of species-specific habitat for most of the mammals listed in Table 12 greatly reduces the likelihood of their occurrence at the site. The likelihood of occurrence of many of these species is further reduced by their proximity to human activities. Larger mammal species have either been eradicated or have moved away from the area due to high levels of human disturbance associated with human occupation in the area as well as development and cultivation pressures, not to mention the impact of the perimeter fence around the property in terms of restricting species movement onto the property.

[3] Dold, A.P. & Victor, J.E. 2007. Brachystelma caffrum (Schltr.) N.E.Br. National Assessment: Red List of South African Plants version 2017.1. Accessed on 2018/01/18.

[4] von Staden, L., Victor, J.E. & Cloete, E. 2006. Impatiens flanaganiae Hemsl. National Assessment: Red List of South African Plants version 2017.1. Accessed on 2018/01/18

[5] Abbott, A.T.D., Johnson, I.M., Grieve, G. & von Staden, L. 2016. Dioscorea brownii Schinz. National Assessment: Red List of South African Plants version 2017.1. Accessed on 2018/01/18

[6] Williams, V.L., Raimondo, D., Crouch, N.R., Cunningham, A.B., Scott-Shaw, C.R., Lötter, M., Ngwenya, A.M. & Brueton, V.J. 2016. Crinum macowanii Baker. National Assessment: Red List of South African Plants version 2017.1. Accessed on 2018/01/18

Small mammal species are also extremely vulnerable to human impacts, poaching as well as dogs and feral cats. It is therefore quite unlikely that the development site itself constitutes significant habitat for any species of threatened mammal species as well as for mammal species in general. The dominant small mammal species occurring within adjacent intact habitats are also likely to be limited to those with one or more of the following traits:

- Have generally small range requirements and broad habitat requirements;
- Tolerance for human disturbance;
- Characterised by high reproductive and survival rates; and
- The ability to move easily between remaining untransformed vegetation patches.

Table 12. Potential occurrence of mammal species within the study area.

Species Name	IUCN Status	Habitat Requirements/ Preferences (after Stuart & Stuart, 2007)	Distribution/ Range	Habitat requirements met at site?	Site within distribution/ range?	POC
Reddish-grey Musk Shrew *Crodidura cyanea*	**DD**	Moist habitats but also found in very dry terrestrial habitats. Show a preference for dense, matted vegetation.	Widespread in RSA	Possible	√	Possible
Aardwolf *Proteles cristatus*	**Rare**	Preference for open habitats and avoids heavily wooded areas and forest.	Widespread in RSA	Possible	√	Unlikely due to human presence and perimeter boundary fences
African striped weasel *Poecilogale albinucha*	**DD**	Moist grasslands with flourishing populations of small rodents (their main food source). Soil texture may be important as weasels often excavate their own burrows.	Eastern RSA	Possible	√	
Brown hyaena *Parahyaena brunnea*	**Rare**	Potentially wide distributional tolerance (historically).	Northern southern Africa	Possible	√	
Leopard *Panthera pardus*	**Rare**	Extremely wide distributional tolerance (historically).	Northern RSA, NE Eastern Cape, Western Cape	*X*	√	Highly Unlikely
Blue duiker *Cephalophus monticola*	**Rare**	Confined to forests and dense bush.	Western coastal RSA	*X*	√	Highly Unlikely
Honey badger *Mellivora capensis*	**VU**	Most major habitats.	Widespread in RSA	Possible	√	Unlikely due to human presence
African Wild cat *Felis silvestris lybica*	**VU**	Open, dry habitats.	Widespread in RSA	Possible	√	Unlikely due to human presence and perimeter boundary

Species Name	IUCN Status	Habitat Requirements/ Preferences (after Stuart & Stuart, 2007)	Distribution/ Range	Habitat requirements met at site?	Site within distribution/ range?	POC
						fences
Oribi *Ourebia ourebi*	**VU**	Open short grassland with taller patches for cover.	Southern KZN, NE Eastern Cape	Possible	*X*	Highly Unlikely
Cape clawless otter *Aonyx capensis*	**NT**	Unpolluted, un-silted streams (though species is not adversely affected by turbid waters) and rivers with good supply of food (crabs) and dense riverine vegetation (long grass, reeds, bushes) and other cover (holes, boulders).). Areas with dense reed beds and a rocky substrate on banks are used most intensively, probably on account of a localized high food biomass. Impoundments, both large and small, appear to be secondary (less suitable) habitat.	Eastern RSA	*X*	√	Highly Unlikely
Serval *Leptailurus serval*	**NT**	Servals enjoy with well-watered habitats like grass savannas along river reed beds and swamps, in brush and open woodlands and along the edge of forests.	Eastern RSA	*X*	√	Unlikely
Swinny's Horseshoe Bat *Rhinolophus swinnyi*	**EN**	Found in moist montane rainforest, and dry and moist savanna. Populations are dependent on caves, mines and similar habitats for roosting. It appears to be sparsely distributed in parts of its range.	Eastern part of South Africa	*X*	√	Unlikely
Sykes' Monkey *Cercepithecus albogularis*	**Rare**	High forest, forest margins and riverine gallery forest.	Eastern RSA	*X*	√	Highly unlikely
Tree hyrax/dassie *Dendrohyrax arboreus*	**Not evaluated**	Suitable forest and bush areas, including coastal dune forest.	Central KZN, Eastern and coastal EC	*X*	√	Highly unlikely
Giant golden mole *Chrysospalax villoosus*	**Not evaluated**	Very patchy and limited distribution, occurring only in relict areas of indigenous high forest.	Central KZN, Eastern and coastal EC	*X*	√	Highly unlikely

Key to Species Threat Status: **EN –** Endangered, **VU** – Vulnerable, **NT** – Near Threatened, **DD** – Data Deficient

B. Avifauna (birds)

The South African Bird Atlas Project (SABAP) aims to map the distribution and relative abundance of birds in southern Africa and relies heavily on data uploaded by "citizen scientists". Birds of conservation concern were identified through use of the South African Bird Atlas Project (SABAP) database (available online at http://sabap2.adu.org.za/). Information for the Quarter Degree Grid Square (QDGS): 3128DB was used.

Whilst the majority of species recorded by the SABAP are considered locally common birds, there are a number of bird species that are considered to be of conservation concern based on their conservation/threat status (Table 13, below). The distributional ranges and habitat requirements/preferences for each bird species of conservation concern was reviewed (based on available literature) to estimate the likelihood of these species occurring within the study area. Based on their habitat preferences and distributional range, five (5) birds of conservation concern could possibly utilise the grassland and wetland habitat at the site and surrounds, including African marsh-harrier (*Circus ranivorus*), Black-winged Lapwing (*Vanellus melanopterus*), Lesser Kestrel *(Falco naumanni),* Grey Crowned Crane (*Balearica regulorum*) and Denham's (Stanley's) Bustard (Neotis denhami) (Table 12):

- A pair of **Grey-Crowned Crane** (VU) was observed by the ecologists from Eco-Pulse in 2012 within the moist grassland adjacent to the wetlands on the site in the northern section of the project area and probably exploit the site as the area is fenced and less vulnerable to predators.
- **Stanley's Bustard** (VU) is also known to occur within the grasslands within the adjacent Luchaba Nature Reserve to the north, however due to the airport property being fenced-off; it is quite unlikely that this bird species frequents the site.

Table 13. Summary of the potential occurrence of bird species of conservation concern within the study area.

Species Name	Status	**Habitat Preferences** (after Chittenden, 2009; IUCN, 2016)	POC
African Crowned Eagle (*Stephanoaetus coronatus)*	NT	Favours tall closed canopy forest, riparian forest, dense woodland and gorges. Also inhabits gum and pine forestry plantations. Normally chooses tallest canopy tree to build large stick platform nest.	Highly Unlikely
African marsh-harrier *(Circus ranivorus)*	VU	Inland and coastal wetlands as well as adjacent moist grassland. Breeding demands a stretch of undisturbed long grass with concealed clearings.	Possible
Black-winged Lapwing (*Vanellus melanopterus*)	NT	Breeds in short grassland a higher elevations and open plains and dry savanna at lower altitudes. Frequents wastelands, cultivated or fallow fields, meadows, airfields, coastal flats and golf courses during times of non-breeding.	Possible
Cape Vulture *Gyps coprotheres*	VU	Flies long distances over open country, usually found near mountains, where it breeds and roosts on cliffs.	Highly Unlikely
Denham's (Stanley's) Bustard (*Neotis denhami*)	VU	Inhabits grasslands, grassy *Acacia*-studded dunes, fairly dense shrubland, light woodland, farmland, crops, dried marsh and arid scrub plains	Known to be present within the adjacent Luchaba

Species Name	Status	**Habitat Preferences** (after Chittenden, 2009; IUCN, 2016)	POC
			Reserve but unlikelty to frequent the fenced-off site
Grey Crowned Crane *(Balearica regulorum)*	VU	Breeds in marshes, pans and dam margins with tall emergent vegetation. Found in pairs during breeding season, roosting on the ground near nest in wetlands. Feed in adjacent short to medium height grassland, wetlands and agricultural fields.	**Possible** (observed by Eco-Pulse in 2012)
Secretarybird *(Sagittatius serpentarius)*	NT	Open grassland with scattered trees/shrubs.	Unlikely
Southern Ground-Hornbill *(Bucorvus leadbeateri)*	VU	Favours open woodland.	Highly Unlikely
Martial Eagle	VU	Mostly open savanna and woodland on plains.	Unlikely
Lesser Kestrel *(Falco naumanni)*	VU	Open savanna, grassland and verges of cultivated land.	Possible

Key to Species Threat Status: **VU** – Vulnerable **NT** – Near Threatened

C. Reptiles

A number of endemic and near-endemic reptile species, including lizards, snakes and skinks, modelled to occur in this region of the Eastern Cape and could potentially reside in the more intact grassland and wetland/riverine habitats in the study area (Table 14, below).

No endangered species are likely to occur based on the data/literature consulted. All reptile species are sensitive to major habitat alteration and fragmentation. As a result of human presence in the area coupled with historic and still active agricultural disturbances, alterations to the original reptilian fauna are expected to have already occurred, with remaining areas where anthropogenic impacts are limited possibly hosting some of the species listed.

Table 14. Summary of reptile species of conservation significance potentially occurring in the study area.

Species Name	Threat Status	Habitat Requirements/ Preferences (after Bates *et al*. 2014)	Distribution/ Range	Habitat requirements met at site?	Site within distribution/ range?	POC
Bibron's Blind Snake *Afrotyphlops bibronii*	**Near-Endemic**	Grassland / savannah: burrows in loose soil, common in old termitaria under rocks and rotting logs.	Eastern RSA	√	√	Possible
Cape Girdled Lizard *Cordylus cordylus*	**Endemic**	Rupicolous species, occurring in diverse habitats from coastal rocks to mountain tops.	Widespread across southern RSA	Partial	√	Unlikely
Cape Grass Lizard *Chamaesaura anguina anguina*	**Endemic**	Found mostly on mountain slopes in fynbos and grassland habitats.	Widespread across RSA	Partial	√	Unlikely
Cape Many-Spotted Snake *Amplorhinus*	**Near-Endemic**	Reed beds, vleis and riverside vegetation, grassland and montane	Scattered populations in east and south	√	√	Possible

Species Name	Threat Status	Habitat Requirements/ Preferences (after Bates *et al*. 2014)	Distribution/ Range	Habitat requirements met at site?	Site within distribution/ range?	POC
multimaculatus		forest.	RSA			
Common South African Slug Eater *Duberria lutrix lutrix*	**Endemic**	Favours damp localities in grassland, moist savanna, lowland forest and fynbos.	Widespread across RSA	Partial	√	Unlikely
Delalande's Sandveld Lizard *Nnucras lalandii*	**Endemic**	Generally associated with montane and temperate grassland, takes shelter in underground burrows or under rocks.	Widespread across RSA.	Partial	√	Unlikely
Dusky-Bellied Water Snake *Lycodonomorphus laevissimus*	**Endemic**	Inhabits riverine and other aquatic habits, particularly well-wooded streams.	Eastern RSA	X	√	Unlikely
Eastern Ground Agama *Agama aculeate distanti*	**Endemic**	Occurs in grassland and woody habitats, occasionally in rocky areas.	Widespread across central and eastern RSA	√	√	Possible
Eastern Cape Dwarf Chameleon *Bradypodion ventrale*	**Endemic**	Considered a habitat generalist.	Southern and east Eastern cape	Partial	√	Unlikely
Forest Thread Snake *Leptotyphlops sylvicolus*	**DD**	Subterranean, forest areas and montane grassland.	Scattered in central coastal KZN and northern Eastern Cape	X	√	Unlikely
KwaZulu-Natal Black Snake *Macrelaps microlepidotus*	**NT**	Semi-fossorial species, frequents moist leaf litter and humic soil within forests and coastal bush.	Eastern EC and KZN	X	√	Unlikely
Kentani Dwarf Chameleon *Bradypodion kentanicum*	**VU**	Trees and bushes of coastal scarp forest.	Eastern Cape	X	√	Unlikely
Olive Ground Snake *Lycodonomorphus inornatus*	**Endemic**	Grassland, savannah, fynbos, forest.	Eastern parts of RSA	√	√	Possible
Pondo Flat Gecko *Afroedura pondolia*	**Endemic**	Rupicolous species, occurring on rock outcrops and cliffs in a variety of wooded habitats.	Eastern EC and KZN	X	√	Unlikely
Pondo Dwarf Chameleon *Bradypodion caffer*	**EN**	Coastal forest.	Few coastal localities in EC.	X	√	Unlikely
Southern Brown Egg-Eater *Dasypeltis inornata*	**Endemic**	Prefers open coastal woodland and moist savannah, shelters under rocks.	Eastern RSA	X	√	Unlikely
Southern Rock Agama *Agama atra*	**Near-Endemic**	Rocky habitats.	Widespread in RSA	X	√	Unlikely
Spotted Thick-Toed Gecko *Pachydactylus*	**Near-Endemic**	Broad range of habitats but chiefly in mesic areas.	Southern and eastern RSA	√	√	Possible

Species Name	Threat Status	Habitat Requirements/ Preferences (after Bates *et al*. 2014)	Distribution/ Range	Habitat requirements met at site?	Site within distribution/ range?	POC
maculatus						
Spotted Rock Snake *Lamprophis guttatus*	**Near-Endemic**	Rocky areas.	Scattered across RSA	Partial	√	Possible
Spotted Harlequin Snake *Homoroselaps lacteus*	**Endemic**	Semi-fossorial species found in sandy substrates, old termitaria and under rocks.	Widespread across RSA	Partial	√	Unlikely
Variable Legless Skink *Acontias poecilus*	**EN**	Found in moist soil or under leaf litter in forested habitats. Occurs from sea level up to 900 m in the Eastern Cape.	Southern coastal reaches of KZN and adjacent eastern parts of EC.	X	√	Unlikely
Western Natal Green Snake *Philothamnus natalensis occidentalis*	**Endemic**	Occurs in lowland forest, wooded grassland and forest edges.	Eastern and southern RSA	X	√	Unlikely

Key to Species Threat Status: **EN –** Endangered, **VU** – Vulnerable, **NT** – Near Threatened, **DD** – Data Deficient

D. Amphibians

The study area has not been highlighted as a particularly important area for the conservation of amphibian species such as frogs, with few known endemic or threatened species highlighted for the project site. Amphibian species of conservation concern are unlikely to be present at the site or within the surrounding aquatic habitats due to the lack of sutable habtiat provided for key species such as the Endangereed Kloof Frog, *Natalobatrachus bonebergi* (Table 15).

Table 15. Summary of the potential occurrence of amphibian species within the study area.

Species Name	Threat Status	Habitat Requirements/ Preferences (after IUCN, 2016)	Distribution/ Range	Habitat requirements met at site?	Site within distribution/ range?	POC
Natalobatrachus bonebergi Kloof Frog	**EN**	Coastal and densely forested kloofs, along slow flowing streams.	Coastal KZN and EC	X	√	Highly unlikely
Afrixalus knysnae Knysna Leaf-Folding Frog	**EN**	Small pans in grassland.	Coastal NE EC	X	√	Unlikely
Leptopelis natalensis Forest tree frog	**Endemic**	Riverine bush and swamp forest, coastal forest.	Coastal KZN and NE coastal EC.	X	√	Highly unlikely

Key to Species Threat Status: **EN –** Endangered

E. Invertebrates

There is generally very little available long-term information on invertebrate species and populations for most of South Africa, with no known available information on invertebrates for the study area to enable the assessment of potential occurrence.

4 BASELINE VEGETATION & HABITAT ASSESSMENT

4.1 Vegetation Community Description & Condition Assessment

Following a walk-through site visit conducted over a 3-day period in summer (March 2018), the following terrestrial vegetation communities were identified for the site and surrounding area (shown mapped in Figure 9):

1. **Slightly Modified Primary Mthatha Moist Grassland**: found exclusively on the northern property and accounting for roughly 141 hectares (ha) of the property;
2. **Degraded Secondary Grassland**: found exclusively on the southern property and accounting for roughly 45 hectares (ha) of the property.

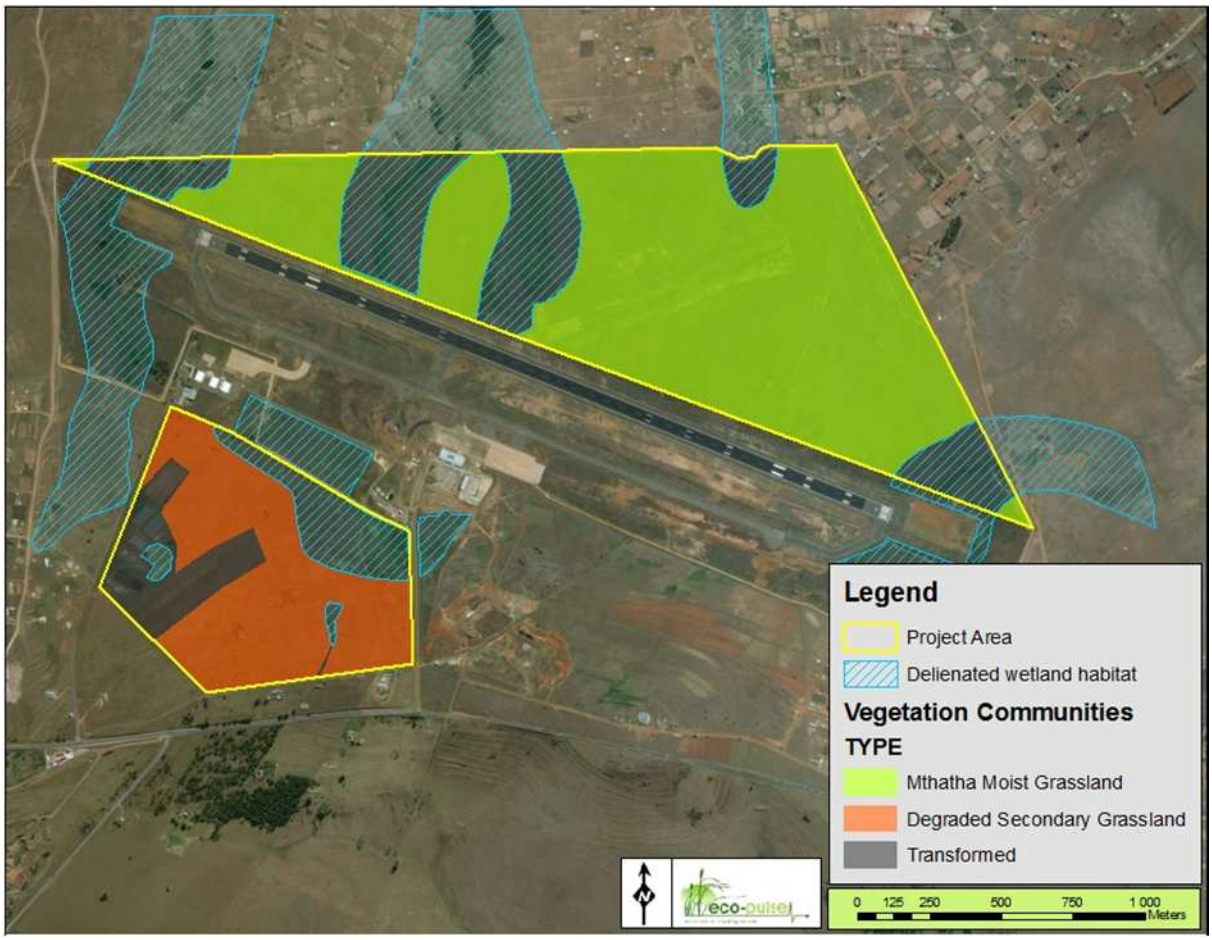


Figure 9 Map showing the two terrestrial vegetation communities surveyed for the northern and southern properties.

A list of 90 plant species recorded in the mapped vegetation communities is provided as **Annexure A** of this report.

Please note that freshwater wetland habitat (shown delineated in Figure 9) has not reported on in this 'terrestrial ecological report' but has been addressed in detail in the ***Specialist Wetland Assessment report for the project (Eco-Pulse, 2018 ; Report no. EP341-02).***

4.1.1 *Mthatha Moist Grassland (Slightly Modified)*

The Transkei region of the Eastern Cape has been settled and grazed for a long period of time. Generally speaking, grasslands in proximity to human settlements and where there is or has been active livestock grazing are frequently degraded and most often depleted of natural plant diversity, and very often, only unpalatable grasses and weeds remain.

The grassland identified on the northern property (north of the Mthatha airfield runway) is quite unusual in that it is primary in the sense that there is still some herbaceous and geophyte diversity. The **(Slightly Modified) Mthatha Moist Grassland** was identified solely for the northern property and accounts for roughly 141 ha of the site. Considering that weed and Invasive Alien Plant (IAP) infestation levels was typically low and the structural integrity of the grassland was intact, it was concluded that the grassland is **slightly modified** but not entirely representative of reference state. *It is worth noting that the condition assigned to this vegetation community is a condition class below largely intact or unmodified.* The Mthatha Moist Grassland is an 'endangered' vegetation type nationally (Mucina & Rutherford, 2006).

Noteworthy features and characteristics of this primary grassland community are:

- It is evident that fencing the Mthatha Airport Precinct has allowed the grassland to recover from historic anthropogenic impacts such as overgrazing and poor veld management.
- The vegetation community was found to comprise a medium-tall grassland community occurring exclusively on the crest and convex slopes of undulating lowlands within the northern property.
- Concave and low-lying areas where identified as being wetland habitat.
- The Mthatha Moist Grassland comprised a relatively low diversity of tufted grasses and forb species.
- A striking feature of the grassland was that it was dominated almost exclusively by *Themeda triandra* (Red grass), a climax grass species typically found in good condition veld that has not been overgrazed or heavily disturbed (van Oudtshoorn, 2012). Although its abundance is cited as an indicator of a grassland community in good condition and at a 'climax' successional stage, in this case it is better described as a species that becomes abundant in under-utilized grassland or veld that is not frequently burnt which is the case at the northern property.

- *Hyparrhenia hirta,* a species associated with disturbed sites, was found to be also abundant albeit not at the same level as *T. triandra*. The abundance of *H. hirta* is likely to be linked with historically poor veld management prior to fencing of the Mthatha Airport precinct. In the absence of grazing and fire regime, it is expected that this grass species will decrease in abundance with time.
- Forb diversity and abundance was found to be low, with usually 4 or fewer species encountered per m^2. In certain localised areas, forbs were not even recorded. Forbs recorded included mainly ruderal* species and weeds common in grasslands occurring in summer rainfall areas. Such species belong to families such as *Asteraceae, Fabaceae, Apocynaceae, Rubiaceae, Hyacinthaceae, Lamiaceae, Iridaceae* and *Scrophulariaceae*. The most common were identified as *Chamaecrista mimosoides*, Crabbea hirsute Cyanotis speciosa, Eriospermum sp*. (not found in flower), *Helichrysum nudifolium subsp. nudifolium*, Helichrysum odoratissimum*, Hermannia parviflora, Lobelia flaccida, Pelargonium alchemilloides*, Vigna vexillata** and *Zornia capensis*.
- There was no woody vegetation except for a minority and scattered presence of alien invasive species (principally *Acacia mearnsii*, Black-Wattle).
- Whilst no red listed plants were identified, a rare plant species not usually found in the Mthatha area, *Periglossum mackenii,* was recorded. Provincially protected plant species were also not recorded. Although not recorded, there is a strong likelihood that *Kniphofia* species may be present particularly in wet habitats. These are conspicuous in flower but being grass-like in growth form may be inconspicuous or invisible amongst grasses when not in flower which explains why they may not have been recorded during the site survey.
- The grassland in the environments of Mthatha beyond the fenced airport precinct is heavily grazed, apparently very frequently burned, dominated by *Aristida junciformis* and other wiry, unpalatable grasses, and has been mostly eviscerated of herbaceous plant diversity except for species that are unpalatable or toxic to cattle and goats. Some of this grassland has also been historically cultivated.

Photo 1: View of the slightly modified primary grassland (Mthatha Moist Grassland) occurring on the northern property, with the mid-slope section covered by the climax grass species, *Themeda triandra*.

Photo 2: Disturbed vegetation community along the edge of the Mthatha Moist Grassland. This area is subject to frequent mowing.

Photo 3: *Bulbine sp*. recorded within the Mthatha Moist Grassland.

4.1.2 *Degraded Secondary Grassland (Seriously Modified)*

The Secondary Degraded Grassland found exclusively on the smaller southern property comprises a 45ha medium-tall grassland community occurring on the upper portion of a north-facing slope within the southern property. The grassland was assigned as 'secondary' status as the property had been historically cultivated and transformed for rural infrastructure such as homesteads. Following cessation of cultivation, relocation of locals and fencing of the property, a mixed secondary grassland community has become established through a natural successional process. Given abovementioned

impacts and present vegetation status (structurally and compositionally), the Degraded Secondary Grassland has been assigned a condition class of **seriously modified**. In other words, the vegetation community is highly dissimilar to the reference Mthatha Moist Grassland. Although this may be an instance of Mthatha Moist Grassland, as nearly all appears to be old cultivated land and to have been transformed or severely degraded, it is not considered very valuable from a plant diversity perspective. The vegetation is certainly less valuable than most of that occurring on the northern property by comparison.

Noteworthy features and characteristics of this primary grassland community are:

- The grassland comprised a low diversity of tufted grasses and forbs. *Hyparrhenia dregeana* and *H. hirta* were found to be most dominant. *T. triandra* was observed to be uncommon and this likely attributed to the exclusion of disturbance regimes which allowed it to spread.
- Forbs were observed to be limited to a few weeds and ruderals. The species composition was similar to the recorded in the Mthatha Moist Grassland (described above) with the exception of the presence of *Monopsis unidentata*, a species that flourishes in damp, disturbed areas.
- The Secondary Degraded Grassland was found not to host red-listed or rare plants but offered refuge to a provincially protected forb, *Gladiolus ecklonii*. Should their habitat be transformed, these protected plant species will need to be translocated prior to commencement of construction. A plant permit will be required from the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT).
- Despite the vegetation community being in an early successional stage of recovery, there were still major anthropogenic impacts present at the site, albeit in localised areas. These included habitat transformation to establish greenhouse infrastructure, small-scale potato and maize cultivation and a leaking water pipeline which has created an artificial wetland habitat in an areas otherwise would have been terrestrial. The legacy of human habitation was still evident in the form of concrete slabs and hardened surfaces which has had a restrictive effect on natural vegetation establishment.

Photo 4: View of the Secondary Degraded Grassland sampled within the southern property.

Photo 5: *Gladiolus ecklonii*. recorded within the Secondary Degraded Grassland.

Photo 6: Active maize cultivation within the southern property.

4.2 Ecological Importance & Sensitivity (EIS) Assessment

The Slightly Modified 'Primary' Mthatha Moist Grassland occurring exclusively on the northern property was assessed as being of **Moderately-High EIS** owing largely to the fact that it is of moderately-high Ecological Importance because (i) it is representative of an 'Endangered' vegetation type and (ii) the grassland falls within an area categorised as a Critical Biodiversity Area (CBA). At a local level, the Mthatha Moist Grassland can be considered rare given high transformation and disturbance of grasslands in the area. In terms of Ecological Sensitivity the vegetation community was assessed as being of moderate sensitivity owing to (i) the perceived lack of sensitive and intolerant terrestrial biota and (ii) low risk to erosion.

The Degraded Secondary Grassland occurring exclusively on the southern property was assessed as being of **Low EIS**. Although it is not representative of its benchmark vegetation type, the Secondary Degraded Grassland is located within a Critical Biodiversity Area 2. In terms of Ecological Sensitivity the vegetation community was assessed as being of moderately-low sensitivity owing to (i) the lack of sensitive and intolerant terrestrial biota and (ii) low risk to erosion.

Table 16. Summary of EIS assessment results.

Terrestrial Vegetation Community	Reference Vegetation Type (Mucina & Rutherford, 2006)	Provincial Threat Status (ECBCP)	Condition	Ecological Sensitivity and Importance
1. Primary Grassland	Mthatha Moist Grassland	'Endangered'	Slightly modified, representative	Moderately-High
2. Secondary Grassland	Mthatha Moist Grassland	'Endangered'	Seriously modified, no longer representative	Low
3. Transformed Areas	-	-	Transformed	None

5 ECOLOGICAL IMPACT ASSESSMENT

This Chapter of the report deals with the identification, description and significance assessment of the potential construction and operational impacts and risks posed to terrestrial vegetation, habitat and species by the WC: SEZ Phase 1 development.

5.1 Proposed Development Context

The planned development (according to the latest development layout plan: see Figure 10) includes the following aspects:

- The development proposed for the **Phase 1: 'North'** property (183 ha) will include:
  - Agriculture on 164ha of the property
  - Access road infrastructure
  - Storm water conveyance and attenuation infrastructure

- The development proposed for the **Phase 1: 'South'** property (72 ha) will include:
  - Hotel & conferencing development (5.5 ha)
  - Commercial development (6.6 ha)
  - Industrial development (22 ha)
  - Intensive agriculture and business process outsourcing (23 ha)
  - Internal road infrastructure
  - Storm water conveyance and attenuation infrastructure
  - Water pipeline reticulation
  - Wastewater pipeline infrastructure

Based on this information, impacts were identified and described and then assessed in terms of significance.

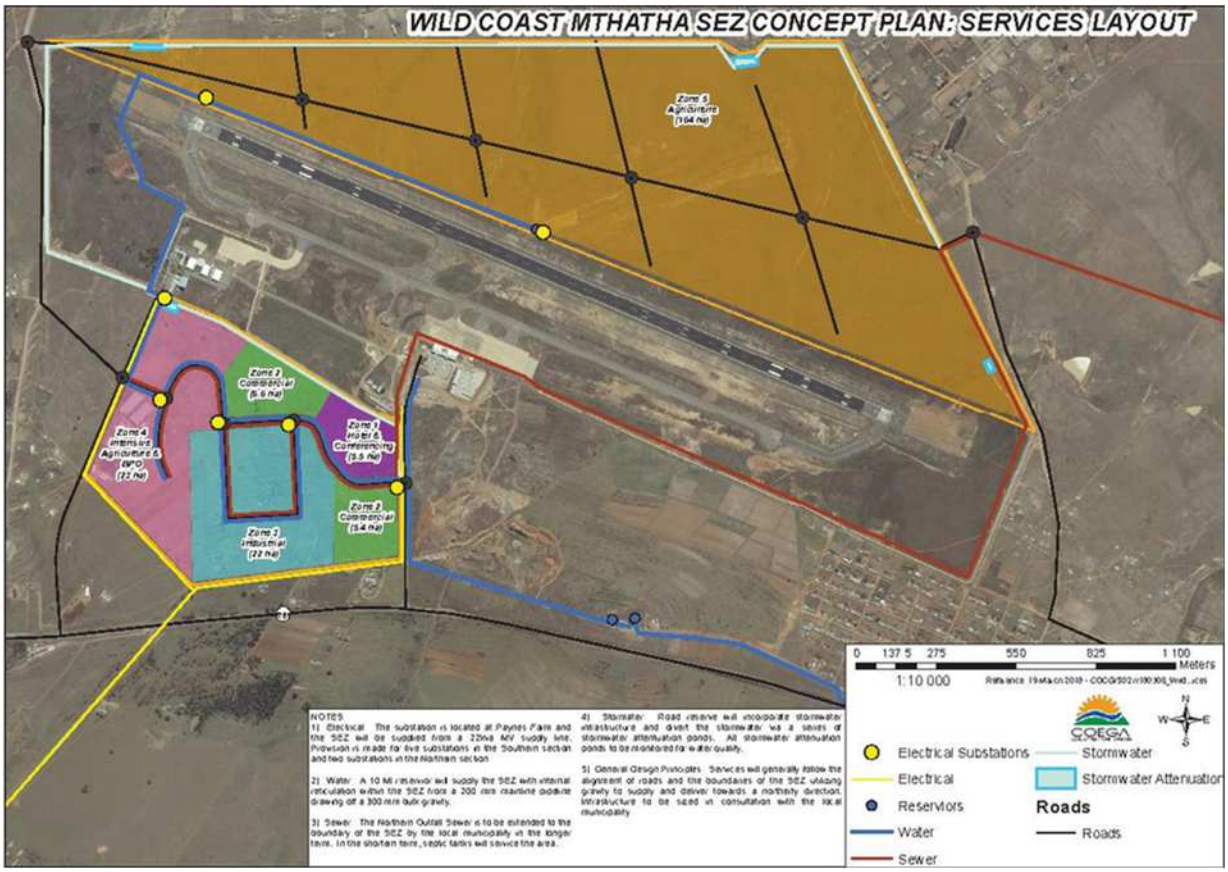


Figure 10 Proposed land uses and services infrastructure development layout plan for Phase 1 of the WC: SEZ (Source: Coega Development Corporation).

5.2 Impact Identification and Description

Natural ecosystems are inherently vulnerable to human activities and these activities can often lead to irreversible damage or longer term, gradual/cumulative changes to ecosystems. Threats to terrestrial ecosystems and biodiversity include processes and activities which reduce system persistence, affect landscape structure and composition and alter community diversity and patterns, including reduced genetic diversity. One such threat to biological process could be the loss of important species due to loss or transformation of habitat. When making inferences on the potential impacts or risks that development activities place on ecosystems, it is important to understand that these impacts speak specifically to their effect on the ecological condition and/or functional importance/value of these ecosystems. Generally, impacts can be grouped into the following broad categories:

A. **Direct impacts**: are those impacts directly linked to the project (e.g. clearing of land, destruction of vegetation and habitat).

B. **Indirect impacts**: are those impacts resulting from the project that may occur beyond or downslope/downstream of the boundaries of the project site and/or after the project activity has ceased (e.g. migration of pollutants from construction sites).

There is normally a risk that human development can generally impact either directly (e.g. physical change to vegetation & habitat) or indirectly (e.g. soil erosion and disturbance creating conditions for alien plants to invade natural areas).

Typical ecological impacts to terrestrial vegetation and habitat that are likely to be associated with the WC SEZ Phase 1 development project are discussed in detail below. Impacts were identified and described based on an understanding of the receiving terrestrial environment and associated biodiversity, the location and extent of the proposed development footprint and the identification of factors that could affect the receiving terrestrial environment through the various project phases (i.e. construction and operational impacts).

Note that while an attempt has been made to separate impacts into categories, there is inevitably some degree of overlap due to the inherent interrelatedness of many ecological impacts.

Impact 1: Direct physical destruction of flora and fauna

This refers to the direct physical destruction, complete removal or partial destruction of vegetation and loss of indigenous flora and fauna by machinery and workers during the construction and operational phases of the agricultural and mixed-use development project.

Construction Phase Ecological Impacts:

Based on the proposed development footprint (shown in Figure 10) which intends to maximise the available space for development infrastructure and agricultural land use, a total loss of primary grassland habitat is expected under the current proposed development scenario which does not seek to avoid permanent loss of terrestrial grassland habitat on the northern and southern properties. This is particularly relevant to the northern property where a loss of predominantly intact primary grassland habitat (estimated to be in the region of ~141 ha) can be considered to be of **'high' impact significance** based on the extent of transformation and the 'endangered' vegetation status. The loss of large areas of endangered vegetation type is considered significant as this could contribute to a change in the threat status of the vegetation (i.e. from endangered to 'critically endangered' status) and could also play a role in reducing the ability to achieve provincial and national conservation targets set for this vegetation type. This would likely warrant the consideration of a biodiversity offset as a means of compensating for the permanent (residual) impact on terrestrial grassland vegetation communities and habitat. *The reader is referred to* ***Chapter 7 'Biodiversity Offset Requirements'*** *for further information on offset requirements.*

In addition to the potential loss of primary Mthatha Moist Grassland on the northern property, there is also the potential for the development to result in the loss of provincially protected plant species (i.e. *Gladilous ecklonii*) located on the southern property if measures are not taken to conserve these plants. These plants are however not red-data listed and are species of 'Least Concern' according to SANBI, reducing the intensity and magnitude of impact of any loss of these 'protected' plant species.

Impact Description	Mitigation Level	Impact Significance
		Construction Phase
1 Direct physical destruction of flora and fauna	'Poor' Mitigation	High (-)
	'Good' Mitigation	Moderate (-)

Operational Phase Ecological Impacts:

Direct physical destruction of vegetation and habitat is likely to be restricted to the construction phase and unlikely to be relevant/applicable to the operational development.

Impact Description	Mitigation Level	Impact Significance
		Operational Phase
1 Direct physical destruction of flora and fauna	'Poor' Mitigation	N/A
	'Good' Mitigation	N/A

Impact 2: Degradation and fragmentation of habitat

This impact refers to the secondary effects of vegetation disturbance, including but not limited to: erosion risk and encroachment/colonisation of terrestrial habitats by Invasive Alien Plants (IAPs).

Construction Phase Ecological Impacts:

Vegetation clearing and disturbance of natural habitat not only reduces the availability of habitat (refugia/breeding/nesting sites) and food for local wildlife but can also temporarily or even permanently restrict corridor movement between natural areas through associated fragmentation of natural habitat and the severing of natural ecological linkages/corridors. This will be of particular significance where relatively un-impacted grassland areas are affected, especially for existing local wildlife movement corridors. The effect of fragmentation will generally be greater for fauna than for flora and is typically lower for grasslands when compared with typical wooded/forest communities in the region. With the primary grassland being fenced (impervious barrier to species movement) and subject to noise disturbance (airport), this areas is unlikely to be a practical wildlife corridor used by conservation important species, therefore habitat fragmentation is less of an issue. The development would probably have some impact on small mammals such as rodents and shrews, however, there should be adequate adjacent terrestrial grassland habitat retained in surrounding areas for small mammals. Nocturnal species such as hares would generally avoid disturbance through their nocturnal habit and avifauna would readily move off the site at the first sign of human activity. Excavation for development would have a direct impact on moles through loss of habitat, with the overall extent of impact related to the proportion of area developed. Loss of habitat may have a deleterious impact on ants.

Outside the development footprint, there is bound to be use of the open space area for storage of construction materials, access and setting up a construction site camps. Such activities are likely to result in further degradation of already degraded vegetation communities through vegetation clearing, trampling and soil compaction. Use of heavy machinery within open spaces will likely alter the

soil structure underneath. It has been shown that compaction can be up to 200 times greater than in undisturbed land (Trombulak & Frissell, 2000). If soil compaction is not addressed at the cessation of construction, plants that need deep soils will fail to establish themselves. Only plants that do well in shallow and compact soils will establish. Furthermore, construction activities are likely to temporarily denude the vegetation on the site and expose the soils to erosive elements. This could be exacerbated by water flowing down trenches and access roads, as well as from trench de-watering activities. Soil erosion can result in the loss of valuable topsoil and formation of erosion gullies. This can cause localized habitat loss / alteration due to increased sediment deposition or erosion of natural areas. Some of the key ecological effects related to the erosion/deposition of sediment may include:

- Habitat alteration due to increased sediment deposition or erosion of areas;
- Reductions in photosynthetic activity and primary production caused by sediments impeding light penetration;
- Reduced density and diversity of organisms as a result of habitat degradation, blanketing of sites and the establishment of more tolerant taxa or exotic species; and
- Exposure disturbed sites to invasion by weeds and other undesirable plants.

Impact Description	Mitigation Level	Impact Significance
		Construction Phase
2 Degradation and fragmentation of habitat	'Poor' Mitigation	Moderate (-)
	'Good' Mitigation	Moderately-Low (-)

Operational Phase Ecological Impacts:

Following construction and during site operation, the potential disturbance of soil and vegetation within natural areas (and adjacent habitats) typically encourages the establishment of pioneer vegetation and in many cases creates an ideal opportunity and optimal conditions for weeds and Invasive Alien Plants (IAPs) to invade both disturbed and adjacent undisturbed grassland habitat. IAPs can have far reaching detrimental effects on native biota and has been widely accepted as being a leading cause of biodiversity loss. They typically have rapid reproductive turnover and are able to outcompete native species for environmental resources, alter soil chemistry and stability, promote erosion, change litter accumulation, reduce food supply for fauna and soil properties and promote of suppress fire. Failure to manage stripping of vegetation, topsoil and rehabilitation can lead to serious IAP infestation which compromises the quality of habitat provided by the naturally occurring grassland vegetation community. Clearing and disturbance can also result in an increase in edge habitat immediately adjacent to disturbed areas. Edge habitat is characterized by a predominance of generalist and alien species that are usually highly competitive species which can invade areas of established vegetation, resulting in a loss of sedentary species of mature habitats which are normally considered sensitive. Edge effects will be typically lower for grasslands when compared with typical wooded communities such as forests. The spread of existing alien plants within natural areas can be exacerbated if not properly managed and new alien plant species may be introduced to natural areas as a result of human disturbance and re-vegetation using undesirable plants species that are not naturally common to the region.

Impact Description	Mitigation Level	Impact Significance
		Operational Phase
2 Degradation and fragmentation of habitat	'Poor' Mitigation	Moderate (-)
	'Good' Mitigation	Low (-)

Impact 3: Pollution of soil, water and vegetation

This refers to the alteration or deterioration in the physical, chemical and biological characteristics of soil and water, which inevitably impacts negatively on vegetation.

Construction Phase Ecological Impacts:

During the construction phase, there is a chance that soils, water and vegetation may be polluted. Waste products and pollutants generated during the construction phase of the development may include fuels and oils from construction vehicles, cement and concrete products, paints and other hazardous substances; as well as solid waste in the form of building material and litter from labourers. These can potentially enter the surrounding natural grassland environments either directly through disposal/mismanagement of waste products/pollutants or more indirectly through surface runoff during rainfall events. These contaminants have the capacity to negatively affect soil and grassland ecosystems at the site, including sensitive or intolerant species of flora and fauna. When highly toxic pollutants come into contact with plants they often result in the destruction of plant parts (e.g. leaves) ultimately resulting in the death of the plant. Where significant changes in soil/water quality occur, this will ultimately result in a shift in flora and soil microbes species composition, favouring more tolerant species and encouraging the invasion of early successional and alien invasive species and potentially resulting in the localised exclusion of any sensitive species. As these pollutants can typically linger in the soil for extensive periods of time, they may inhibit the establishment of vegetation during rehabilitation of any disturbed grassland areas.

Impact Description	Mitigation Level	Impact Significance
		Construction Phase
3 Pollution of soil, water and vegetation	'Poor' Mitigation	Moderate (-)
	'Good' Mitigation	Low (-)

Operational Phase Ecological Impacts:

Pollution sources from developments in their operational-phase can vary greatly. Mixed-use development that incorporates a range of land-uses including industry, commercial/retail space and agriculture can typically be associated with the following potential operational phase contaminants:

- **Suspended solids –** associated with runoff from hardened surfaces and bare soils leading to soil erosion and sedimentation.
- **Nutrients** – associated with agricultural runoff and fertilise application.
- **Sewage –** associated with leaks, infrastructure failure and/or storm water ingress into sewer manholes leading to the surcharge of contaminated water.

- **Hydrocarbons, oils and grease** – run-off from parking lots and roads.
- **Toxicants** – run-off containing detergents and other toxic substances used by residents.

During operation, solid and/or liquid wastes stored and handled at the site could enter adjacent environments if not managed adequately and could lead to pollution of the adjacent habitat, flora and fauna. With regards to any access roads planned: roads are also accepted as a source of numerous particulate and chemical pollutants. Acting either as a fertilizer (nitrogen), growth stimulator (carbon dioxide) or pollutant (heavy metals), vehicular emissions play a significant role in transforming road verge plant populations creating so-called 'edge effects' (Angold, 1997) which decrease with distance from the road. Pollution and chemicals on roads can also be dispersed via storm water run-off into the surrounding environment and have far reaching consequences (Coffin, 2007).

Impact Description	Mitigation Level	Impact Significance
		Operational Phase
3 Pollution of soil, water and vegetation	'Poor' Mitigation	Moderate (-)
	'Good' Mitigation	Low (-)

Impact 4: Nuisance Factors (Noise, Vibrations, Light)

This refers to the alteration of the ambient environment by nuisance factors such as noise, vibrations, light pollution, etc. produced by machinery, vehicles and labourers during construction and site operation

Construction Phase Ecological Impacts:

Typical construction activities associated with the establishment of infrastructure are known to generate noise and vibrations. Local wildlife (fauna) generally responds to disturbances caused by human activities according to the magnitude, timing, and duration of the particular disturbance. Human activities can affect an animal's ability to feed, rest, and breed if it is unable to habituate to the disturbance caused (Rodgers & Schwikert, 2003). Anthropogenic activities occurring within a close proximity to natural habitats containing fauna (wildlife) can lead to both the physical disturbance of habitats supporting animal life by construction machinery/labourers (already discussed above under Impacts 1 and 2) as well as the disturbance of fauna due to artificial noise and artificial light pollution at the site during construction. These impacts are generally short lived and limited to the construction period and locally common species already occurring at the site are likely to be less sensitive to noise/light disturbance (due to the proximity of existing rural human settlement) and can probably become habituated at the site. Light pollution will only become a problem if construction activities proceed during the night or if there is a need to maintain a well-light construction site throughout the night (for safety / security reasons).

Impact Description	Mitigation Level	Impact Significance
		Construction Phase
4 Nuisance Factors (Noise, Vibrations, Light)	'Poor' Mitigation	Moderately-Low (-)

	'Good' Mitigation	Moderately-Low (-)

Operational Phase Ecological Impacts:

The ecological negative effects of artificial noise, vibration and light pollution/nuisance impacts have already been discussed above under construction phase impacts.

Longer term noise, vibration and light pollution impacts will likely persist during the operational life-span of the development project, and will likely include noise generated by vehicles accessing the site and transporting goods and materials, machinery operating at industrial sites and noise generated by residents, employees and labourers, sirens, etc. The frequency, intensity and the extent of the noise impacts is expected to be relatively high during operation and will also be variable across the site depending on the specific operational land use and activities occurring.

Impact Description	Mitigation Level	Impact Significance
		Operational Phase
4 Nuisance Factors (Noise, Vibrations, Light)	'Poor' Mitigation	Moderately-Low (-)
	'Good' Mitigation	Moderately-Low (-)

5.3 Impact Significance

5.3.1 Ecological Impact Significance Assessment

Impact significance is defined broadly as a measure of the 'desirability, importance and acceptability of an impact to society' (Lawrence, 2007). The degree of significance depends upon two dimensions: the measurable characteristics of the impact (e.g. intensity, extent, duration) and the importance societies/communities place on the impact. Put another way, impact significance is the product of the value or importance of the resources, systems and/or components that will be impacted and the intensity or magnitude (degree and extent of change) of the impact on those resources, systems and/or components.

When making inferences on the significance of the impact of development activities on terrestrial ecosystems and biodiversity, it is important to understand that these impacts speak specifically to their effect on ecosystem condition, functioning and process. All of these are linked to the physical components and processes of terrestrial ecosystems, including soils, vegetation, habitat as well as the biota that inhabit these ecosystems. Our approach therefore is to first describe and assess the impacts to ecosystem components (i.e. each of the impact groups), then consolidate and interpret these changes in terms of impacts to overall ecosystem unit functioning and the supply of ecosystem services. Thereafter, the significance of each impact pathway and their associated changes in ecosystem functioning and supply of ecosystem services was assessed in terms of the ultimate consequences (impacts to resources of known societal value). Figure 11 below shows conceptually how impacts to a terrestrial ecosystem, vegetation community or habitat type can have a number of possible negative ecological consequences, ranging from loss of sensitive species to reduced ecosystem functioning and goods & services provision.

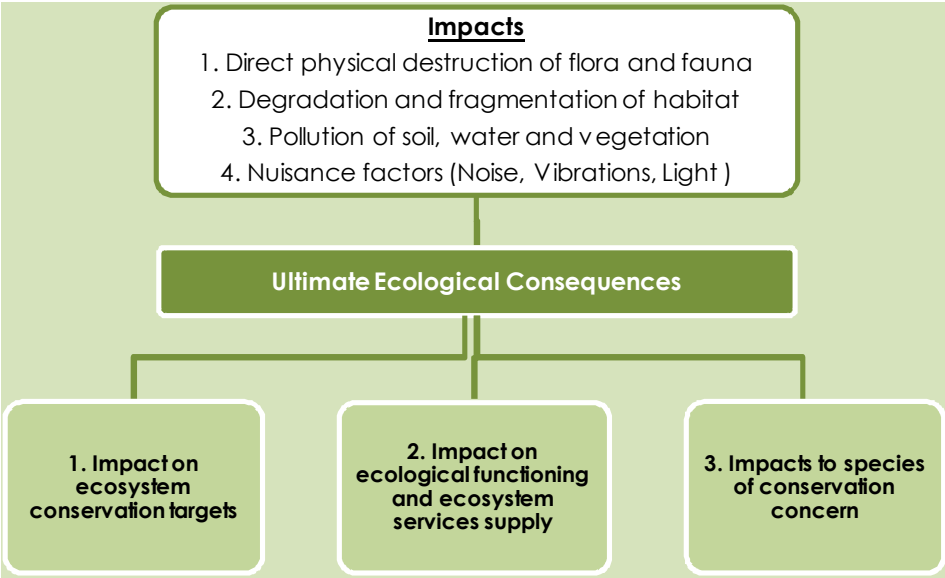


Figure 11 Conceptual diagram showing the range of typical negative ecological consequences for terrestrial ecosystems resulting from typical direct and indirect anthropogenic impacts.

An attempt has been made to quantify the relative significance of the ultimate negative consequences associated with the range of potential negative impacts identified in Figure 11 and described under Section 5.2, with a summary of the results of the impact significance assessment provided in Table 17, below (for each phase of the project). The significance of the identified potential negative ecological consequences of the proposed development on freshwater ecosystems was assessed for the following realistically possible scenarios:

i. **Realistic "standard mitigation" scenario** – this is a realistic worst case scenario involving the poor implementation of construction mitigation, bare minimum incorporation of recommended design mitigation, poor operational maintenance, and poor onsite rehabilitation.

ii. **Realistic "best practical mitigation" scenario** – this is a realistic best case scenario involving the effective implementation of construction mitigation, incorporation of the majority of design mitigation, good operational maintenance and successful rehabilitation. Please note that this realistic scenario does not assume that unrealistic mitigation measures will be implemented and/or measures known to have poor implementation success (>90% of the time) will be effectively implemented.

Table 17. Summary of construction and operation phase terrestrial ecological impact significance ratings.

Impact Description	Mitigation Level	Impact Significance	
		Construction Phase	Operational Phase
1 Direct physical destruction of flora and fauna	'Poor' Mitigation	High (-)	N/A
	'Good' Mitigation	Moderate (-)	N/A

Impact Description	Mitigation Level	Impact Significance	
		Construction Phase	Operational Phase
2 Degradation and fragmentation of habitat	'Poor' Mitigation	Moderate (-)	Moderate (-)
	'Good' Mitigation	Moderately-Low (-)	Low (-)
3 Pollution of soil, water and vegetation	'Poor' Mitigation	Moderate (-)	Moderate (-)
	'Good' Mitigation	Low (-)	Moderately-Low (-)
4 Nuisance Factors (Noise, Vibrations, Light)	'Poor' Mitigation	Moderately-Low (-)	Moderately-Low (-)
	'Good' Mitigation	Moderately-Low (-)	Moderately-Low (-)

5.3.2 Contextualising Ecological Impact Significance

It is important that the significance of the individual impacts to the terrestrial ecosystems in the study area be contextualised in terms of the 'ultimate consequences' of the impacts discussed and assessed in Sections 5.2 and 5.3.1.

5.3.2.1.1 Impact on ecosystem conservation targets

Based on the ecological baseline assessment undertaken, the intended transformation of the indigenous primary grassland community located at the site poses the greatest constraint to the development from a terrestrial ecological perspective. The Eastern Cape Biodiversity Conservation Plan (ECBCP) (Berliner & Desmet, 2007) maps the site as a ***Terrestrial Critical Biodiversity Area 2 (T2)***, which captures the near-natural landscape and presence of 'Endangered' vegetation type(s) identified through the systematic conservation assessment (i.e. the **Mthatha Moist Grassland** vegetation type). Further transformation of this vegetation type may therefore compromise the ability to meet conservation targets set for this vegetation type at the National and Provincial level. According to the ECBCP then, associated biodiversity management guidelines for the site (based on the CBA2 classification) set out the desired ecological state to ensure biodiversity persistence, which in this case, should be to '***maintain biodiversity in near-natural state with minimal loss of ecosystem integrity and no transformation of natural habitat should be permitted'.*** The vegetation assessment confirmed that a large part of the grassland is not secondary in the sense that it contains several herbaceous and geophytic plants that are not weeds of disturbance but would not prevent development from occurring. However, this does make the destruction of the primary degraded grassland a cause for concern. Essentially, the transformation of the Slightly-Modified Primary Mthatha Moist Grassland occurring on the northern development property at the site does not align with the guidelines for biodiversity management promoted by the Eastern Cape Biodiversity Conservation Plan, and that in essence; transformation or degradation should ideally be avoided in order not to compromise meeting conservation targets set for the vegetation type.

Whilst initial measures aimed at the avoidance of impacts in accordance with the mitigation hierarchy come highly recommended, where avoidance of impacts leading to the transformation of the primary grassland vegetation and habitat at the site of the proposed agricultural development on the northern property will not be practically possible, impacts associated with the transformation of the grassland vegetation and habitat should warrant the need for a suitable 'Biodiversity Offset' as a means of compensating for the irreplaceable loss of primary Mtahtha Moist Grassland. *Biodiversity Offsets as a means of impact mitigation are covered under* ***Chapter 7*** *of this report*.

5.3.2.1.2 Impact on ecological functioning and ecosystem services supply

Terrestrial grassland ecosystems typically provide a range of important ecosystem goods and services to society. These ecosystems typically support a rich diversity of grasses, wild flowers, invertebrates, reptiles, birds and other animals. Other services provided by these ecosystems include their role in reducing runoff and attenuating downstream flooding, assisting with binding topsoil and controlling erosion as well as their role in storing carbon, especially in the topsoil. Benefits to local communities may include medicinal plants and harvestable grass/herb/forb material.

The anticipated transformation of the primary Mthatha Moist Grassland community on the northern property will impact negatively on the level of supply of typical ecological goods and services provided by the grassland community at a local scale, which would generally be considered undesirable and should ideally be avoided where possible. Compensation for the loss of habitat and ecosystem functioning will however be met through a relevant 'Biodiversity Offset' as a means of compensating for the irreplaceable loss of primary grassland. *Biodiversity Offsets as a means of impact mitigation are covered under* ***Chapter 7*** *of this report*.

5.3.2.1.3 Impact to species of conservation concern

Activities involving the clearing/harvesting of natural vegetation could generally result in the destruction or loss of plants and animal species of conservation significance. This of course depends on whether these species are present at a site or not and on the threat status of individual species. If a subpopulation of a species of conservation concern is found to occur on a proposed development site, it would be one indicator that development activities are likely to result in the loss of biodiversity, bearing in mind that loss of subpopulations of these species will either increase their extinction risk or may in fact contribute to their extinction risk.

Only one protected plant species (*Gladiolus ecklonii*) has been identified on the site and occurs within the secondary degraded grassland on the southern property. This plant species is protected at a provincial level under the Decree No. 9 (Environmental Conservation) of 1992. The loss of any of the above-mentioned species is undesirable. The impact of the proposed development on flora of conservation concern can best be mitigated through an appropriate search and rescue and plant translocation programme prior to commencement of construction. This is however subject to undertaking the search and rescue correctly and timeously and obtaining the relevant plant permits.

Where protected plants are successfully rescued and translocated, the potential impact to flora species of conservation concern can be deemed to be of low significance.

Based on the desktop POC assessment for fauna (wildlife) undertaken, the probability of the site being important for hosting Red data listed/threatened populations or even individuals is considered to be relatively low. This is based on the following factors:

1. The lack of species-specific habitat for most of the mammals, reptiles and amphibians greatly reduces the likelihood of their occurrence at the site.
2. The likelihood of occurrence of many of these species is further reduced by their proximity to human activities. Larger mammal species have either been eradicated or have moved away from the area due to high levels of human and domesticated livestock disturbance associated with human occupation in the area as well as increased grazing pressure.
3. Small mammal species are also extremely vulnerable to human impacts, poaching as well as dogs and feral cats. It is therefore quite unlikely that the development site itself constitutes significant habitat for any species of threatened mammal species as well as for mammal species in general.
4. Various endemic species of reptiles could potentially utilise the site, but are unlikely to persist in great numbers. All reptile species are sensitive to major habitat alteration and fragmentation. As a result of human presence in the area coupled with livestock grazing disturbances, alterations to the original reptilian fauna are expected to have already occurred.
5. Amphibian species of conservation concern are unlikely to be present at the site or within the surrounding wetland/aquatic habitats due to the lack of sutable habtiat provided for key species.
6. Grassland habitat lost is unlikely to support populations of nesting/breeding bird species of conservation importance.

Overall, the development is expected to have a low impact on faunal species of conservation concern.

6 IMPACT MITIGATION & MANAGEMENT

6.1 Introduction

A strong legislative framework which backs up South Africa's obligations to numerous international conservation agreements creates the necessary enabling legal framework for the protection and management of terrestrial ecosystems and biodiversity in the country. According to the National Environmental Management Act No. 107 of 1998 (NEMA): sensitive, vulnerable, highly dynamic or stressed ecosystems (such as terrestrial forests and grasslands) require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure. NEMA also requires "*a risk-averse and cautious approach which takes into account the limits of current knowledge about the consequences of decisions and actions*". The 'precautionary principle' therefore applies and cost-effective measures must be implemented to pro-actively prevent degradation of the region's water resources and terrestrial biodiversity and the social systems that depend on these ecosystems and habitats. ***Ultimately, the risk of ecological degradation and biodiversity reduction/loss must drive sustainability in development design.***

Of particular importance is the requirement of 'duty of care' with regards to environmental remediation stipulated in Section 28 of NEMA (National Environmental Management Act No.107 of 1998):

> **Duty of care and remediation of environmental damage**: "(1) *Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot be reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment*."

6.2 Approach to Impact Mitigation: *'The Mitigation Hierarchy'*

The protection of terrestrial ecosystems (grasslands in this instance) and associated biodiversity typically begins with the mitigation of risks and avoidance of adverse impacts and where such avoidance is not feasible; to apply appropriate mitigation in the form of reactive practical actions that minimizes or reduces impacts. The management of ecosystems should aim to prevent the occurrence of large-scale damaging events as well as repeated, chronic, persistent, subtle events which can in the long-term be far more damaging (e.g. as a result of sedimentation and pollution).

'Impact Mitigation' is a broad term that covers all components involved in selecting and implementing measures to conserve biodiversity and prevent significant adverse impacts as a result of potentially harmful activities to natural ecosystems. The mitigation of negative impacts on terrestrial vegetation, habitat and associated biodiversity is a legal requirement for authorisation purposes and must take on different forms depending on the significance of impacts and the particulars of the target area being

affected. This generally follows some form of 'mitigation hierarchy' (see Figure 12, below) which aims firstly at avoiding disturbance of ecosystems and loss of biodiversity, and where this cannot be avoided, to minimise, rehabilitate, and then finally offset any remaining significant residual impacts.

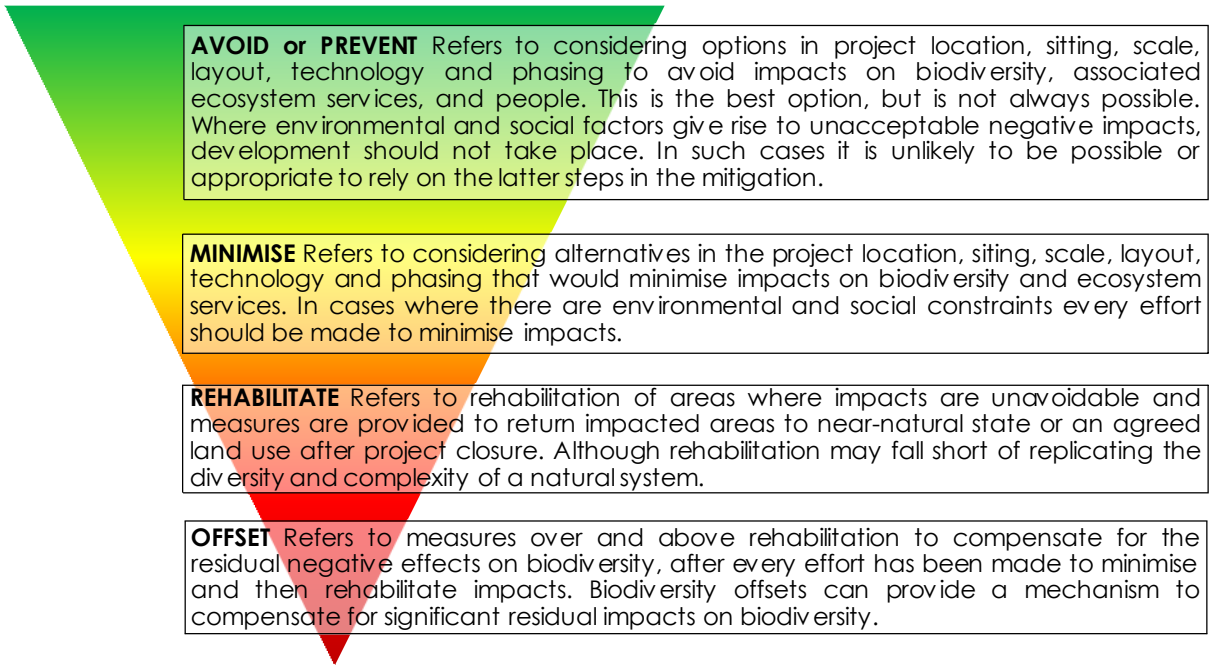


Figure 12 Diagram illustrating the 'mitigation hierarchy' (after DEA *et al.*, 2013).

The mitigation hierarchy is inherently proactive, requiring the on-going and iterative consideration of alternatives in terms of project location, siting, scale, layout, technology and phasing until the proposed development can best be accommodated without incurring significant negative impacts to the receiving environment. In cases where the receiving environment cannot support the development or where the project will destroy the natural resources on which local communities are wholly dependent for their livelihoods or eradicate unique biodiversity; the development may not be feasible and the developer knows of these risks, and can plan to avoid them, the better. In the case of particularly sensitive or threatened/endangered ecosystems, where ecological impacts can be severe, the guiding principle should generally be "*anticipate and prevent*" rather than "*assess and repair*". This principle is also in line with the associated land-use guidelines for 'Critical Biodiversity Areas' or CBAs outlined in the Biodiversity Conservation Plan for the Eastern Cape which are relevant to the study area and which sets out the desired state desired state which should be to '*maintain biodiversity in near-natural state with minimal loss of ecosystem integrity and no transformation of natural habitat should be permitted*' *(*Hayes *et al.*, 2007; Berliner & Desmet, 2007).

Examples of mitigation can include changes to the scale, design, location, siting, process, sequencing, phasing, and management and/or monitoring of the proposed development activities, as well as the restoration or rehabilitation of habitats and vegetation disturbed during construction for example. Where environmental impacts can be severe, the guiding principle should be "anticipate and prevent" rather than "assess and repair". In dealing with potential development risks and impacts to terrestrial

ecosystems and biodiversity, during both the construction and operation phases of the development project, mitigation would be best achieved through stepped-approach to the project which should be implemented as follows:

1. **Avoiding 'direct impacts'** to terrestrial (grassland) ecosystems wherever possible through proper and informed planning;
2. Secondly, **attempting to reduce the risk of incurring significant 'indirect impacts'** (such that associated with storm water runoff, sedimentation, erosion and water pollution) through the integration of appropriate management of storm water, erosion control and pollution control into the development design and through relevant onsite control measures;
3. Thirdly**, addressing residual impacts to areas adjacent to the development site** which may be impacted through onsite **grassland rehabilitation and re-vegetation**; and
4. Lastly, applying relevant **biodiversity offsets** as a means of compensating for residual impacts associated with the loss of primary 'Mthatha Moist Grassland' vegetation at the site.

6.3 Implementation of Mitigation Measures

In terms of Section 2 and Section 28 of NEMA (National Environmental Management Act, 1998), the land owner is responsible for any environmental damage, pollution or ecological degradation caused by their activities "inside and outside the boundaries of the area to which such right, permit or permission relates". In dealing with the range of potential ecological impacts to natural ecosystems and biodiversity highlighted in this report, this would be best achieved through the incorporation of the management & mitigation measures (recommended in this report) into the Construction **Environmental Management Programme (EMPr**) for the development project. The EMPr should be separated into construction & operational phase.

The EMPr should define the responsibilities, budgets and necessary training required for implementing the recommendations made in this report. This will need to include appropriate monitoring as well as impact management and the provision for regular auditing to verify environmental compliance. The EMPr should be enforced and monitored for compliance by a suitably qualified/trained ECO (Environmental Control Officer) with any additional supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that environmental mitigation measures are being implemented and appropriate action is taken where potentially adverse environmental impacts are highlighted through monitoring and surveillance. The ECO will need to be responsible for conducting regular site-inspections of the construction process and activities and reporting back to the relevant environmental authorities with findings of these investigations. The ECO will also need to be responsible for preparing a monitoring programme to evaluate construction compliance with the conditions of the EMPr.

6.4 Development Planning: Environmental Guidelines and Principles

At the forefront of mitigating impacts to the primary grassland habitat on the northern property and surrounds should be the incorporation of ecological and environmental sustainability concepts into the design of the development project, with a central focus on the following:

1. Ensuring that direct impacts to wetlands are avoided wherever possible through ecologically sound and sustainable development layout planning that takes into account the location and sensitivity of the remaining ecological infrastructure at the site;
2. Employing creative design principles and ecologically sensitive methods in infrastructure design and layouts to minimise the risk of indirect impacts;
3. Ensuring that storm water management design and implementation takes into account the requirements of the environment, including wetlands; and
4. Taking necessary efforts aimed at minimising/reducing potential waste streams.

6.4.1 Avoid or restrict transformation of primary grassland

The best environmental option for this project would be to avoid the permanent loss and transformation of primary Mthatha Moist Grassland (*Endangered type)* located on the majority of the northern property. Where complete avoidance is not possible, development should be restricted to conserve at least a representative area of primary grassland on the property (at least areas surrounding wetland habitat which provides a buffering function to wetlands and allows for habitat for aquatic biota to complete their various life-stages). Where losses of primary grassland will be significant, compensation for the loss of habitat and ecosystem functioning will need to be sought through a relevant 'Biodiversity Offset' (*covered under **Chapter 7** of this report).*

Note that the grassland on the southern property is secondary and degraded and of low biodiversity/conservation importance and not representative of the reference vegetation type (Mthatha Moist Grassland, *Endangered*). The transformation of this habitat is regarded as being environmentally acceptable as this will not lead to highly significant impacts and is unlikely to contribute to conservation targets not being met for the Mthatha Moist Grassland vegetation type. An offset would not be required for the total and irreplaceable loss of this secondary degraded grassland type which is not seen as being a noteworthy conservation priority.

6.4.2 Plant Rescue and Translocation

Protected plants occurring on the site appear to be restricted to the southern property where two individuals of the species *Gladiolus ecklonii* were identified in the field (Table 18 and Figure 13). The following recommendations for protected plant rescue and translocation apply:

- Prior to commencement of construction activities, a qualified botanist should be appointed to visit the site during the flowering season / growing season to identify and count any other protected plants that may occur within the grasslands and wetland on the site (these may

have been dormant / not flowering during the site assessment conducted by Eco-Pulse in March 2018).

- Once identified and counted, a protected plant rescue and translocation plan must be compiled and permit applications for the translocation of protected plants must be submitted to the Department of Economic Development, Tourism and Environmental Affairs. This is in accordance with the Transkei Environmental Conservation Decree (No. 9 of 1992) is applicable since Mthatha used to fall within the historic Transkei Sate.
- Once permits have been obtained, all protected plants must be translocated to a temporary facility (nursery) for holding until later use in landscaping at the site.

Table 18. Basic information on *Gladiolus ecklonii*.

Family name:	IRIDACEAE
Botanical name:	***Gladiolus ecklonii***
Common name:	Sheathed Gladiolus
Plant type:	Bulbous herb
Conservation status:	Least Concern **(Provincially Protected)**
Applicable legislation:	Transkei Environmental Conservation Decree (No. 9 of 1992)

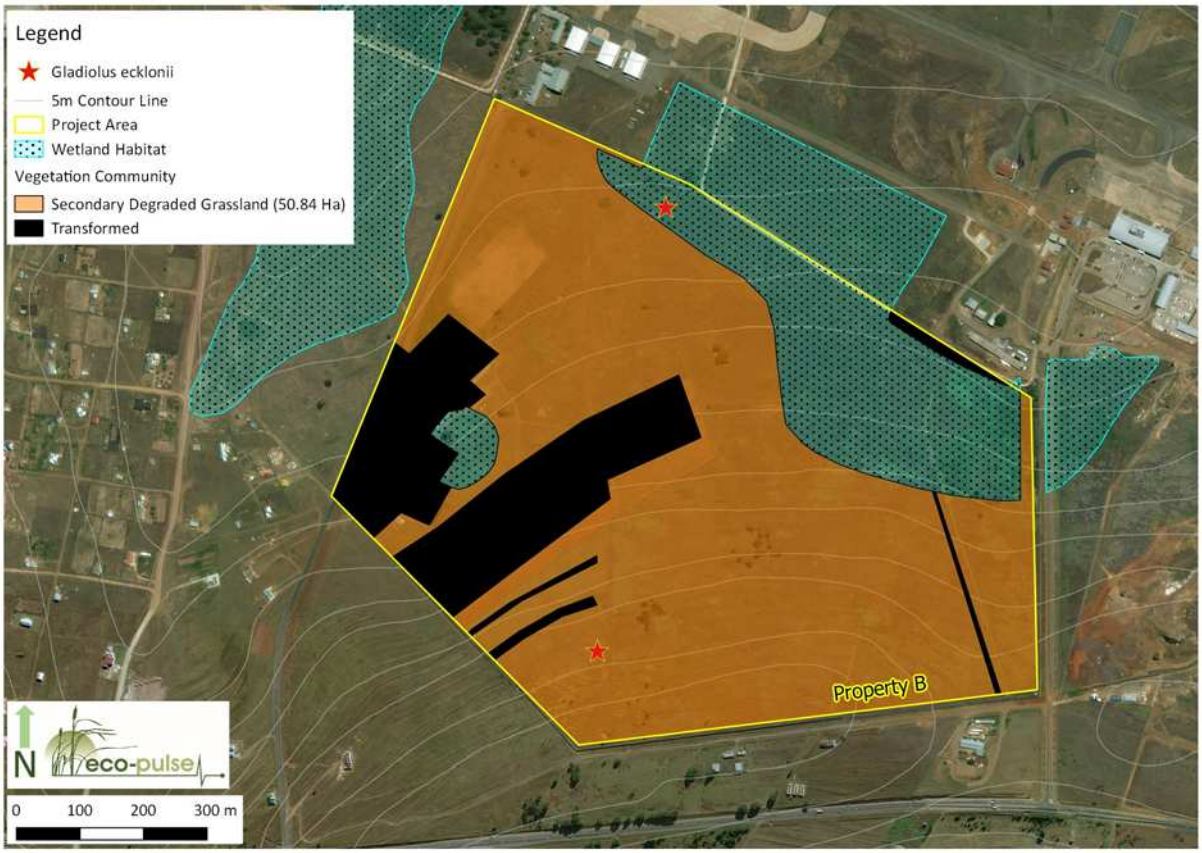


Figure 13 Map showing the location of *Gladiolus ecklonii* specimens located in the field ('red' stars).

6.4.3 Biodiversity Buffer Zones

Biodiversity 'Buffer Zones' (also termed "development set-backs") are essentially strips of vegetated undeveloped land typically designed to act as a protective barrier between human activities and sensitive habitats (such as grasslands and forests), wildlife corridors, breeding and nesting sites (for example). Biodiversity buffer zones have not been considered as part of the mitigation recommendations for this project as no known breeding or nesting sites for local fauna have been identified on the site, no populations of protected flora/fauna are present and no priority wildlife corridors are known to exist.

6.4.4 Storm Water Management & Erosion Control

Detailed planning and design recommendations for storm water management and erosion control are contained in the Specialist Wetland Assessment Report compiled for the project (Eco-Pulse 2018, Report No. EP341-02) and should be referred to. These have not been duplicated here.

6.4.5 Wastewater Management

Detailed planning and design recommendations for wastewater management are contained in the Specialist Wetland Assessment Report compiled for the project (Eco-Pulse 2018, Report No. EP341-02) and should be referred to. These have not been duplicated here.

6.5 Construction-Phase Impact Mitigation & Management

A number of practical measures and onsite controls are also recommended to prevent or limit the impact of the proposed development project during the **construction phase**. These should be included in the Environmental Management Programme (EMPr) for the development project where not already covered by the EMPr. An appropriate fining system should be developed and implemented for any infringements to the EMPr.

The following mitigation measures must be implemented in conjunction with any generic measures provided in the Environmental Management Programme (EMPr):

A. Defining and Management of 'No-Go' Areas

- All construction related activities (soil stockpiles, vegetation clearing etc.) and infrastructure (site camps, laydown and storage) must occur within the boundary of target properties. Areas outside the development footprint or approved access / laydown areas are to be considered to be 'No-Go' areas for workers, machinery, equipment and vehicles.
- The demarcation work must be signed off by the Environmental Control Officer (ECO) before any work commences.
- Demarcations are to remain until construction and rehabilitation is complete.
- Access to and from the development area should be either via existing roads or within the construction servitude.

- Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.
- All disturbed terrestrial areas beyond the construction corridor that are intentionally or accidentally disturbed during the construction phase must be rehabilitated immediately to the satisfaction of the ECO.

B. Managing the Extent of Disturbance

- Vegetation removal/stripping must be limited to the construction footprint. No areas outside the construction footprint may be cleared.
- **Grubbing is not permitted as a method of clearing vegetation**. Any trees needing clearing must be cut down using chain saws and hauled from the site using appropriate machinery.
- The working servitude must be limited to a 10m width on either side of the development footprint where practically possible.
- Vegetation clearing/stripping must only be done as the construction front progresses.
- No clearing of indigenous vegetation outside of the defined working servitudes is permitted for any reason (i.e. for fire wood or medicinal use).

C. Wildlife Management

- Education of workers/employees onsite on not to harm wildlife unnecessarily will assist in mitigating this impact. Contractor induction and staff/labour environmental awareness training needs are to be identified and implemented through staff/contractor environmental induction training. This should include basic environmental training based on the requirements of the EMPr, including training on avoiding and conserving local wildlife.
- No wild animal may under any circumstance be hunted, snared, captured, injured, killed, harmed in any way or removed from the site. This includes animals perceived to be vermin (such as snakes, rats, mice, etc.).
- Any fauna that are found within the construction zone must be moved to the closest point of natural or semi-natural habitat outside the construction corridor.
- The handling and relocation of any animal perceived to be dangerous/venomous/poisonous must be undertaken by a suitably trained individual.
- All vehicles accessing the site should adhere to a low speed limit (30km/h is recommended) to avoid collisions with susceptible species such as reptiles (snakes and lizards).
- No litter, food or other foreign material should be disposed of on the ground or left around the site or within adjacent natural areas and should be placed in demarcated and fenced rubbish and litter areas that are animal proof.
- Ensure that workers accessing the site conduct themselves in an acceptable manner while on site, both during work hours and after hours.
- Temporary noise pollution should be minimized by ensuring the proper maintenance of equipment and vehicles, and tuning of engines and mufflers as well as employing low noise equipment where possible.

- No activities should be permitted at the site after dark (between sunset and sunrise), except for security personnel guarding the development site.

D. Fire Management

- No open fires to be permitted on construction sites. Fires may only be made within the construction camp and only in areas and for purposes approved by the ECO.
- Fire prevention facilities must be present at all hazardous storage facilities.
- Ensure adequate fire-fighting equipment is available and train workers on how to use it.
- Ensure that all workers on site know the proper procedure in case of a fire occurring on site.
- Smoking must not be permitted in areas considered to be a fire hazard.

E. Soil Management (Stockpile Areas)

Measures for managing soil and stockpiles has been covered in detail in the Specialist Wetland Assessment Report compiled for the project (Eco-Pulse 2018, Report No. EP341-02). These have not been duplicated here.

F. Erosion Control Measures

Measures for controlling soil erosion has been covered in detail in the Specialist Wetland Assessment Report compiled for the project (Eco-Pulse 2018, Report No. EP341-02). These have not been duplicated here.

G. Pollution Prevention Measures

Measures for managing pollution risk has been covered in detail in the Specialist Wetland Assessment Report compiled for the project (Eco-Pulse 2018, Report No. EP341-02). These have not been duplicated here.

H. Management of Solid Waste

Measures for managing solid waste generated during construction has been covered in detail in the Specialist Wetland Assessment Report compiled for the project (Eco-Pulse 2018, Report No. EP341-02). These have not been duplicated here.

I. Invasive Alien Plant (IAP) Control

Measures for the control and eradication of IAPs has been covered in detail in the Specialist Wetland Assessment Report compiled for the project (Eco-Pulse 2018, Report No. EP341-02). These have not been duplicated here.

6.6 Post-Construction Rehabilitation Guidelines (disturbed terrestrial habitat)

During construction, there is bound to be disturbance of terrestrial vegetation outside the actual development footprint (for access by vehicles/workers, storage of equipment/material, etc.). Such disturbance may be inevitable and will require rehabilitation post-construction, which is in line with a number of laws that compel the rehabilitation of disturbed natural areas. Of particular importance is the requirement of 'duty of care' with regards to environmental remediation: stipulated in Section 28 of NEMA (National Environmental Management Act, Act 107 of 1998):

- **Duty of care and remediation of environmental damage**: "(1) *Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot be reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment*."

The following guidelines provide a clear and practical means of implementing such rehabilitation once construction activities have ceased or as and when disturbance is created at the site:

1. General Land preparation measures

The following are general land preparation requirements for all areas requiring rehabilitation (prior to any re-vegetation occurring):

- All rubble, litter, foreign materials and waste products needs to be removed from the construction area and disposed of at proper local waste disposal/landfill facilities. Minimise additional disturbance by limiting the use of heavy vehicles and personnel during clean-up operations.
- Any soil stockpiles/spoil material must spread evenly on the ground to match the natural slope.
- All Invasive Alien Plants (IAPs) and weeds must be removed from target sites, preferably by uprooting.
- All embankments are to be shaped to the specification of the project or recommendations of the engineer/ECO.
- Any erosion features within the construction site must be stabilised. Compacted soil infill, rock plugs, gabions, excavation and reshaping or any other suitable measures can be used for this purpose.
- Where significant soil compaction has occurred, the soil may need to be ripped in order to reduce its bulk density thus improving the chances of such that vegetation can become established at the site. Rip and / or scarify all disturbed and compacted areas of the construction site. The ECO with the assistance of the engineer will specify whether ripping and / or scarifying is necessary, based on the site conditions.

- Immediately after ripping and scarifying disturbed areas, about 300mm of topsoil must be applied on top. The thickness of the topsoil maybe reduced at the instruction of the engineer only if the recommended 300mm of topsoil compromises the integrity of the works.
- Topsoil must be placed in the same area from where it was originally stripped. If there is insufficient topsoil available from a particular soil zone to produce the minimum specified depth, topsoil of similar quality may be brought from other areas. Where topsoil is lost during construction as a result of erosion, topsoil will need to be imported to the site and re-established. Such topsoil must be sourced commercially and legally.
- The topsoil must be compacted to similar compaction levels as natural soils in the area. The engineer will provide detailed advice on this.
- For seeding, the soil needs to be prepared to optimise germination. This is typically undertaken by hand hoeing to loosen the soil in the seedbed but should be firm enough to facilitate good contact between the seeds and the soil.

2. Stabilising slopes/Road batters

The following is recommended for stabilisation of slopes and steep road batters:

Prior to revegetation:

- Prior to rehabilitation the site must be stabilised using soft interventions including Grass Fences, Sand bags, geo-cells, fibre rolls and creating benches on the slope. The purpose of these mitigation measures is to reduce soil erosion which may compromise rehabilitation efforts.
- Sediment retaining structures such as silt fences, sandbags, hay bales, brush packs, timber logs must be placed in continuous lines across the slope at regular intervals. The interval between rows of sediment retaining structures will depend on the slope gradient. The steeper it is, the shorter the interval.
- Temporary sediment barriers will need to remain in place until such time as re-vegetation and stabilization of disturbed areas is judged to be a success and the risk of erosion/sedimentation has been reduced to a respectfully low level.
- Creating a benched slope will also help in controlling the velocity of runoff.
- It is important to note that bioengineering interventions are vulnerable to failure if not adequately implemented or poorly maintained.

Post re-vegetation through seeding:

- Immediately after planting the recommended seed mix (hydroseeding / broadcasting of seed), all slopes must be covered with an erosion control blanket such as a SoilSaver. The SoilSaver serves to conserve moisture and hold seeds and soil firmly in place.
- The SoilSaver will require pegging with wooden pegs which can be made from vegetation cleared from the construction footprint.

3. Revegetation of disturbed terrestrial areas

Immediately after preparing the soil, re-vegetation must commence in order to help bind the soil and prevent soil erosion and to inhibit IAP/weed establishment which will compete with the natural vegetation for space, light, nutrients and water. In this regard, the following mitigation measures must be implemented for road batters, roadside drains and disturbed terrestrial habitats/vegetation:

Re-vegetation Method 1: Planting of plugs / sprigs (for disturbed grassland areas)

The following recommendations apply to re-vegetation of areas disturbed during construction:

- The timing of planting is best done shortly before or at the beginning of the growing season (i.e. spring, or at the onset/early summer).
- Once the soil surface is prepared and stabilised, plugs are to be established at moderate densities in alternating rows / patches with areas to be planted. The pattern of planting is to be determined as part of the detailed plan for implementation.
- When using vegetation plugs, the spacing of plugs should not be too wide and planting should be done in patches rather than wider spacing.
- If the soil into which the plugs are to be planted is dry, it will be necessary to add a suitable hydroscopic gel to the receiving cavity at the time the plug is planted (Granger, 2014).
- It is essential that when a plug is planted that the receiving cavity is slightly deeper than the length of the root ball so that when the cavity is pinched closed a slight depression remains around the base of the leaves. This is especially important if the plugs are small and planted into dry soil even though hydroscopic gel has been added to the cavity.
- Live plugs of suitable indigenous *grasses such as Themeda triandra, Hyparrhenia hirta, etc.* can be obtained from well-vegetated 'donor grassland sites' within the study area.
- Note that any harvesting from donor grassland areas must be undertaken with caution so as not to unduly disturb the donor site. For whole/growing plants, ensure that plants are dug up with as much of their roots intact and such that the soil around the roots is not disturbed (i.e. intact root ball). Care also needs to be taken that weeds/alien plants are not transplanted with the donor plants.
- Collected plants should be replanted as quickly as possible following removal (i.e. within hours of harvesting).
- Large clumps of plants can be carefully separated into smaller clumps or into several individual stems with attached roots, known as slips.
- The plants should be planted with their roots in as much of the original soil medium as possible from which they were removed.
- When planting the material, dig a hole deep enough to ensure that the roots do not bend upwards.
- The soil around the plant should be firmly compacted.
- Temporary erosion protection measures must only be removed once good vegetation cover has established.

- It is essential that survival of all plants be monitored closely for at least the first eight weeks from the day following their planting and any dead plants be replaced as soon as possible.
- **No exotic/alien plants are to be used in re-vegetation.**

Re-vegetation Method 2: Seeding by broadcasting or hydroseeding (for areas with bare soils/completely cleared of vegetation)

- Hydroseeding or manual broadcasting of seed is the second preferred option to re-vegetating slopes and areas with bare soils completely void of vegetation. The advantages of hydroseeding include faster germination, increased plant survival, and the ability to cover large, often inaccessible areas rapidly.
- The slurry (basic materials) for hydroseeding must consist of water, seed, fertiliser, anti-erosion compounds (soil binders) and organic supplements to enhance grass growth.
- Prior to seeding, water must be sprayed over target area to provide added moisture.
- The target groundcover of re-vegetated areas shall be no less than 80% of specified vegetation and there must be no bare patches of more than 500 x 500 mm in maximum dimension.
- Ideal species for seeding are mat forming or tufted pioneer grasses that can become quickly established at the site to provide immediate cover in order to stabilise soils and reduce erosion risk. The intention here is that initial pioneer grass cover (annuals) will then be replaced by sub-climax and climax grass species naturally occurring at the site, such as *Themeda triandra,* which will typically out-compete pioneer grasses over time through natural successional processes. Recommended pioneer grasses for attaining an initial cover at disturbed sites (based on the climate and soil occurring at the site) may include *Cynodon dactylon* (Couch grass), *Chloris gayana* (Rhodes grass) and *Eragrostis tef*.
- **No exotic/alien plants are to be used in re-vegetation.**

6.7 Operational-Phase Impact Mitigation & Management

A number of management and mitigation measures are recommended to address the operational impacts of the project and it is recommended that these be included in an operational EMPr for the operational development project and related activities:

A. Access Control

Access to remaining / untransformed primary grassland habitat on the northern property should be controlled / restricted to promote the preservation of these sensitive environments.

B. Management of Disturbed Areas

All maintenance and repair work to infrastructure located within or adjoining open spaces and landscaped areas will need to comply with recommendations and guidelines provided for the construction phase.

C. Erosion Control and embankment stability Concerns

Where soil erosion or bank instability concerns exists at the site, particularly for road embankments, it is recommended that these areas be monitored to inform the need for further intervention. Where erosion/instability concerns persist, these will need to be addressed as per the following guidelines:

- Identify eroded areas and assess whether soft or hard engineered options will be required to stabilise eroded areas such as gullies.
- Methods such as shaping of eroded areas and revegetation of bare surfaces may be considered for minor eroded areas.
- Larger eroded areas, such as large erosion gulley's, created by concentrated flows may require hardened interventions such as concrete/gabions to halt erosion and rehabilitate these areas. In these instances, a rehabilitation engineer would need to be involved in recommending and designing interventions to halt erosion.

D. IAP (Invasive Alien Plant) Control

In line with the requirements of Section 2(2) and Section 3 (2) the National Environmental Management: Biodiversity Act (NEM:BA), which obligates the landowner/developer to control IAPs on his property, all IAPs within the property must be controlled on an on-going basis. The need for this exercise will need to be reviewed based on the presence of IAPs during the operational phase and the ECO will advise accordingly.

E. Landscaping Recommendations

It is recommended that landscaping promote the use of indigenous species common to the region and that as much natural ground cover is established (naturally) on the site to help with binding soils and encouraging water infiltration, thus reducing overland flows and the pressure on storm water management infrastructure.

F. Waste Minimisation, Reuse and Recycling

Waste minimisation recommendations have been covered already in the Specialist Wetland Assessment Report compiled for the project (Eco-Pulse 2018, Report No. EP341-02) and has not been duplicated here.

G. Maintenance of Storm Water Infrastructure

The maintenance of storm water infrastructure has been covered in detail in the Specialist Wetland Assessment Report compiled for the project (Eco-Pulse 2018, Report No. EP341-02) and has not been duplicated here.

6.8 General Ecological Monitoring Requirements

Monitoring is required in order to ensure that terrestrial ecosystems and associated biodiversity associated with the proposed development is protected and maintained without incurring net loss as a result of the project. It is recommended that a Monitoring Programme be developed and implemented in accordance with the following guidelines:

A. Responsibilities for Monitoring

Compliance monitoring will be the responsibility of a suitably qualified/trained ECO (Environmental Control Officer) with any additional supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that monitoring is undertaken effectively and appropriately.

B. Construction Monitoring Objectives

Key monitoring objectives during the construction-phase should include:

- Ensuring that management and mitigation measure are adequately implemented to limit the potential impact on aquatic resources; and
- Ensuring that disturbed areas have been adequately to stabilise and rehabilitated to minimise residual impacts to affected resources.

C. Record keeping

The ECO shall keep a record of activities occurring on site, including but not limited to:

- Meetings attended;
- Method Statements received, accepted and approved;
- Issues arising on site and cases of non-compliance with the EMPr;
- Corrective actions taken to solve problems that arise;
- Penalties/fines issued; and
- Complaints from interested and affected parties.

D. Construction Phase Monitoring Requirements

This involves the monitoring of construction related impacts as identified in this report. Regular monitoring of the construction activities is critical to ensure that any problems with are picked up in a timeous manner. In this regard, the following potential concerns should be taken into consideration:

- Destruction of habitat outside the construction zone including 'No Go' areas;
- Destruction of conservation important/protected plants and trees.
- Signs of intense or excessive erosion (gullies, rills, scouring and headcuts) and/or sedimentation within, along the edge and/or immediately downslope of the construction zone;
- Erosion of disturbed soils, road batters and soil stockpiles by surface wash processes;

- Pollution of soils and water (with a particular focus on hazardous substances such as fuels, oils and cement products);
- Poorly maintained and damaged erosion control measures (e.g. sand bags, silt fences and silt curtains).

These risks can be monitored visually on-site by the ECO (together with construction staff) with relative ease and should be reported on regularly during the construction process. Any concerns noted should be prioritised for immediate corrective action and implemented as soon as possible.

A. Directly after construction (rehabilitation effectiveness)

This involves monitoring the effectiveness of rehabilitation activities. The monitoring and evaluation of rehabilitation activities and outcomes is critical in assessing the extent to which the rehabilitation has achieved what it set out to accomplish. Monitoring the condition of the re-established vegetation cover will be necessary to assess particular aftercare or plant maintenance requirements. Visual monitoring of the site must be carried out in accordance with the rehabilitation plan at regular intervals during the rehabilitation process. The benefit of regular monitoring will be that problems can be quickly identified and easily addressed during the process whilst rehabilitation teams are busy at the site.

The monitoring process must be conducted in the presence of the main contractor by a suitably qualified external/independent party, such as an Environmental Control Officer (ECO) but can also be undertaken by the Environmental Site Officer (ESO), Competent Authority and Interested and Affected Parties (I&APs). Should any defects or failures be identified during each monitoring exercise, the main contractor must take all necessary and relevant actions address these immediately and accordingly. The recovery of disturbed areas that have been rehabilitated should be assessed for at least the first 3 months following rehabilitation completion to assess the success of rehabilitation actions. Any areas that are not progressing satisfactorily must be identified (e.g. on a map) and action must be taken to actively re-vegetate these areas. If natural recovery is progressing well, no further intervention may be required. The ECO should assess the need / desirability for further monitoring and control after the first 6 months and include any recommendations for further action to the relevant environmental authority. Table 19 (below) provides a basic monitoring framework and checklist of aspects of the rehabilitation plan to be monitored.

Table 19. Description of basic visual monitoring requirements to assess the success of areas rehabilitated.

Aspect	Description	Frequency of monitoring
Solid waste and construction rubble	Has all solid waste, litter and construction rubble been adequately cleared from the site and disposed of at a registered site?	Weekly
Salvaged indigenous species	Are salvaged indigenous species being watered twice a week? Are there any mortalities?	Bi-weekly
Watering/maintenance requirements of planted grass,	What is the plant survival rate? Are there areas of bare soil/poor growth?	Daily until plants are established,

Aspect	Description	Frequency of monitoring
trees and shrubs	Is there a need for follow-up revegetation?	thereafter weekly
Response of planted grass, trees and shrubs	What is the progress of revegetation planting? Are there areas of bare soil/poor growth?	Bi-weekly
Alien plant control and eradication (including follow-up control	Are there dense infestations of alien plants within and around the rehabilitated site? (Seedlings, shoots, coppice growth, etc.) Is there a need for further follow-up control?	Weekly during and immediately after rehab, thereafter on a monthly basis
Sediment barriers/traps and erosion control measures	Are sediment/erosion controls functioning adequately? Have these been properly maintained? Are there signs of erosion/sedimentation?	Daily during rehabilitation

At the completion of site rehabilitation, an evaluation of the success of the rehabilitation project will need to be undertaken in order to facilitate the dissemination of lessons learnt and provide a means of reporting on the success of specific rehabilitation initiatives. In order to evaluate project success, the following attributes/rehabilitation indicators need to be clearly defined and understood:

i. Aspects/values of interest referred to herewith as 'concerns';
ii. Level of achievement required to consider the rehabilitation exercise successful; and
iii. Quantitative performance level used as a desirable target.

Table 20, below, provides for basic rehabilitation evaluation guidelines useful for evaluating the success of the rehabilitation project. The evaluation process can be conducted by the developer, Competent Authority, I&APs or an independent ECO after a period of 3-6 months post-completion of the rehabilitation process. An external audit report on performance should ideally be provided as part of the rehabilitation project success evaluation process.

Table 20. Summary guideline for evaluating the success of rehabilitation.

Item	Concern	Performance indicator	Desired Target
1	There should be low levels of Invasive Alien Plants	IAP species cover/abundance	<10% IAP cover
2	Indigenous vegetation should be re-instated	Indigenous species cover/abundance	>80% indigenous cover
3	Erosion and slope instability should be managed appropriately	Signs of soil erosion and slope/bank instability	No signs of erosion
4	Terrestrial areas should be adequately re-planted	Grass cover/abundance	No large gaps in the vegetation structure or bare soils
5	There should be no foreign solid waste materials or waste within rehabilitated areas	Solid waste/litter levels	No solid waste remaining

7 BIODIVERSITY OFFSET REQUIREMENTS

7.1 National and Regional Guidance on Biodiversity Offsetting

According to the latest 'Draft National Policy on Biodiversity Offsetting in South Africa' (DEA, September 2017), biodiversity offsetting is simply defined as:

> "*The process of establishing and **quantifying** the residual negative effects on biodiversity and ecological infrastructure resulting from an activity after every effort has been made to avoid, prevent, reduce, moderate, minimise and rehabilitate impacts and then **counter-balancing** these residual effects through interventions that avoid, prevent, reduce, moderate, minimise and rehabilitate impacts or impacted areas elsewhere in order to achieve a net biodiversity and ecological infrastructure gain*."

This policy aims to provide a set of "minimum requirements" for biodiversity offsets and makes specific provision for offset authorities to compile and publish best-practise guidelines that are aligned with this policy. As such guidelines are lacking for the Eastern Cape, the National Guidelines would therefore be applicable only.

The Draft National Policy also sets out the principal objective of biodiversity offsetting as being "*to slow and progressively reverse the erosion and degradation of our biodiversity and ecological infrastructure resulting from the residual negative impacts of development by counterbalancing these residual negative effects, after every effort has been made to avoid, prevent, reduce, moderate, minimise and then rehabilitate impacts, through avoiding, preventing, reducing, moderating, minimising and rehabilitating current or potential impacts or impacted areas elsewhere*".

Biodiversity offsets are therefore regarded as an important step in the 'mitigation hierarchy' and are recognised for their potential to contribute towards priority actions proposed by the 2011 National Biodiversity Assessment (NBA), namely:

i. ***Reducing loss and degradation of natural habitat in priority areas***. These actions focus on preventing loss and degradation of natural habitat in those biodiversity priority areas that are still in good ecological condition.

ii. ***Protecting critical ecosystems***. These actions focus on consolidating and expanding the protected area network as well as strengthening the effectiveness of existing protected areas.

iii. ***Restoring and enhancing ecological infrastructure***. These actions focus on active interventions required to restore those biodiversity priority areas that are currently not in good ecological condition, in order to enhance ecological infrastructure and support delivery of ecosystem services.

The need for a biodiversity offset is typically evaluated based on the significance of residual impacts to biodiversity, including direct, indirect and cumulative impacts. Simply stated, the significance of an

impact relates to the amount of change to the environment that would be acceptable to affected communities and society as a whole. Guidance on defining impact significance is still somewhat lacking in the draft National Biodiversity Offsetting Policy.

7.2 Impact significance contextualised

The significance assessment methodology developed by Eco-Pulse Consulting and applied in this wetland impact assessment (see Chapter 5 of this report) is largely aligned with the guideline and has been developed to specifically cater for wetland/biodiversity impacts by customizing impact descriptions such that they integrate threat status into the assessment of extent and intensity as part of the impact significance process. The method also specifically addresses different components of wetland biodiversity by considering impacts to (i) ecosystems (different vegetation types), (ii) species of conservation concern and (iii) ecosystem services. As part of this assessment, consideration is also given to direct, indirect and cumulative impacts on biodiversity pattern and process (specifically impacts that affect species movement). This methodology is therefore regarded as being appropriate for assessing the significance of impacts associated with planned developments and the need for biodiversity offsets for this development application.

Whilst impact significance is strongly influenced by the extent of impact, significance is also strongly influenced by the broader context of transformation and the extent to which existing sustainability thresholds (typically defined as conservation targets) have been compromised. As loss continues, the importance of safeguarding remaining habitat remnants increases. If steps are not taken to counter on-going impacts, sustainability thresholds for biodiversity are exceeded as reflected by a critically endangered (CR) threat status.

The contextual overview of the study area provided in Section 3.2 of this ecological report illustrates that primary **Mthatha Moist grassland** vegetation (as found occurring on the 'northern' development property) is considered 'endangered' in terms of conservation/threat status at a national level (Mucina & Rutherford, 2006). This context shows that this grassland vegetation type is under threat nationally and provincially and suggests that further losses to this vegetation type are likely to constitute a 'significant' impact. This is also relevant in light of the identification of the development site as a "*Terrestrial Critical Biodiversity Area (CBA) level 1* 2 (T2)" in terms of the Eastern Cape Biodiversity Conservation Plan, which represents in this instance sections of near-natural landscape and the presence of representative 'Endangered' vegetation types and which require high levels of protection and the recommended management objective for such areas should be to: '*maintain biodiversity in near-natural state with minimal loss of ecosystem integrity and no transformation of natural habitat should be permitted*' (Hayes et al., 2007; Berliner & Desmet, 2007)

7.3 Preliminary assessment of the need for wetland offsets

While the impact mitigation and risk management measures and guidelines proposed in Chapter 6 of this wetland report aim to reduce residual impacts to aquatic ecosystems, based on the proposed

development layout (see Figure 10), large-scale transformation of primary grassland habitat is being pursued to maximise the developable 'agricultural; area at the site of the WC: SEZ Phase 1 development (northern property). Should the current development plan be authorised by the relevant environmental authorities based on the development motivation, this will result in the permanent loss of an estimated **141 ha of 'endangered' primary Mthatha Moist Grassland vegetation** and habitat which initially would be considered to be of **'high' impact significance** and should warrant the consideration of a biodiversity offset as a means of compensating for the permanent loss of grassland vegetation and habitat (i.e. residual impacts).

7.4 Preliminary offset recommendations

The need and desirability of biodiversity offsets will still need to be confirmed by the regulating authority. The extent of the area to target for an offset (based on losses, threat status of the vegetation type and ecosystem conservation ratios/multipliers), together with the mechanisms and cost implications for doing so, will also need to be investigated once confirmation for the need for an offset has been obtained from the regulating authorities. The offset would need to be determined based on exact level of threat and taking into account levels of protection, ecological condition, presence of threatened species, and contribution to important ecological processes and ecosystem services. The minimum appropriate size of a viable offset should be determined by provincial guidance.

An appropriate **Biodiversity Offset Plan** would need to be developed under this scenario if approved by the relevant environmental authorities (the development of such a plan is beyond the scope of work of this appointment). The offset plan would need to confirm offset targets for residual grassland vegetation and habitat losses, identify suitable offset receiving areas and outline the process for the establishment, governance and management of the offset in collaboration with the assessing environmental and conservation authorities at the national and provincial levels of Government.

It must however be reiterated that a Biodiversity Offset should be seen as a **last resort measure after all other forms of impact mitigation and development planning have been exhausted.**

The developer should also be aware that a Biodiversity Offset is typically a complex and costly exercise and these costs and implications should be carefully considered before committing to such a process.

8 CONCLUSION

The Coega Development Corporation (CDC) intends to develop Phase 1 of the Wild Coast Special Economic Zone (ECSEZ), located immediately adjacent to the existing Mthatha Airport north-west of Mthatha town in the Eastern Cape Province of South Africa. Eco-Pulse Environmental Consulting Services assessed the terrestrial ecosystems and biodiversity associated with the project in early summer 2018) to inform the environmental requirements for the project in terms of the NEMA and NEMA: EIA regulations.

The Specialist Terrestrial Ecological Assessment undertaken by Eco-Pulse identified two (2) terrestrial vegetation communities, including (i) a Slightly Modified Primary Mthatha Moist Grassland of 'moderately-high' EIS located on the northern property and accounting for roughly 141 hectares (ha) of the site and (ii) a Degraded Secondary Grassland of 'Low' EIS and found exclusively on the southern property and accounting for roughly 45 hectares (ha) of the site. Based on the desktop POC assessment for fauna (wildlife) undertaken, the probability of the site being important for hosting Red data listed/threatened populations or even individuals is considered to be relatively low and, the development is expected to have a low impact on faunal species of conservation concern.

Protected plants occurring on the site appeared to be restricted to the southern property where two individuals of the species *Gladiolus ecklonii* were identified in the field. It is recommended that a protected plant rescue and translocation plan must be compiled and implemented and the relevant permit applications for the translocation of protected plants be submitted.

The most significant ecological impact likely to be associated with the proposed development pertains to the potential permanent transformation and loss of a substantial amount of primary Mthatha Moist Grassland vegetation and habitat (~141 ha). Whilst initial measures aimed at the avoidance of impacts in accordance with the 'mitigation hierarchy' come highly recommended (as per Chapter 6 of this report), where avoidance of impacts leading to the transformation of the primary grassland vegetation and habitat will not be practically possible, impacts should warrant the need for a suitable 'Biodiversity Offset' as a means of compensating for the irreplaceable loss of primary Mthatha Moist Grassland. The need and desirability of biodiversity offsets will still need to be confirmed by the regulating authority. A biodiversity offset plan will need to be developed should an offset be pursued by the developer which will require the finalisation of assumed losses, extent of the area to target for an offset (based on losses, threat status of the vegetation type and ecosystem conservation ratios/multipliers), together with the mechanisms and cost implications for doing so to be investigated once confirmation for the need for an offset has been obtained from the regulating authorities.

A Biodiversity Offset should be seen as a last resort measure after all other forms of impact mitigation and development planning have been exhausted. The developer should also be aware that a Biodiversity Offset is typically a complex and costly exercise and these costs and implications should be carefully considered before committing to such a process.

Should you have any queries regarding the findings and recommendations in this Specialist Terrestrial Ecological Assessment report, please contact Eco-Pulse Environmental Consulting Services directly.

Yours faithfully

Adam Teixeira-Leite *Pr.Sci.Nat. (Ecological Science)*
Senior Scientist & Wetland/Terrestrial Ecologist: Eco-Pulse Environmental Consulting Services
Email: ateixeira@eco-pulse.co.za | **Mobile:** (+27) 82 310 6769

9 REFERENCES

Angold, P., 1997. The impact of a road upon adjacent heathland vegetation: effects on plant species composition. Journal of Applied Ecology, 34(2):409-417.

Auckland Regional Council. (1999). Erosion & sediment control: Guidelines for Land Disturbing Activities in the Auckland Region. Auckland.

Avian Demographic Unit. 2016. Online database.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J., De Villiers, M.S., (eds). 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Suricata 1. South African National Biodiversity Institute (SANBI), Pretoria.

Berliner, D. and Desmet, P. 2007. Eastern Cape Biodiversity Conservation Plan: Technical Report. Department of Water Affairs and Forestry Project No 2005-012, Pretoria. 1 August 2007.

Chittenden, H., 2009. Robert's Bird Guide: A comprehensive field guide to over 950 bird species in southern Africa

Coffin, A. (2007). From roadkill to road ecology: A review of the ecological effects of roads . Journal of Transport Geography, 15(5):396-406.

DEAT (Department of Environmental Affairs and Tourism). 1998. Guideline Document on EIA Regulations of Environmental Affairs and Tourism.

Department of Environmental Affairs (DEA), 2017. Policy on Biodiversity Offsetting in South Africa (Draft). Version 2 (Revision 1), Friday, 22 September 2017.

Endangered Wildlife Trust (EWT). Red Data Book of the Mammals of South Africa: A Conservation Assessment.

Farmer A. 1991. The effects of Dust on Vegetation – A review. Environmental Pollution 79 (1993) 63 – 75.

Gelbard, J., & Belnap, J. (2003). Roads as conduits for exotic plant invasions in a semiarid landscape. Conservation Biology, 17(2):420.

Hayes, Y., Berliner, D. and Desmet, P. 2007. Eastern Cape Biodiversity Conservation Plan Handbook. Department of Water Affairs and Forestry Project No 2005-012, King William's Town. August 2007.

IUCN. 2016. The IUCN Red List of Threatened Species. Available at: www.iucnredlist.org. Accessed: 15 August 2016.

Kaytech. (2016, April 6). WP content. Retrieved from kaytech.co.za: http://kaytech.co.za/wp-content/uploads/2014/05/GrassFence-data-sheet.pdf

Lawrence, D.P., 2007. Impact significance determination - Designing an approach. Environmental Impact Assessment Review 27 (2007) 730 - 754.

Marais, J., 2004. A complete guide to the snakes of Southern Africa. Second edition. Struik Publishers, Cape Town, South Africa.

Mucina, L., & Rutherford, M. 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. Pretoria: South African National Biodiversity Institute.

Passmore, N.I. and Carruthers, V.C., (1995). South African Frogs: A complete guide. Southern Book Publishers & Witwatersrand University Press.

Rodgers, J. A., Jr. and S. T. Schwikert. 2003. Buffer zone distances to protect foraging and loafing waterbirds from disturbance by airboats in Florida. Waterbirds 26: 437-443

SANBI (South African Biodiversity Institute), 2010. Threatened Species: A guide to Red Lists and their use in conservation. Threatened Species Programme, Pretoria, South Africa. 28 pp. SANBI, on-line at http://redlist.sanbi.org/eiaguidelines.php

SANBI (South African Biodiversity Institute), PRECIS (National Herbarium Pretoria Computerized Information System) http://posa.sanbi.org

Shulze, R. 1997. South African altas of agrohydrology and climatology. Report TT82/96. Pretoria: Water Research Commission.

Southern African Bird Atlas Project. Online database: http://sabap2.adu.org.za/ Accessed May/June 2016.

Stuart, C. and Stuart, T., (2007). Field guide to mammals of Southern Africa. Fourth Edition. Struik Publishers.

Supe GN and Gawande SM. 2015. Effects of Dustfall on Vegetation. Internation Journal of Science and Research

Trombulak, S., & Frissell, C. (2000). Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology, 14(1):18-30.

10 ANNEXURES

ANNEXURE A: Plant Species List

NB: alien exotic species shown in "Red" text & conservation important plants shaded in "green").

No.	Species Name	Common Name	Type	Species Status	Conservation Status	Mthatha Moist Grassland	Secondary Degraded Grassland
1.	*Acacia mearnsii*	Black wattle	Tree	Alien (invasive)	N/A	x	x
2.	*Acacia natalitia*		Tree	Indigenous	LC		x
3.	*Ajuga ophrydis*	Bugle Plant	Herb	Indigenous	LC	x	
4.	*Alectra sessiliflora*		Herb (upright)	Indigenous	LC	x	
5.	*Andropogon eucomus*	Snowflake grass	Grass	Indigenous	LC	x	x
6.	*Anthospermum rigidum*		Herb	Indigenous	LC		x
7.	*Argyrolobium tuberosum*	Little Russet Pea	Herb	Indigenous	LC	x	
8.	*Bidens pilosa*	Blackjack	Herb (upright)	Alien (weed)	N/A	x	x
9.	*Bulbine abyssinica*		Herb	Indigenous	LC	x	
10.	*Bulbine asphodeloides*		Herb	Indigenous	LC	x	x
11.	*Bulbine narcissifolia*		Herb	Indigenous	LC	x	
12.	*Centella asiatica*	Marsh pennywort	Herb (flat growing)	Indigenous (weed)	LC	x	x
13.	*Cephalaria sp.*		Herb	Indigenous	LC	x	
14.	*Chaetacanthus burchellii*		Herb	Indigenous	LC	x	
15.	*Chamaecrista capensis*		Herb	Indigenous	LC	x	
16.	*Chamaecrista mimosoides*	Dwarf Senna	Herb (upright)	Indigenous	LC	x	x
17.	*Cirsium vulgare*	Scotch thistle	Herb (upright)	Alien (weed)	N/A	x	
18.	*Commelina africana*	Yellow commelina	Herb (flat growing)	Indigenous		x	x
19.	*Convolvulus saggitatus*		Herb	Indigenous	LC	x	
20.	*Conyza canadensis*	Horseweed fleabane	Herb (upright)	Alien (weed)	N/A	x	x
21.	*Conyza chilensis*	Fleabane	Herb (upright)	Alien (weed)	N/A	x	x
22.	*Crabbea hirsuta*		Herb	Indigenous	LC	x	
23.	*Cucumis zeyheri*		Herb	Indigenous (weed)	LC	x	
24.	*Cyanotis speciosa*	Wondering Jew	Herb	Indigenous	LC	x	
25.	*Diclis reptans*	Dwarf Snapdragon	Herb	Indigenous	LC	x	x
26.	*Dicoma anomala*		Herb	Indigenous	LC	x	
27.	*Digitaria eriantha*	Common finger grass	Grass/reed	Indigenous	LC	x	x
28.	*Eriospermum sp.*		Herb	Indigenous	LC	x	
29.	*Falkia repens*		Herb	Indigenous	LC	x	

No.	Species Name	Common Name	Type	Species Status	Conservation Status	Mthatha Moist Grassland	Secondary Degraded Grassland
30.	*Gazania krebsiana*		Herb (upright)	Indigenous (weed)	LC	x	
31.	*Gladiolus sp.*		Herb	Indigenous	Provincially Protected	x	x
32.	*Gomphocarpus physocarpus*	Milkweed	Herb (upright)	Indigenous	LC	x	x
33.	*Helichrysum nudifolium* var. *nudifolium*	Hottentot's tea	Herb (upright)	Indigenous	LC	x	x
34.	*Helichrysum odoratissimum*		Herb	Indigenous	LC	x	x
35.	*Helichrysum rugulosum*		Herb (upright)	Indigenous	LC	x	x
36.	*Hermannia parviflora*		Herb	Indigenous	LC	x	
37.	*Hermannia* sp.		Herb	Indigenous	LC	x	
38.	*Hibiscus aethiopicus*		Herb	Indigenous	LC	x	
39.	*Hyparrhenia dregeana*		Grass	Indigenous	LC	x	x
40.	*Hyparrhenia hirta*	Common thatching grass	Grass	Indigenous	LC	x	x
41.	*Hypoxis acuminata*		Herb (upright)	Indigenous	LC	x	
42.	*Hypoxis argentea*		Herb (upright)	Indigenous	LC	x	
43.	*Hypoxis hemerocallidea*	Star-flower	Herb (upright)	Indigenous	LC	x	
44.	*Imperata cylindrica*	Cottonwool grass	Grass	Indigenous	LC	x	
45.	*Indigofera hilaris*		Herb	Indigenous	LC	x	
46.	*Indigofera zeyheri*		Herb	Indigenous	LC		x
47.	*Ipomoea crassipes*		Climber	Indigenous	LC	x	
48.	*Ledebouria marginata*		Herb (flat growing)	Indigenous	LC	x	
49.	*Ledebouria ovatifolia*		Herb	Indigenous	LC	x	
50.	*Ledebouria revoluta*		Herb	Indigenous	LC	x	
51.	*Linum thunbergii*		Herb	Indigenous	LC	x	
52.	*Lobelia flaccida*		Herb (upright)	Indigenous	LC	x	x
53.	*Melilotus albus*	White sweet clover	Herb/shrub	Alien (weed)	N/A	x	
54.	*Melinis repens*	Natal red-top	Grass/reed	Indigenous	LC	x	
55.	*Monopsis uniflora*		Herb (upright)	Indigenous	LC		x
56.	*Oenothera rosea*			Alien (weed)	N/A	x	
57.	*Oenothera sp.*			Alien (weed)	N/A	x	x
58.	*Oxalis sp.*		Herb (flat growing)	Indigenous	LC	x	x
59.	*Paspalum dilatatum*	Dallis grass	Grass	Indigenous (weed)	LC	x	x
60.	*Pelargonium alchemelloides*		Herb (upright)	Indigenous	LC	x	
61.	*Pelargonium luridum*	Wild geranium	Herb	Indigenous	LC	x	
62.	*Polygala* sp.		Herb	Indigenous	LC	x	
63.	*Rhynchosia adenodes*		Herb	Indigenous	LC	x	

No.	Species Name	Common Name	Type	Species Status	Conservation Status	Mthatha Moist Grassland	Secondary Degraded Grassland
64.	*Richardia brasiliensis*	Mexican Richardia	Herb (upright)	Alien (weed)	N/A	x	x
65.	*Schizocarpus nervosus*		Herb	Indigenous	LC	x	
66.	*Schkuhria pinnata*	Dwarf Marigold	herb	Alien (invasive)	N/A	x	
67.	*Searsia pyrioides* var. *integrifolia*	Mountain Firethorn Currant	Shrub	Indigenous	LC	x	
68.	*Senecio bupleurioides*		Herb (upright)	Indigenous	LC	x	
69.	*Senecio glaberrimus*		Herb (upright)	Indigenous	LC	x	
70.	*Senecio madagascarensis*		Herb (upright)	Indigenous	LC	x	
71.	*Senecio pterophorus*		Herb (upright)	Indigenous	LC	x	
72.	*Senecio sp. (not in flower)*		Herb (upright)	Indigenous	LC	x	x
73.	*Solamun alaeagnifolium*		Tree	Alien (invasive)	N/A	x	x
74.	*Sporobolus africanus*	Rat's tail dropseed	Grass	Indigenous	LC	x	x
75.	*Stachys sp.*		Herb	Indigenous	LC	x	
76.	*Striga asiatica*	Witchweed		Indigenous	LC	x	
77.	*Sutera sp.*			Indigenous	LC	x	x
78.	*Tagetes minuta*	Khaki weed	Herb (upright)	Alien (weed)	N/A	x	x
79.	*Tephrosia capensis*		Herb	Indigenous	LC	x	
80.	*Teucrium trifidum*		Herb (upright)	Indigenous	LC	x	
81.	*Themeda triandra*	Red grass	Grass	Indigenous	LC	x	x
82.	*Thunbergia capensis*		Herb	Indigenous	LC	x	
83.	*Tolpis capensis*		Herb	Indigenous	LC	x	
84.	*Verbena bonariensis*	Purple-top	Herb (upright)	Alien (invasive)	N/A		x
85.	*Verbena officialis*	Purple top	herb	Alien (weed)	N/A		x
86.	*Vernonia natalensis*		Herb	Indigenous	LC	x	
87.	*Vigna vexillata*			Indigenous	LC	x	
88.	*Wahlenbergia stellariodes*		Herb (upright)	Indigenous	LC	x	
89.	*Xysmalobium undulatum*	Milkwort	Herb (upright)	Indigenous	LC	x	
90.	*Zornia capensis*	Caterpillar bean	Herb	Indigenous	LC	x	x

ANNEXURE B: Impact Significance Assessment Tables

B1. Construction-Phase Ecological Impact Significance.

CONSTRUCTION PHASE IMPACT SIGNFICANCE: *'Poor' or 'Standard' Impact Mitigation Scenario*								
No.	**Nature of Impact**	**Status**	**Extent**	**Intensity**	**Duration**	**Probability**	**Impact Significance**	**Confidence**
C1	Direct physical destruction of flora and fauna	Negative	Provincial / National	Moderately-High	Permanent	Highly Probable	High	High
C2	Degradation and fragmentation of habitat	Negative	Local	Moderately-High	Long-term	Highly Probable	Moderate	Medium
C3	Pollution of soil, water and vegetation	Negative	Local	Moderately-High	Long-term	Probable	Moderate	Medium
C4	Nuisance Factors (Noise, Vibrations, Light)	Negative	Local	Moderate	Short-term	Highly Probable	Moderately-Low	Low

CONSTRUCTION PHASE IMPACT SIGNFICANCE: *'Good' or 'Best Practical' Impact Mitigation Scenario*								
No.	**Nature of Impact**	**Status**	**Extent**	**Intensity**	**Duration**	**Probability**	**Impact Significance**	**Confidence**
C1	Direct physical destruction of flora and fauna	Negative	Local	Moderately-High	Permanent	Highly Probable	Moderate	High
C2	Degradation and fragmentation of habitat	Negative	Surrounding Area	Moderately-High	Long-term	Highly Probable	Moderately-Low	Medium
C3	Pollution of soil, water and vegetation	Negative	Site	Moderate	Short-term	Possible	Low	Medium
C4	Nuisance Factors (Noise, Vibrations, Light)	Negative	Local	Moderate	Short-term	Probable	Moderately-Low	Low

B2. Operational-Phase Ecological Impact Significance.

OPERATION PHASE IMPACT SIGNFICANCE: *'Poor' or 'Standard' Impact Mitigation Scenario*								
No.	**Nature of Impact**	**Status**	**Extent**	**Intensity**	**Duration**	**Probability**	**Impact Significance**	**Confidence**
O1	Direct physical destruction of flora and fauna	N/A						
O2	Degradation and fragmentation of habitat	Negative	Local	Moderately-High	Long-term	Highly Probable	Moderate	Medium
O3	Pollution of soil, water and vegetation	Negative	Local	Moderately-High	Long-term	Probable	Moderate	Medium
O3	Nuisance Factors (Noise, Vibrations, Light)	Negative	Local	Moderate	Long-term	Highly Probable	Moderately-Low	Medium

OPERATION PHASE IMPACT SIGNFICANCE: *'Good' or 'Best Practical' Impact Mitigation Scenario*								
No.	**Nature of Impact**	**Status**	**Extent**	**Intensity**	**Duration**	**Probability**	**Impact Significance**	**Confidence**
O1	Direct physical destruction of flora and fauna	N/A						
O2	Degradation and fragmentation of habitat	Negative	Site	Moderately-High	Long-term	Possible	Low	Medium
O3	Pollution of soil, water and vegetation	Negative	Local	Moderately-High	Long-term	Possible	Moderately-Low	Medium
O3	Nuisance Factors (Noise, Vibrations, Light)	Negative	Local	Moderate	Long-term	Probable	Moderately-Low	Medium