PROPOSED KWAHLOKOHLOKO SUB-SUPPLY AREA (SSA) 1, PHASE 2, WATER SUPPLY PROJECT, UMLALAZI LOCAL MUNICIPALITY, KWAZULU-NATAL

Terrestrial Biodiversity Assessment Report

Version 1.2

Date: 31st August 2022

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SPECIALIST ASSESSMENT REPORT DETAILS AND DECLARATION OF INDEPENDENCE

This is to certify that the following assessment and report has been prepared independently of any influence or prejudice and as per the requirements of:

1. Section 32 (3) of the NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (Act No. 107 OF 1998) ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS 2014 as per Government Notice No. 38282 GOVERNMENT GAZETTE, 4 DECEMBER 2014 (as amended in 2017).
2. Procedures to be followed for the assessment and minimum criteria for reporting of identified environmental themes in terms of Section 24(5)(a) and (h) of the NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, when applying for Environmental Authorisation, as per Government Notice No. 648 in Government Gazette No. 42451 (10 May 2019).

Assessment Title:	Terrestrial Biodiversity Assessment
Project:	Proposed Kwahlokohloko Sub-Supply Area (SSA) 1, Phase 2, Water Supply Project
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Field of study/expertise:	Wetland & Terrestrial Ecology

Details of Specialist Team

The relevant experience of specialist team members involved in the compilation of this report are briefly summarized below. *Curriculum Vitae's* of the specialist team are available on request.

Specialist	Role	Details
Ryan Kok *Pr.Sci.Nat.* Scientist & Ecologist	Project leader, fieldwork, author, sign-off	Ryan is a Scientist and Wetland / Aquatic Ecologist at Eco-Pulse with a BSc degree in Environmental Science; BSc Honours and MSc degree in Biological & Ecological Sciences. He is a registered Professional Natural Scientist (Pr. Sci. Nat.) with >5 years' experience, having worked extensively on numerous specialist ecological assessment projects, for wetland/aquatic habitats in KZN, the Free State, Gauteng, Eastern Cape, and Mpumalanga. Ryan also has 8 years' experience in GIS and environmental modelling, with extensive field experience in monitoring and analysing data. Since being part of Eco-Pulse Ryan has utilized his GIS skills in Environmental Management Frameworks, Wetland Inventories and Prioritization Assessments for major Municipalities. He is also experienced in undertaking alien plant surveys and developing ecological rehabilitation and management plans and ecological monitoring programmes.
David Styles Botanist (private) *Pr.Sci.Nat.*	Fieldwork & species ID	David is a botanist with over 15 years' experience and an MSc in Botany. He is one of the most well-known and renowned botanists in KZN, having undertaken hundreds of assessments of vegetation and habitat for a range of clients, including private developers and large corporates. David is also the editor of the journal Plant Life. He is the author of over 30 publications on the subject of botany and botanical survey work in southern Africa

EXECUTIVE SUMMARY

This report sets out the findings of a **Specialist Terrestrial Biodiversity Impact Assessment** to inform the application for environmental approval in terms of the NEMA: EIA Regulations (2014, as amended in 2017) for the proposed Kwahlokohloko Sub-Supply Area (SSA) 1, Phase 2, Water Supply Project within the Umlalazi Local Municipality, Kwa-Zulu Natal. An assessment of the terrestrial vegetation communities, habitats, ecosystems and associated biodiversity was undertaken by Eco-Pulse Environmental Consulting Services in June/July 2022.

The main findings of the terrestrial biodiversity assessment have been summarized below.

Summary of Baseline Terrestrial Biodiversity Assessment:

Four (4) terrestrial vegetation communities were observed along the proposed pipeline development corridor, namely Moist Coast Hinterland Grassland in fair condition, Secondary Open Grassland in poor condition, Zululand Lowveld in fair condition and Dense Invasive Alien Plants (see summary Table A).

Table A. Summary of vegetation communities with ecological condition and EIS ratings.

Vegetation Community Type	Threat Status[1]	Condition	Ecological Importance / Sensitivity	Protected Plants Present?
Moist Coast Hinterland Grassland	EN	Fair	High	Yes
Secondary Open Grassland	N/A	Poor	Low	No
Zululand Lowveld	VU	Fair	Medium	Yes
Dense Invasive Alien Plants	N/A	Lost	Very Low	No

Four (4) conservation important plant species were recorded within the corridor of the pipeline that was assessed, including: *Aloe maculata, Aloe marlothii, Eucomis autumnalis, Stangeria eriopus* which are provincially protected in accordance with the KwaZulu-Natal Nature Conservation Management Amendment Act, 1999 (No. 5 of 1999). *Stangeria eriopus* is also a Red data listed species which has a threat status of 'Vulnerable' and was observed on-site within several small colonies in the western section of the pipeline.

Fauna of conservation concern were not observed during the site visit, however based on the habitat requirements and ranges of species, several rare and endangered small mammals, birds, reptiles and millipedes/molluscs (invertebrates) could potentially utilise the grassland and wooded thornveld habitats in the study areas for refuge, feeding/foraging, nesting and breeding purposes.

[1] Threat Status (Jewitt, 2016):

CR: Critically Endangered; EN: Endangered; VU: Vulnerable; LT: Least Threatened

Terrestrial biodiversity impacts and impact management/mitigation:

Construction phase impacts associated with this project were predicted as being most significant and likely to range between 'Moderate Low' to 'High' significance under a 'poor/standard' mitigation scenario, with key impacts being to intact/important grassland patches and protected plants. Under a 'good' or 'best-practical' mitigation scenario that seeks to avoid sensitive grassland habitat and protected plant species through appropriate pipeline re-alignment, most construction phase impacts can be avoided or reduced in terms of intensity and probability by restricting impacts to the thornveld vegetation community, thereby reducing impact significance to 'Moderately Low' to 'Low' levels overall.

Operational impacts are likely to be limited to the risk of further impact by Invasive Alien Plants (IAPs) and weeds, leading to further loss of biodiversity and leading to reduced ecosystem condition and functioning (moderate significance) and these can be potentially mitigated and managed through onsite IAP control, eradication and basic rehabilitation of disturbed habitat post-construction.

Key mitigation recommendations include:

1. Pipeline re-alignment to avoid ecologically important and sensitive grassland habitat and protected plants;
2. Implementing a protected plant permitting, rescue and translocation plan where impacts to protected plants cannot be avoided;
3. Implementing best-practice construction phase management in terms of access control, demarcations, vegetation clearing, waste and pollution management, erosion control on steep slopes, fire management, alien plant control and wildlife management;
4. Undertaking follow-up alien plant control post-construction; and
5. Implementing a post-construction rehabilitation programme that includes re-vegetation where necessary.

Note that given the fact that most of the habitats degraded and/or already infested by IAPs, the potential success of clearing operations will require a more comprehensive and holistic programme to manage IAPs within the target thornveld vegetation community at the site.

Biodiversity offsets can be avoided where impacts to protected plants and grassland patches are avoided through protected plant relocation and pipeline realignment. Under a best practical mitigation scenario, the project is considered to be environmentally acceptable from a terrestrial biodiversity perspective, provided that the mitigation and management recommendations in Chapter 6 of this report are strictly adhered to.

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1.1 Project Details

To address the water challenges in King Cetshwayo district, the King Cetshwayo District Municipality (KDCM) has embarked on a key infrastructure project. The Kwahlokohloko water project is intended to address the water shortages from the Greater Mthonjaneni bulk scheme, and improve the water supply to eShowe.

Eco-Pulse Consulting was approached by Terratest to undertake a Terrestrial Ecological (habitat/vegetation) Impact Assessment for the proposed Kwahlokohloko Sub-Supply Area (SSA) 1, Phase 2, Water Supply Project near Eshowe, within the uMlalazi Local Municipality, KwaZulu-Natal. This assessment is required to inform the Environmental Authorisation (EA) process for the project. The location of the proposed bulk pipelines and new reservoir has been shown in Figure 1, below.

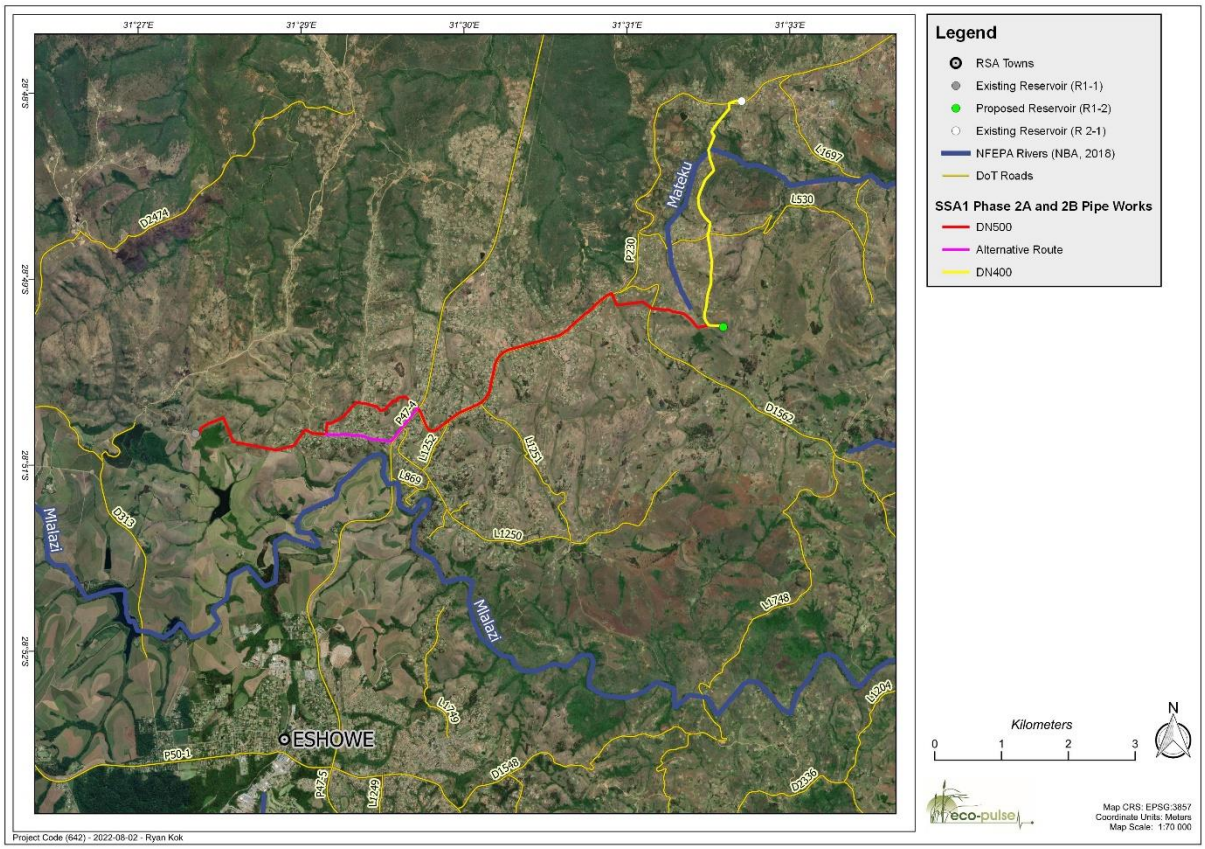

Figure 1 Map showing the location of the study area located near the eShowe town, KwaZulu-Natal.

1.2 Project Description

The project will involve the installation of bulk water pipelines linking two existing reservoirs with a new reservoir to service the KwaHlokohloko community and surroundings (as shown in Figure 2). This will involve:

- **DN (i.e., diameter) 500mm pipe**: Total of ±10km, from existing reservoir R1-1 in Kwahlokohloko (co-ordinates 28°50'43.82"S; 31°27'31.87"E), up to the new reservoir R1-2;
- **DN 400mm pipe**: Total of ±4 km, partly in shared trench with DN500 and running from the new reservoir towards the existing reservoir R2-1 (coordinates 28°48'2.81"S; 31°32'33.41"E) in Habeni;
- **DN 315mm pipe**: ±1.2km (in shared trench with DN500 and DN 400) from new reservoir R1-2 in a westerly direction, pipe will cater for future project; and
- **New Reservoir R1-2**: co-ordinates 28°49'52.85"S; 31°32'22.54"E, in KwaMphehlela, capacity of 1.55ML.

The proposed pipeline alignment and reservoir is shown in Figure 2 below.

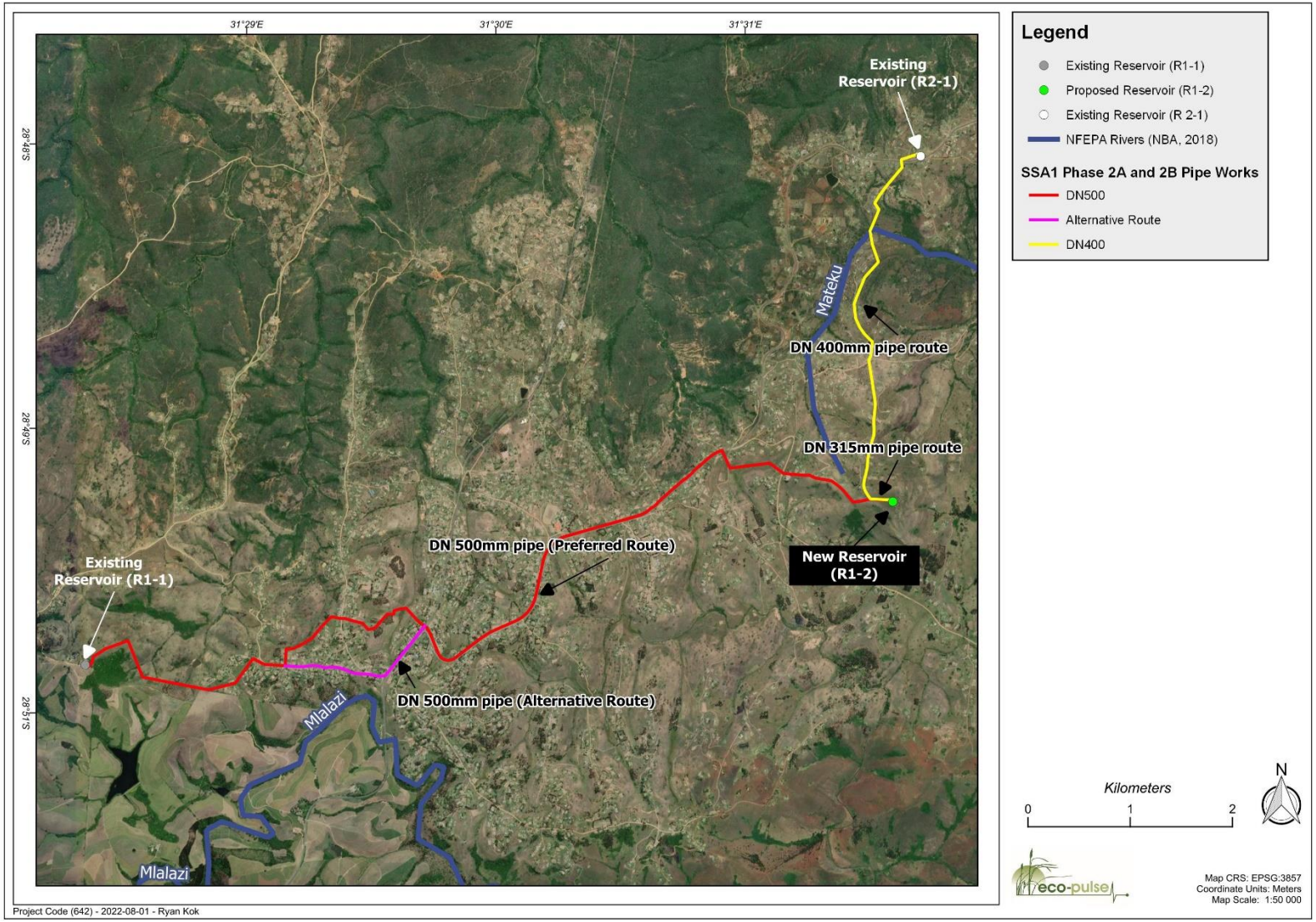

Figure 2 Proposed bulk water pipeline alignments and new reservoir location.

1.3 Purpose of the Assessment

Given that the initial outputs of the desktop (online) DFFE EIA Screening Report (Eco-Pulse, June 2022) suggests a 'Very High Sensitivity' associated with the Terrestrial Biodiversity Theme, a 'High Sensitivity' for Animal Species Theme, and a 'Medium Sensitivity' for the Plant Species Theme, this necessitates a more detailed assessment covering Terrestrial Biodiversity (fauna & flora) to inform the EIA process for the proposed Kwahlokohloko Sub-Supply Area (SSA) 1, Phase 2, Water Supply Project.

Note that whilst the Screening Report outputs also highlight 'Very High Sensitivity' associated with the Aquatic Biodiversity Theme, this has been verified to be associated with wetlands on the site and downstream, which is covered under the separate 'Wetland Assessment Report' (Eco-Pulse, 2022).

1.4 Scope of Work

The following scope of work was undertaken:

- A biodiversity assessment by a SACNASP registered specialist/ecologist (*Pr.Sci.Nat.*).
- Desktop level mapping of remaining untransformed terrestrial habitat and vegetation within the development footprint and immediate adjacent areas.
- Review of any documented and available studies/information for the site and surrounding areas.
- Contextualization of the study area in terms of important biophysical characteristics and conservation planning using available spatial datasets and conservation plans including:
    - National Vegetation Types (Mucina & Rutherford, 2006);
    - Available faunal species records/atlases for the study area;
    - Plants of Southern Africa (POSA) database records for the study area (SANBI); and
    - Provincial Biodiversity Conservation Plan (EKZNW, 2010).
- Desktop assessment of the floral and faunal species of conservation concern (SCC) that may occur within the development footprint based on available species records for the region (e.g., POSA database, SABAP2, Red Data Lists, etc.).
- Undertaking a site walkover and field survey of the remaining untransformed vegetation and habitat on the development zone to record necessary information required to assess vegetation condition and the site ecological importance of mapped untransformed vegetation communities as well as habitat suitability for key species:
    - Field survey of vegetation and habitat across the untransformed terrestrial habitat types identified were investigated (included species identification and status, relative abundance of different species, identification of pioneer and alien plant species and a description of habitat and vegetation type and ecological condition rating).
    - The geographic location of any terrestrial plant SCC (rare/protected plants and trees) noted during the site survey were identified and mapped.
    - Basic survey (limited to day-time survey) to further validate the potential occurrence of fauna of conservation concern potentially occurring in the area (where possible) based

on habitat availability and using visual observations of species as well as evidence of their occurrence on the site (e.g. burrows, nests, excavations, animal tracks, etc.)[2]

- Compile plant species lists for the delineated vegetation communities with a key focus on recording any species of conservation significance.
- Description of any significant landscape features (including important flora/faunal associations).
- A description of the terrestrial biodiversity and ecosystems, including:
    - Main vegetation types[3],
    - Threatened ecosystems, including Listed Ecosystems and locally important habitat types identified;
    - Ecological drivers/processes and functioning of the ecosystem(s) present on the site and surrounds;
    - Ecological connectivity, habitat fragmentation, and fine-scale habitats;
    - Species, distribution important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified; and
    - Identification of ecological corridors that the development could impede, including migration and movement of flora and fauna.
- Identify and record the location of all floral SCC on the property using a hand-held GPS.
- Record any fauna (direct sightings or tracks/signs of faunal activity) where possible.
- 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.
- Assessment of the ecological importance/sensitivity of terrestrial habitat 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.
- 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 together with preliminary planning and design mitigation / recommendations to avoid and minimise direct and indirect terrestrial ecological impacts (including potential biodiversity buffer zones according to best practice guidelines) for consideration by the client/applicant.
- Identification and description of the various direct and indirect terrestrial ecological impacts for the various phases of the development project (includes construction and operation phases), including:
    - Impact on vegetation species composition and structure
    - Impact on ecosystem threat status
    - Impact on explicit subtypes in the vegetation

[2] **Note**: This excludes any detailed faunal trapping. If a potential cryptic faunal species is flagged as having a high likelihood of occurring on the site, further specialist faunal trapping/sampling work may be required by the appropriate taxon specific specialist and this will be flagged as part of any additional studies need to inform the EIA.

[3] Descriptions of the main vegetation communities will be provided, with an emphasis on reporting on dominant species and species of conservation significance (e.g. rare, protected, red-data listed flora/fauna).

  - Impact on overall species and ecosystem diversity
  - Impact on populations of species of special concern
  - Impact on ecological processes and functionality
  - Impact on ecological connectivity
- Provision of impact mitigation measures / recommendations to avoid and minimise direct and indirect impacts, including alternatives in terms of location and design of the development.
- Identification of key impacts that should be monitored as part of on-going management of the site, and recommendation of simple guidelines/methods for ecological monitoring.
- Identification and reporting on any other permit/licensing requirements that may be relevant to the site (for example protected plant/tree permits/license requirements).
- Describe any assumptions made and any uncertainties or gaps in knowledge, as well as identifying the need for any future specialist inputs should these be deemed relevant to the project (e.g. focal faunal species assessments).
- Reporting: Compilation of a single Specialist Terrestrial Biodiversity Impact Assessment Report including all relevant maps and supporting information. *Reports will comply with the relevant requirements of the Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes when Applying for EA (GN R320 of 2020). The assessment will be conducted in accordance with the minimum requirements of the protocols prescribed for the themes of Terrestrial Biodiversity as specified in the DFFE National Web-based Environmental Screening Tool Report. These protocols replace the requirements of Appendix 6 of the EIA Regulations GN R982, 2014 (as amended) in terms of NEMA.*

1.5 Relevant Environmental Legislation

Terrestrial ecosystems, their relevant species, vegetation, habitats and biodiversity in general are governed in South Africa by the following legislation:

- National Environmental Management Act (NEMA) No. 107 of 1998 inclusive of all amendments;
- National Environmental Management: Biodiversity Act (NEMBA) No. 10 of 2004;
- The National Environmental Management: Protected Areas Act No. 57 of 2003;
- Conservation of Agricultural Resources Act No. 43 of 1983;
- National Forests Act No. 84 of 1998; and
- At a Provincial level, flora and fauna (plants and animals) of conservation significance are protected by the KwaZulu-Natal Nature Conservation Management Act 9 of 1997.
  - KwaZulu-Natal Nature Conservation Management Amendment Act, 1999 (No. 5 of 1999)

2 APPROACH AND METHODS

2.1 Desktop Assessment

2.1.1 Confirmation of Terrestrial Ecosystem Context

The following data sources and GIS spatial information provided listed in Table 1 was consulted to inform the biophysical and conservation context of the biodiversity onsite and to assess the significance of the impacts of the proposed development. The data type, relevance to the project and source of the information has been provided.

Table 1. Data sources and GIS information consulted to inform the Terrestrial Habitat Impact Assessment.

DATA/COVERAGE TYPE	RELEVANCE	SOURCE
Colour aerial photography	Desktop mapping of vegetation communities	Bing / Google Earth™ Imagery
Latest Google Earth ™ imagery	To supplement available aerial photography in mapping vegetation communities	Google Earth™ On-line
5m Elevation Contours (GIS Coverage)	Desktop mapping of drainage network and calculation of slope angle	Surveyor General
KZN Geology (GIS Coverage)	Assessment of underlying geology controlling soil formation and consequently vegetation types	Council for GeoScience
South African Vegetation Map (GIS Coverage)	Classification of vegetation types and determination of reference primary vegetation	SANBI (2018)
KwaZulu-Natal Vegetation Map (GIS Coverage)	Classification of vegetation types and determination of reference primary vegetation	Scott-Shaw & Escott (2011)
National Biodiversity Assessment – Threatened Ecosystems (GIS Coverage)	Identification of conservation important ecosystems	SANBI (2018)
KZN Terrestrial Conservation Plan (GIS Coverage)	Identification of fauna, flora and ecosystems of conservation importance.	EKZNW (2010)
KZN Systematic Conservation Assessments (SCAs) (GIS Coverage)	Identification of fauna, flora and ecosystems of conservation importance	EKZNW (2016)
SANBI On-line threatened species database	Assessment of threatened plant species potentially occurring on site	SANBI on-line database
SANBI's PRECIS (National Herbarium Pretoria Computerized Information System) (electronic database)	Determination of conservation important plant species	http://posa.sanbi.org
Red Data Books (Data Lists of Plants, Mammals, Reptiles and Amphibians)	Determination of conservation important plants, mammals, reptiles and amphibians	Various sources
Second Southern African Bird Atlas Project (SABAP2) (electronic database)	Determination of conservation important birds	SABAP2, 2017

2.1.2 Species of Conservation Concern Potential Occurrence (POC) Assessment

The purpose of undertaking the potential occurrence assessment was to flag the possible occurrence of SCC in order to highlight floral and faunal species to look out for and/or inform the need for additional focussed floral or faunal surveys. SCC are species that have a high conservation importance in terms of preserving South Africa's high biological diversity. South African conservation agencies use the

internationally endorsed IUCN Red List Categories and Criteria to determine the conservation status of biota, which are published in various Red Lists for specific orders of animals and plants. However, the IUCN Red List is considered a global assessment, therefore, South Africa uses a revised system of the IUCN criteria which has been developed to serve as a regional assessment for the country. The regional assessment only accounts for the distribution or range of a species falling within the borders of South Africa, this means that any species not endemic to South Africa will be assessed based on their distribution and numbers within the country and populations and distributions that extend beyond our borders have not been considered as part of the regional assessment.

Consequently, a species' status on the national Red List may differ from its global status on the IUCN Red List. In addition, to including species that are assessed according to the IUCN Red List Criteria as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Data Deficient (DD) or Near Threatened (NT); at the regional scale, South Africa has further revised the list of species of conservation concern in the country to include: range-restricted species which are not declining and are Nationally Listed as Rare or Extremely Rare [also referred to in some Red Lists as Critically Rare]. The EIA screening tool has also included endemic or range-restricted species, and some provincially protected species as part of its modelling efforts. Refer to Figure 3 for an overview of the relevant categories of SCC.

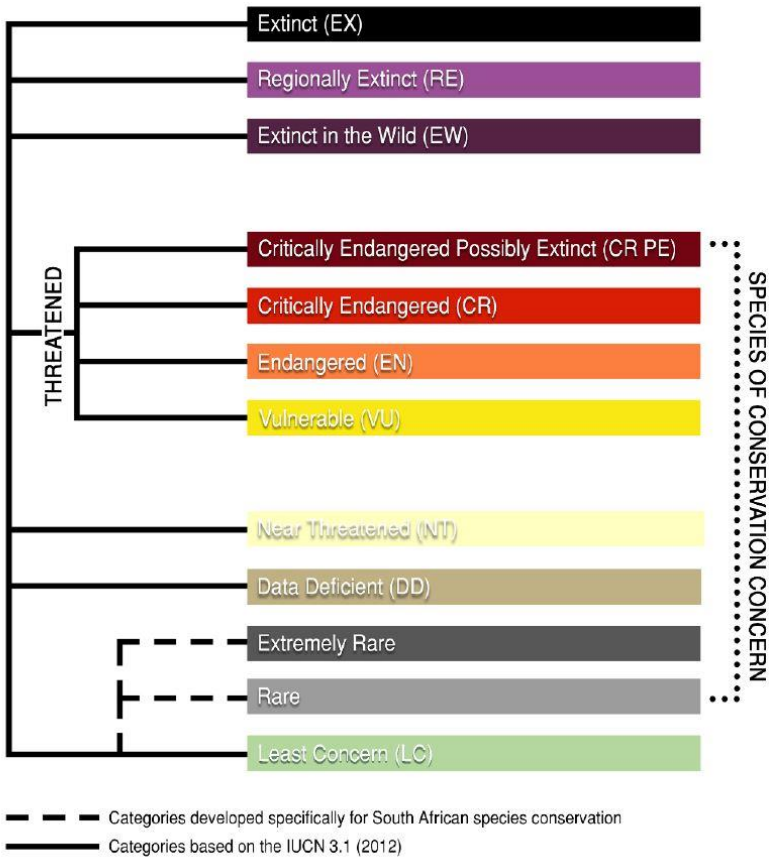

Figure 3 The different categories of species of conservation concern (SCC) modified from the IUCN's extinction risk categories (reproduced in part from IUCN, 2012) - *extracted directly from SANBI (2020)*.

A description of the different South African Plant Red List categories as well as all species that form part of the larger complement considered as species of conservation concern is provided in Table 2 (Categories marked with N are non-IUCN national Red List categories for species not in danger of extinction but considered of conservation concern; the IUCN equivalent of these categories is Least Concern (LC).

Table 2. Description of South African Plant Red List Categories (Source: SANBI on-line at http://redlist.sanbi.org/eiaguidelines.php).

Status		Category	Description
SPECIES OF CONSERVATION CONCERN	EXTINCT/APPROACH-ING EXTINCTION	Extinct (EX)	A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.
		Regionally Extinct (RE)	A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
		Extinct in the Wild (EW)	A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.
	THREATENED SPECIES	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.
	OTHER SPECIES OF CONSERVATION CONCERN	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^{N}	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^{N}	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.
OTHER CATEGORIES		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.

Status	Category	Description
	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.

Flora and fauna of conservation significance (including threatened, protected and rare species) likely to occur in the various habitats of the study area were assessed at a desktop level using information obtained from the following documents, on-line services and GIS information:

- List of SCC obtained from the EIA screening tool[4]
- SANBI's Plants of South Africa website (POSA) that allows the interrogation of the Botanical Database of Southern Africa (BODATSA) (http://posa.sanbi.org);
- Outputs of the KZN Terrestrial Conservation Plan (CPLAN) (EKZNW, 2010);
- Outputs of the South African Bird Atlas Project (SABAP) (http://sabap2.adu.org.za/);
- Outputs of the South African Frog Atlas Project (SAFAP) (http://safap2.adu.org.za/);
- Atlas of African Orchids (http://vmus.adu.org.za/);
- iNaturalist (https://www.inaturalist.org);
- Geographical distribution data in Biodiversity Management Plans;
- Data from the Animal Demography unit (ADU, 2013); and
- Various resources and references for Red Data listed species in South Africa (such as the Red Data Lists of Plants, Mammals, Reptiles and Amphibians).

The habitat requirements/preferences for each plant/animal species of conservation concern was reviewed (based on available literature) and was then compared with the habitat occurring on the site in order to estimate the likelihood of these species occurring on the target property (as per the assessment matrix in Table 3, below). The presence/absence of the plant species only was then verified during field surveys. *No formal faunal verification study was undertaken. Such verification would require undertaking a faunal survey of the site by a qualified zoologist.*

[4] **Note:** In the event that a SCC is either not listed in the Screening Tool Report or it erroneously lists a SCC highly unlikely to occur within the proposed development footprint, this will be indicated and an explanation/motivation for exclusion or inclusion of the relevant SCC will be provided. Moreover, in the event that the inclusion or exclusion of an SCC affects the outcome of the impact significance assessment, this will also be stipulated as part of the reporting process.

Table 3. 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

The presence/absence of plant species only was then verified during field surveys. While general field observations for fauna were made, no taxon specific faunal sampling was undertaken (such verification would need to be undertaken by a qualified zoologist and taxon specialist who would conduct a faunal survey for the relevant taxa flagged for the site). Faunal features like dens, spoor[5] and skat[6] were recorded where possible but were not sought out. Table 4 below was then used to rate the likelihood of occurrence as either being "Low", "Medium" or "High" or "Confirmed[7]" (if species were observed during fieldwork on site within the development footprint, they were categorised as confirmed).

Table 4. Likelihood of occurrence rating derived from rationale base on distribution and habitat preferences of species at a desktop level, and field-based observations at a site level.

Likelihood of Occurrence Rating	Rationale
Confirmed	Species was observed on-site
High: probable	Highly Probable
Medium: possible	Possible
Medium: unlikely	Unlikely
Low	Highly unlikely or Improbable

For plant SCC any threatened or rare species that are highly likely to occur but were missed during out-of-season site visits will be flagged for additional appropriately timed surveys by a botanist. For plant SCC

[5] Spoor refers to a track of an animal e.g., print made by hooves.

[6] Skat refers to animal droppings.

[7] Definitive answers regarding the presence or absence of a particular SCC are not always possible. In such situations, the precautionary principle is applied so that preventative action is taken in the face of uncertainty. For species that are difficult to detect, it is not always possible to provide compelling evidence that a species does not occur. Therefore, if the habitat conditions appear suitable and there is data to suggest that the species did or could occur (e.g., confirmed records on adjacent properties), then the precautionary approach is to assume that the species does indeed occur there, and mitigation and management decisions need to be made accordingly.

confirmed on-site and who are likely to lose individuals of their population due to the development, an estimate of this impact on their overall population will be determined under a pre-mitigation scenario.

2.2 Baseline Assessment

2.2.1 Vegetation Survey

A single field survey was undertaken on the **30th of June and 1st of July (mid-winter)** to collect baseline data and to inform the design and layout of the proposed development as well as the impact assessment. The site visit and field survey entailed undertaking a site walkover within the study area at key locations, with the following data collected in the field:

- **Broad vegetation and structural type** – The vegetation communities encountered were classified into broad vegetation structural types e.g., grassland, forest, bushland, scrubland etc. where applicable. Overall morphology and architecture of the plant community were also recorded where applicable.
- **Qualitative plant species composition** – Species composition refers to the relative proportions (%) of various plant species cover in relation to the total vegetation cover of a given area. The relative abundance of each species encountered was rated qualitatively on a 3-point scale of low, moderate and high based on visual observations.
- **Species of conservation concern (SCC)** – SCC are species that have a high conservation importance in terms of preserving South Africa's biodiversity and include rare and threatened species. This category also includes those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD).
- **Observable onsite impacts** – Evidence of the physical disturbance to vegetation and soils and indirect impacts like erosion, sedimentation, contamination etc. were recorded.
- **Distinct vegetation boundaries** – Clear boundaries between distinct vegetation communities were recorded onsite. Between sampling points boundaries were extrapolated using the latest colour aerial photography for the area.

The location of protected plant species was recorded using a handheld GPS device. Where species could not be identified in the field, samples and photographs were taken to confirm at a later stage using available literature.

Note that no formal vegetation plots were undertaken, and no formal faunal sampling or searches were undertaken. Faunal features such as dens, spoor and skat were recorded where possible but were not sought out.

2.2.2 Vegetation Mapping & Classification

Distinct vegetation communities were broadly mapped based on observed changes in species composition that were recorded using a hand-held GPS. These GPS waypoints were imported into GIS for mapping purposes.

2.2.3 Ecological Condition Assessment

Vegetation communities / habitat units defined for the study area were assessed qualitatively in terms of their ecological condition. Ecological condition refers to the extent to which the composition, structure and function of an area or biodiversity feature has been modified from a natural reference condition. Table 5 below was used for providing a description and indicators of each ecological condition class. The descriptions provided are based on the Lexicon of Biodiversity Planning in South Africa (SANBI, 2016).

Table 5. Description and indicators of Ecological Condition Classes.

High-level classes	Description	Detailed classes	Description	Indicators
Good	Composition, structure and function are still intact or largely intact.	**Natural**	Unmodified. No significant changes in composition, structure or function have taken place.	• Characterised by native flora typical of reference sites. • Structural characteristics resemble that of reference plant communities. • Low to no disturbances evident.
		Near-natural	Small changes in composition and structure may have taken place, but ecosystem functions are essentially unchanged.	• A very minor change to vegetation composition is evident at the site. • Abundance of ruderal/pioneer species is slightly higher than natural. • Limited disturbances evident.
Fair	Ecological function is maintained even though composition and structure have been compromised.	**Moderately Modified/semi-natural**	Ecological function is predominantly unchanged even though composition and structure have been compromised.	• Natural vegetation composition has been moderately altered. • Introduced alien and/or increased ruderal/pioneer species are still clearly less abundant than native species characteristic of the natural species composition. • Moderate change in structural characteristics (e.g., moderate increase / decrease in woody plants). • Moderate disturbances evident
Poor	Ecological function has been severely compromised or lost in addition to structure and composition.	**Severely Modified**	Loss of composition, structure and ecological function is extensive.	• Natural vegetation composition has been largely altered. • Introduced alien and/or increased ruderal/pioneer species occur in approximately equal abundance to the characteristic indigenous species. • High change in structural characteristics relative to reference plant communities. • High levels of grazing / disturbance evident.
		Irreversibly Modified	The ecosystem has been modified	• Natural vegetation composition has been substantially altered

High-level classes	Description	Detailed classes	Description	Indicators
			completely, with an almost complete loss of composition and structure. All or most ecosystem function has been destroyed and the changes are irreversible.	but some characteristic species remain. • Vegetation consists mainly of introduced, alien and/or ruderal/pioneer species. • Evidence of erosion or compaction based on or reflecting high levels of disturbance. • Evidence of recent transformation (e.g., agriculture).
Lost	Composition, structure and function destroyed.	**Outright Loss**	(The result of a hard surface e.g., concrete, as opposed to "irreversibly modified" which may be a soft surface such as irrigated cropland.)	• Present cultivated lands (crops, forestry, etc.). • Developed land (Houses, Roads, etc.)

2.2.4 Site Ecological Importance

Site Ecological Importance (SEI) was assessed based on the approach outlined in the Species Environmental Assessment Guideline (SANBI, 2020), according to best-practice for environmental impact assessments in South Africa. The approach detailed below is largely reproduced verbatim with minor adjustments from the document referenced above.

All the vegetation communities that have been mapped as well as any rare or threatened flora recorded occurring on-site were considered 'receptors of impacts' within this terrestrial assessment report. Each receptor (e.g., a threatened floral species or a mapped vegetation community) was taken into consideration to determine the Floral SEI associated with the development project. The process of assessing SEI is described in more detail below (SANBI, 2020).

SEI is considered to be a function of the Biodiversity Importance (BI) of the receptor (e.g., species of conservations concern, the vegetation /community or habitat type present on the site) and its resilience to impacts – Receptor Resilience (RR) as follows:

SEI = BI + RR

BI in turn is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows:

BI = CI + FI

CI is defined here as: "*The importance of a site for supporting biodiversity features of conservation concern present e.g., populations of IUCN Threatened and Near-Threatened species (CR, EN, VU & NT), Rare, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.*"

Key criteria used to inform the CI at a site include the following (SANBI, 2020):

- IUCN Threatened and Near-Threatened Species (CR, EN, VU & NT) - either the global or national assessments, where the global and national assessments differ for the same taxon, the most recent evaluation of status was used in calculating SEI.
- Rare species i.e., those included on South Africa's National Red List as Rare or Critically Rare or Extremely Rare. These are highly restricted species that are currently not declining. However, should any development impact on a population of these species they will immediately qualify under one of the IUCN categories of threat.
- Range-restricted species – the presence of terrestrial flora with a global population extent of occurrence (EOO) of 10 000 km^2 or less.
- Significant areas of threatened vegetation types – this is a function of both the area (size) being considered in relation to the total extent of that vegetation type (i.e., proportion) and how threatened (CR, EN, VU) the vegetation types are.
- Natural processes – natural unmanaged areas with low levels of ecological disturbance have largely intact natural processes such as pollination, seed dispersal and migration, and thus have greater intrinsic conservation importance than those that are modified through ecological disturbance.

Please note that no faunal species have been assessed as receptors within this report as this should be done by the relevant faunal taxon specialist and is beyond the scope of this vegetation assessment. Moreover, the SEI has only been assessed for vegetation communities that fall within the project footprint and does not extend to the entire Project Area of Influence which falls beyond the project footprint. Assessment of Conservation Importance will include an assessment of the suitability/potential of the vegetation communities to support floral populations which fall under one of the criteria included for threatened and rare species.

Table 6. Conservation Importance Criteria (SANBI, 2020)

Conservation Importance	Fulfilling Criteria
Very High	• Confirmed or highly likely occurrence of CR, EN, VU or Critically Rare species that have a global EOO of < 10 km^2 • Any area of natural habitat[8] of a CR ecosystem type or large area (> 0.1 % of the total ecosystem type extent[9]) of natural habitat of EN ecosystem type • Globally significant populations of congregatory species (>10% of global population)
High	• Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO > 10 km2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than

[8] This excludes areas of transformed habitat within a defined ecosystem even if these are partially restored, e.g. Highveld grasslands that have been converted to maize fields and then abandoned so that some form of functional grassland is restored; this is not natural habitat as it does not and will not in the future have species composition representative of the original natural habitat.

[9] Calculated from the threatened ecosystem of South Africa shapefile available from the SANBI (current available version 2011: http://bgis.sanbi.org/Projects/Detail/49)

Conservation Importance	Fulfilling Criteria
	A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. • Small area (>0.01% but < 0.1 % of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1 %) of natural habitat of VU ecosystem type. • Presence of Rare species. • Globally significant populations of congregatory species (>1% but <10% of global population).
Medium	• Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under A criterion only and which have more than 10 locations or more than 10 000 mature individuals. • Any area of natural habitat of threatened ecosystem type with status of VU Presence of range-restricted species • > 50 % of receptor contains natural habitat with potential to support SCC
Low	• No confirmed or highly likely populations of SCC • No confirmed or highly likely populations of range-restricted species • < 50 % of receptor contains natural habitat with limited potential to support SCC
Very Low	• No confirmed and highly unlikely populations of SCC • No confirmed and highly unlikely populations of range-restricted species • No natural habitat remaining

FI of the receptor (e.g., the vegetation/fauna community or habitat type) is defined here as the receptors' current ability to maintain the structure and functions that define it, compared to its known or predicted state under ideal conditions.

Simply stated, FI is: "*A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts.*" (SANBI, 2020)

These criteria can be defined as (SANBI, 2020):

- **Connectivity to other natural areas** – connectivity, which can also be measured conversely as the degree of habitat fragmentation, refers to how connected habitat patches are to each other, which has a significant influence on numerous ecological processes, such as migration and dispersal opportunities of biota and therefore genetic exchange between populations. Connectivity to other similar habitats becomes more important as the remaining intact and functional area of a habitat decreases, mainly because population sizes decrease and are therefore at greater risk from ecological perturbations and inbreeding effects. The degree of connectivity between habitat patches varies greatly with the dispersal ability of the taxon or taxon group (e.g., fossorial reptiles) in question;
- **Degree of current persistent negative ecological impacts** – persistent negative impacts such as uncontrolled spread of alien and invasive flora effectively decreases both the remaining intact area and ecosystem functioning of a particular habitat; and
- **Remaining intact and functional area** – the proportion of the receptor that supports natural habitat with intact ecological processes - small areas are less likely to withstand ecological

degradation compared to large areas and are therefore better able to maintain structure and function allowing for intact ecological processes.

Ecological processes can be considered to be mostly intact and functional if the receptor area has low levels of current ecological disruptors, has good connectivity to other areas and is a relatively large area.

Table 7. Functional Integrity Criteria (SANBI, 2020).

Functional Integrity	Fulfilling Criteria
Very High	• Very large (>100 ha) intact area for any conservation status of ecosystem type or >5 ha for CR ecosystem types • High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches • No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing)
High	• Large (>20 ha but <100 ha) intact area for any conservation status of ecosystem type or >10 ha for EN ecosystem types • Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches • Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential
Medium	• Medium (>5 ha but <20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types • Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches • Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance; moderate rehabilitation potential
Low	• Small (>1 ha but <5 ha) area • Almost no habitat connectivity but migrations still possible across some transformed or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential • Several minor and major current negative ecological impacts
Very Low	• Very small (<1 ha) area • No habitat connectivity except for flying species or flora with wind-dispersed seeds. • Several major current negative ecological impacts

Recalling that BI is a function of CI and the FI of a receptor, BI was thereafter derived from a simple matrix of CI and FI as follows:

Table 8. Biodiversity Importance Matrix (SANBI, 2020).

Biodiversity Importance		**Conservation Importance**				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Functional Integrity	**Very High**	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

RR is defined here as: "*The intrinsic capacity of the receptor to resist major damage from disturbance and /or to recover to its original state with limited or no human intervention.*" (SANBI, 2020)

The fulfilling criteria to evaluate RR is based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor (Table 9). Each rare and threatened species and mapped vegetation community will be assigned a RR Rating ranging from Very High Resilience to Very Low Resilience with a short rational provided for each rating. Receptor resilience is dependent on the nature of the disturbance or impact and therefore needs to be assessed in relation to these factors in the accompanying rationale for each rating assigned. Thus, a receptor is likely to have multiple ratings associated with a suite of anticipated impacts linked to the proposed development. However, only the lowest receptor resilience rating assigned to each receptor will be reported on to highlight the most notable vulnerability associated with a receptor and the relevant anticipated impact that represents the greatest threat.

Table 9. Receptor Resilience Criteria (SANBI, 2020).

Resilience	Fulfilling Criteria
Very High	Habitat that can recover rapidly (~ less than 5 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed
High	Habitat that can recover relatively quickly (~ 5-10 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed
Medium	Will recover slowly (~more than 10 years) to restore > 70 % of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~less than 50 % of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed
Very Low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed

Finally, once both BI and RR were assessed SEI was determined from the final matrix as follows:

Table 10. SEI Matrix (SANBI, 2020).

Site Ecological Importance		Biodiversity Importance				
		Very High	High	Medium	Low	Very Low
Receptor Resilience	Very Low	Very High	Very High	High	Medium	Low
	Low	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	High	Medium	Medium	Low	Low	Very Low
	Very High	Medium	Low	Very Low	Very Low	Very Low

SEI was then clearly mapped for each vegetation community in relation to the proposed development activities and infrastructure. Interpretation of SEI in the context of the proposed development activities was then provided according to Table 11 below.

Table 11. Interpretation of SEI in relation to proposed development activities (SANBI, 2020).

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation - No destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages. Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimization mitigation – Changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimization & restoration mitigation - Development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimization & restoration mitigation - Development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimization mitigation - Development activities of medium to high impact acceptable and restoration activities may not be required.

2.3 Biodiversity Impact Assessment Framework

The Biodiversity Impact Assessment has been aligned closely with the minimum criteria and requirements for Terrestrial Biodiversity Impact Assessments contained in the "*Procedures to be followed for the assessment and minimum criteria for reporting of identified environmental themes of Section 45 (a) and (h) of the National Environmental Management Act, 1998, when applying for Environmental Authorization*", contained in Government Gazette No. 648 (10 May 2019).

For the purposes of this assessment, the assessment of potential impacts was undertaken using an "Impact Assessment Methodology for EIAs" adopted by Eco-Pulse (2019). This assessment was informed by baseline terrestrial biodiversity information contained in this report relating to the importance and sensitivity of terrestrial habitats and potential occurrence of protected species as well as available information on the proposed development provided by the client and experience in similar projects in South Africa and KZN.

The process begins with a description of the proposed development and associated activities (for the various phases, including construction and operation); with the various environmental stressors and direct/indirect risks associated with development activities then defined. Based on the stressors and anticipated risks, impacts are then described under six (6) distinct categories with impact significance assessed for each impact category based on a range of assessment criteria. The general framework for the biodiversity impact assessment is shown below in Table 12.

Table 12. Terrestrial Biodiversity Impact Assessment Framework for the development project.

TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT FRAMEWORK	
DEVELOPMENT TYPE & ACTIVITIES	
Construction Phase Activities *To be described and defined*	Operational Phase Activities *To be described and defined*
ENVIRONMENTAL STRESSORS & RISKS	
Construction Phase Stressors & Risks *To be identified and described*	Operational Phase Stressors & Risks *To be identified and described*
TERRESTRIAL BIODIVERSITY IMPACTS	
1	Impact on vegetation structure and plant species composition
2	Impact on populations of species of special concern
3	Impact on targets for threatened ecosystems
4	Impact on ecological processes and functionality of ecosystems
5	Impact on overall species and ecosystem diversity
6	Impact on ecological connectivity

Once risks, stressors and predicted impacts had been identified and defined, the significance of the potential impacts of the proposed development on terrestrial biodiversity and ecosystems was then assessed for the following scenarios:

- **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.
- **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.

The general approach to impact significance assessment is to rate intensity as the realistic worst-case consequence (endpoint) of an activity (according to Table 13). Thereafter, the next step would be to assess the likelihood of this consequence occurring, as well as the extent and duration of the impact. This is repeated for each ultimate ecological consequence.

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 13. Criteria and numerical values for rating ecological 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 are irreversibly compromised (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 being effective. High costs are associated with rehabilitation and remediation, but still considered possible. · Measurable reduction in extent of endangered and critically endangered habitat types. · Measurable reduction in endangered and critically endangered floral and faunal populations.
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 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

Score	Rating	Description
		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 processes 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		
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 similar conditions and settings.
0.2	**Unlikely**	The possibility of the impact occurring is low with less than a 10% chance of the impact 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 14. Impact significance categories and definitions.

Impact Significance	Impact Significance Score Range	Definition
High	**18 - 26**	Unacceptable and fatally flawed. Impact should be avoided and there is 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 have a strong influence on the decision regarding the proposed activity and thus, a clear and substantiated need and desirability for the project needs to be provided, 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 is 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 15. 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.

2.4 Assumptions and Limitations

The following limitations and assumptions apply to the studies undertaken for this report:

2.4.1 Sampling

- The study focused on 'terrestrial' or 'dryland' vegetation occurring within the study area. Wetland/aquatic vegetation and habitats were not included as these were dealt with separately in the Specialist Wetland Assessment Report compiled by Eco-Pulse (Report No. EP643-01).
- The field assessment was undertaken in mid-winter (June/July 2022) outside of the recommended sampling season. The assessment therefore does not cover the seasonal variation in conditions at the site.
- With ecology being dynamic and complex, there is the likelihood that some aspects (some of which may be important) may have been overlooked.
- Rapid sampling and rapid habitat assessment tools were used due to time and budget constraints and the inherent low sensitivity of the majority of the receiving terrestrial environments at the site. Thus, formal vegetation plots and detailed habitat sampling and analyses were not undertaken, limiting the resolution of the information captured and produced in this study.
- The location of plant species of conservation concern was recorded using a Garmin Montana™ Global Positioning System (GPS) and captured on a map of the area using a Geographical Information System (GIS). GPS accuracy was limited to 3-5m.
- While an assessment of the potential occurrence of species of conservation concern has been undertaken, and is informed by readily available information, this provides only a surrogate indicator of the likelihood of such species occurring. This is however regarded as appropriate given the level of habitat degradation/transformation across much of the project area.
- The accuracy of desktop species information is limited to historic data and available databases for the area apply. Note that data and information obtained from published articles, reference books, field guides, official databases or any other official published or electronic sources are assumed to be correct, and no review of such data was undertaken by Eco-Pulse.
- Information on the threat status of plants species was informed 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.
- The assessment of the potential occurrence of fauna was informed by the presence and condition of ideal habitat for each faunal species. The habitat condition / integrity was used as a surrogate indicator of the likelihood of a particular species being present.
- In terms of faunal surveys and assessments, no formal faunal sampling or surveys were undertaken and this report does not serve as a substitute for detailed and taxon-specific specialist reports required for faunal species flagged as being of very high – medium sensitivity and where these are likely to occur at the site.
- Due to the complexities of ecological systems and the sensitive dependence on initial conditions, any predictions of the effects of perturbation are made with very low confidence.
- Additional information used to inform the assessment was limited to data and GIS coverage's available for the province and district municipality at the time of the assessment.

2.4.2 Seasonality

- Since the study was undertaken in mid-winter (June/July 2022), the seasonal variation in site conditions could not be accurately established and was based on a rather low confidence estimation based on the conditions and evidence at the time of the assessment.
- Seasonality can influence the species of flora encountered at the site. Species likely to be dormant over the winter season (especially grassland forbs, herbs and flowering plants) may therefore have been overlooked during sampling. With the project area being located in the high rainfall coastal zone of KZN however, where temperature ranges do not fluctuate as significantly between seasons (in contrast to the conditions occurring in the Hinterland of the Province and Highveld for example), seasonal variations in conditions and species are unlikely to be significant to warrant additional summer season surveys. Most species of plants were flowering at the time of the assessment (including the provincially protected plants: *Aloe maculata* and *Hypoxis hemerocallidea*), making identification straight-forward.
- Also, habitats which were degraded by existing human impacts, the likelihood of there being flora/fauna of conservation concern occurring (other than those identified) is considered to be low.

2.4.3 Impact Assessment

- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological concerns arising from the vegetation & habitat field surveys and based on the assessor's working knowledge and experience with similar development projects.
- Evaluation of the significance of impacts with mitigation takes into account mitigation measures provided in this report and standard mitigation measures included in an appropriate Environmental Management Programme (EMPr).

3 ECOSYSTEM CONTEXT

Understanding the biophysical and conservation context of the study area and surrounding landscape is important as it informs decision making regarding the significance of the area to be affected. In this regard, national, provincial and regional biophysical and conservation datasets were screened, the results of which are presented in the sections that follow.

3.1 Biophysical Setting

A summary of key biophysical setting details for the study area and catchment area is presented in Table 16 below.

Table 16. Key biophysical setting details of the study area.

Biophysical Aspects	Desktop Biophysical Details	Source
Elevation	300 – 600 m a.m.s.l. (above mean sea level)	Google Earth™
Mean annual precipitation (MAP)	600 – 700mm	DWA, 2005
Rainfall seasonality	Summer	DWA, 2005
Geomorphic Province	South-Eastern Coastal Hinterland	Partridge *et al*., 2010
Geology	Dwyka Group Tillite (glacial diamictite)	RSA 1:1000 0000 Geological Map (SA Geological Society)
Quaternary catchment	W12D, W13A & W12E	DWS
Main collecting river(s) in the catchment	Mhlatuze (W12D), Mlalazi (W13A) & Mateku (W12E)	NFEPA Rivers (CSIR, 2011)
DWS Ecoregion	14.05 (North-Eastern Uplands)	DWA, 2005

3.2 Ecological and Conservation Context

To inform the appraisal of current existing disturbances and impacts, as well as the assessment of residual impacts associated with the proposed bulk water pipelines and reservoir under a post-mitigation scenario, the reference vegetation type and additional spatial conservation data sets ranging from species-specific to landscape scale were interrogated and are summarised below.

The national vegetation classification indicates that the reference terrestrial vegetation for the study area located within the development footprint on the property comprises **'KwaZulu-Natal Coastal Belt Grassland', 'Moist Coast Hinterland Grassland', 'Dry Coast Hinterland Grassland', 'Eastern Valley Bushveld'** and **'Zululand Lowveld'** (SANBI, 2018) and according to the Beta Vegetation Map Vector Shapefile, these vegetation types are considered 'Endangered', 'Vulnerable', 'Vulnerable', 'Least Threatened' and 'Least Threatened', respectively (Table 17). The provincial vegetation map identified the same vegetation types along the development footprint with the **provincial threat status of 'Critically Endangered'** for 'KwaZulu-Natal Coastal Belt Grassland', **'Endangered'** for 'Moist Coast Hinterland Grassland' while 'Dry Coast Hinterland Grassland', 'Eastern Valley Bushveld' and 'Zululand Lowveld' have a **'Vulnerable'**, **'Least Threatened'** and '**Vulnerable'** provincial threat status, respectively (Table 17).

Table 17. National and provincial vegetation classification and threat status (SANBI, 2018; Scott-Shaw & Escott, 2011)

Vegetation Types	National Threat Status	Provincial Threat Status
KwaZulu-Natal Coastal Belt Grassland	Endangered (EN)	Critically Endangered (CR)
Moist Coast Hinterland Grassland	Vulnerable (VU)	Endangered (EN)
Dry Coast Hinterland Grassland	Vulnerable (VU)	Vulnerable (VU)
Eastern Valley Bushveld	Least Threatened (LT)	Least Threatened (LT)
Zululand Lowveld	Least Threatened (LT)	Vulnerable (VU)

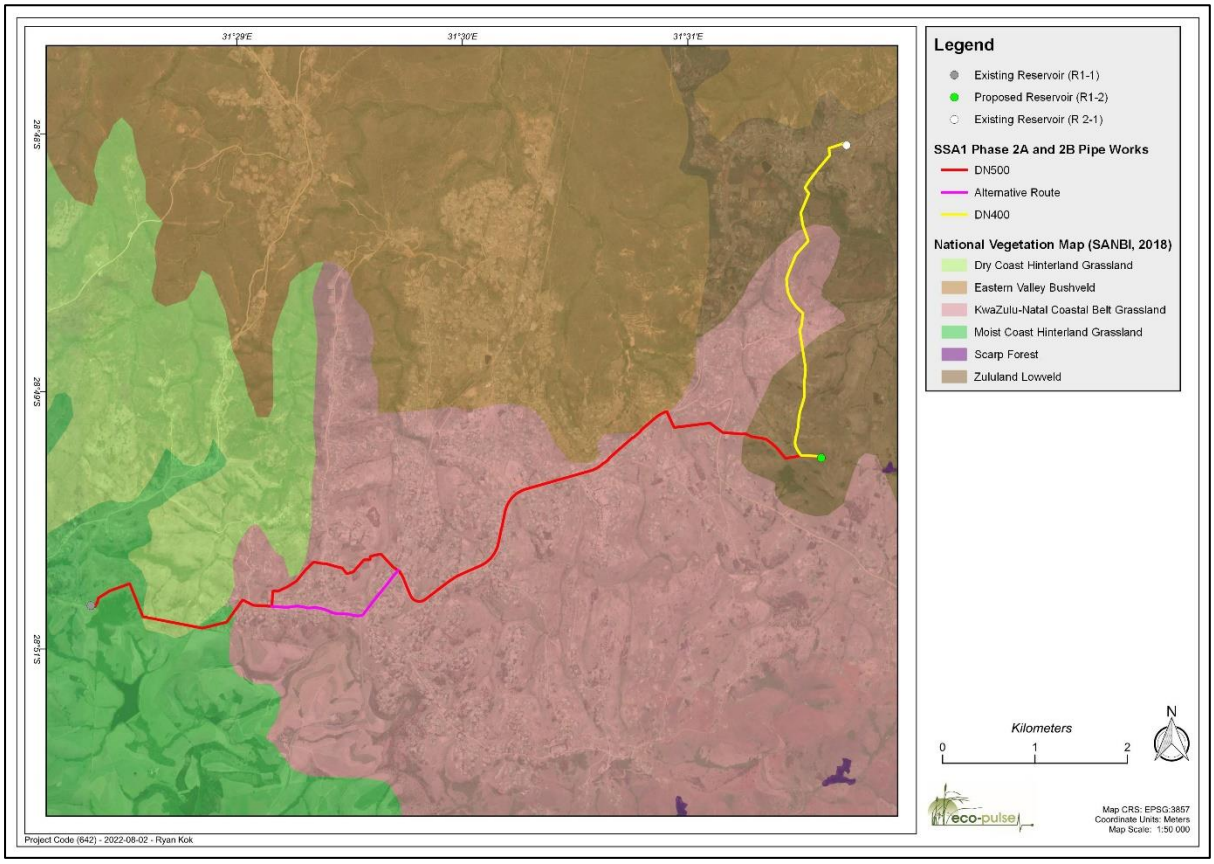

Figure 4 National vegetation map (SANBI, 2018).

The probable reference vegetation types assigned above are characterised by the following important/diagnostic, biogeographically significant and endemic taxa:

KwaZulu-Natal Coastal Belt Grassland (Mucina & Rutherford, 2011):

Important taxa

Graminoids: *Aristida junciformis subsp. galpinii, Digitaria eriantha, Panicum maximum, Themeda triandra, Alloteropsis semialata subsp. eckloniana, Cymbopogon caesius, C. nardus, Eragrostis curvula, Eulalia villosa, Hyparrhenia filipendula, Melinis repens.* Herbs: *Berkheya speciosa subsp. speciosa, Cyanotis speciosa, Senecio glaberrimus, Alepidea longifolia, Centella glabrata, Cephalaria oblongifolia, Chamaecrista mimosoides, Conostomium natalense, Crotalaria lanceolata, Dissotis canescens, Eriosema squarrosum, Gerbera ambigua, Hebenstretia comosa, Helichrysum cymosum subsp. cymosum, H. pallidum, Hibiscus pedunculatus, Hybanthus capensis, Indigofera hilaris, Pentanisia prunelloides subsp. latifolia, Senecio albanensis, S. bupleuroides, S. coronatus, S. rhyncholaenus, Sisyranthus*

imberbis, Stachys aethiopica, S. nigricans, Vernonia galpinii, V. oligocephala. Geophytic Herbs: *Bulbine asphodeloides, Disa polygonoides, Hypoxis filiformis, Ledebouria floribunda, Pachycarpus asperifolius, Schizocarphus nervosus, Tritonia disticha.* Low Shrubs: *Clutia pulchella, Gnidia kraussiana, Phyllanthus glaucophyllus, Tephrosia polystachya.* Woody Climbers: *Abrus laevigatus, Asparagus racemosus, Smilax anceps.* Small Trees & Tall Shrubs: *Bridelia micrantha, Phoenix reclinata, Syzygium cordatum, Acacia natalitia, Albizia adianthifolia, Antidesma venosum.*

Moist Coast Hinterland Grassland (Mucina & Rutherford, 2011):

Important taxa

Graminoids: *Aristida junciformis subsp. junciformis, Bothriochloa insculpta, Eragrostis curvula, Hyparrhenia hirta, Panicum maximum, Paspalum scrobiculatum, Sporobolus africanus, S. pyramidalis, Themeda triandra.*Herbs: *Chamaecrista mimosoides, Conostomium natalense, Gerbera ambigua, Helichrysum allioides, Hermannia grandistipula, Pentanisia prunelloides, Selago tarachodes, Senecio exuberans, Vernonia galpinii. Geophytic Herbs Hypoxis argentea, Watsonia densiflora.* Succulent Herb: *Aloe minima.* Low Shrubs: *Agathisanthemum bojeri, Euryops laxus, Gnidia anthylloides.* Small Trees: *Vachellia natalitia, V. nilotica, V. sieberiana var. woodii.*

Dry Coast Hinterland Grassland (Mucina & Rutherford, 2011):

Important taxa

Graminoids: *Aristida junciformis subsp. junciformis (d), Bothriochloa insculpta, Eragrostis curvula, Hyparrhenia hirta, Panicum maximum, Paspalum scrobiculatum, Sporobolus africanus, S. pyramidalis and Themeda triandra.* Herbs: *Chamaecrista mimosoides, Conostomium natalense, Gerbera ambigua, Helichrysum allioides, Hermannia grandistipula, Pentanisia prunelloides, Selago tarachodes, Senecio exuberans and Vernonia galpinii.* Geophytic Herb: *Hypoxis argentea and Watsonia densiflora.* Succulent Herb: *Aloe minima.* Low Shrubs: *Agathisanthemum bojeri, Euryops laxus and Gnidia anthylloides.* Small Trees: *Acacia natalitia, A. nilotica and A. sieberiana var. woodii.*

Eastern Valley Bushveld (Mucina & Rutherford, 2011):

Important taxa

Tall Trees: *Acacia robusta*, *Sclerocarya birrea* subsp. *caffra*. Small Trees: *Acacia natalitia* (d), *A. nilotica* (d), *Combretum molle* (d), *Spirostachys africana* (d), *Acacia tortilis* subsp. *heteracantha*, *Berchemia zeyheri*, *Boscia albitrunca*, *Brachylaena elliptica*, *Cussonia spicata*, *Dombeya rotundifolia*, *Encephalartos natalensis*, *E. villosus*, *Hippobromus pauciflorus*, *Schotia brachypetala*, *Ziziphus mucronata*. Succulent Trees: *Euphorbia tirucalli* (d), *Aloe marlothii* subsp. *marlothii*, *A. rupestris*, *Euphorbia ingens*, *E. triangularis*. Tall Shrubs: *Dichrostachys cinerea* (d), *Calpurnia aurea*, *Coddia rudis*, *Ehretia rigida* subsp. *rigida*, *Euclea crispa* subsp. *crispa*, *Grewia occidentalis*, *Olea europaea* subsp. *africana*. Succulent Shrubs: *Aloe arborescens*, *Euphorbia grandicornis*, *Kleinia fulgens*. Soft Shrubs: *Hypoestes aristata*, *Peristrophe cernua*. Woody Climber: *Acacia brevispica* subsp. *dregeana*. Herbaceous Climber: *Ischnolepis natalensis*. Graminoids: *Aristida congesta* (d), *Eragrostis curvula* (d), *Hyparrhenia hirta* (d), *Melinis repens* (d), *Panicum maximum* (d), *Themeda triandra* (d), *Cymbopogon pospischilii*, *Eragrostis superba*, *Heteropogon contortus*, *Panicum deustum*, *Sporobolus fimbriatus*, *S. pyramidalis*, *Tristachya leucothrix*, *Urochloa mosambicensis*. Herbs: *Achyranthes aspera*, *Hibiscus pedunculatus*. Geophytic Herb: *Sansevieria hyacinthoides*.

Zululand Lowveld (Mucina & Rutherford, 2011):

Important taxa

Tall Trees: *Acacia burkei* (d), *A. nigrescens* (d), *Sclerocarya birrea* subsp. *caffra* (d). Small Trees: *Acacia tortilis* subsp. *heteracantha* (d), *A. gerrardii*, *A. natalitia*, *A. nilotica*, *A. senegal* var. *rostrata*, *A. welwitschii* subsp. *welwitschii*, *Boscia albitrunca*, *Combretum apiculatum*, *C. molle*, *Ozoroa paniculosa*, *Phoenix reclinata*, *Schotia brachypetala*, *Spirostachys africana*, *Teclea gerrardii*, *Ziziphus mucronata*. Succulent Trees: *Aloe marlothii* subsp. *marlothii*, *Euphorbia grandidens*, *E. ingens*. Tall Shrubs: *Dichrostachys cinerea* (d), *Euclea divinorum* (d), *Coptosperma supra-axillare*, *Crotalaria monteiroi*, *Euclea crispa* subsp. *crispa*, *E. schimperi*, *Galpinia transvaalica*, *Gardenia volkensii*, *Gymnosporia maranguensis*, *G. senegalensis*, *Jatropha zeyheri*, *Lycium acutifolium*, *Olea europaea* subsp. *africana*, *Tarchonanthus parvicapitulatus*, *Tephrosia polystachya*, *Triumfetta pilosa* var. *tomentosa*. Low Shrubs: *Barleria obtusa*, *Crossandra greenstockii*, *Felicia muricata*, *Gymnosporia heterophylla*, *Indigofera trita* subsp. *subulata*, *Justicia flava*, *J. protracta*

subsp. *protracta*, *Melhania didyma*, *Orthosiphon serratus*, *Pearsonia sessilifolia*, *Ruellia cordata*, *Sida serratifolia*, *Tetraselago natalensis*. Succulent Shrubs: *Euphorbia grandicornis, E. trichadenia, E. vandermerwei*. Soft Shrub: *Pavonia columella*. Herbaceous Climber: *Fockea angustifolia*. Graminoids: *Dactyloctenium australe* (d), *Enteropogon monostachyus* (d), *Eragrostis capensis* (d), *E. curvula* (d), *E. racemosa* (d), *Heteropogon contortus* (d), *Panicum maximum* (d), *Sporobolus pyramidalis* (d), *Themeda triandra* (d), *Aristida bipartita, A. congesta, Bothriochloa insculpta, Chloris mossambicensis, Cymbopogon caesius, Digitaria natalensis, Leptochloa eleusine, Panicum deustum, Schizachyrium sanguineum, Setaria incrassata, Sporobolus nitens, Trachypogon spicatus, Tristachya leucothrix*. Herbs: *Acrotome hispida, Argyrolobium rupestre, Aspilia mossambicensis, Chamaecrista biensis, C. mimosoides, Corchorus asplenifolius, Felicia mossamedensis, Gerbera ambigua, Helichrysum rugulosum, Hibiscus pusillus, Kohautia virgata, Lotononis eriantha, Senecio latifolius, Stachys aethiopica, Tragia meyeriana, Vernonia capensis*. Succulent Herb: *Aloe parvibracteata.*

In terms of conservation planning datasets, the 'NEMBA threatened ecosystems: remaining extent' dataset flags the potential presence of 'intact natural vegetation' within portions of the study area which includes 'Moist Coast Hinterland Grassland', 'Dry Coast Hinterland Grassland' and 'Zululand Lowveld'.

The Systematic Conservation Assessments (SCAs) is a strategic conservation plan developed in 2016 by the Provincial Conservation Authority, Ezemvelo KZN Wildlife (EKZNW) to ensure that representative samples of biodiversity are conserved. It is used as a land use decision support tool in KwaZulu-Natal and replaced the 2010 Terrestrial Systematic Conservation Plan (MINSET). The SCAs are derived from merging the Provincial Terrestrial Systematic Conservation Plan (TSCP) with other conservation datasets. In terms of terrestrial conservation, three conservation categories were developed including (i) CBA: Irreplaceable, (ii) CBA: Optimal, and (iii) Ecological Support Area. These conservation categories are described in Table 18 below.

Table 18. Description and derivation of conservation categories.

Conservation Category	Description	Development Process
Critical Biodiversity Area: Irreplaceable	Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.	The coverage was created by merging the following datasets: • 2010 MINSET – Irreplaceable and highly irreplaceable categories. • National Threatened Ecosystems – Critically endangered category • KZN Threatened Ecosystem – Critically Endangered and Endangered category. • Landscape Corridor critical linkages - Corridor type
Critical Biodiversity Area: Optimal	Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding high-cost areas as much as possible.	The coverage was created by merging the following datasets: • 2010 MINSET – Optimal categories. • Local Knowledge – aquatic and terrestrial optimal categories.
Ecological Support Area	ESA are functional but not necessarily entirely natural terrestrial or aquatic areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the CBAs.	The coverage was created by merging the following datasets: • Local Knowledge – aquatic and terrestrial ESA categories. • Local corridor • Landscape corridor

According to the KwaZulu-Natal Terrestrial Systematic Conservation Plan (TSCP) (EKZNW, 2016) areas of **CBA: Irreplaceable** are present within and around the development footprint as shown in Figure 5. It is evident from the TSCP (EKZNW, 2011) spatial coverage that the 'CBA: Irreplaceable' status assigned to these areas is vegetation driven due to the current and potential presence of the North Coast Grassland. Other species and vegetation types driving the classification include the **mollusc:** *Euonyma lymneaeformis, Gulella separata, Edouardia conulus* **millipedes**: Doratogonus falcatus, Centrobolus fulgidus, Doratogonus natalensis, Doratogonus peregrinus **insect:** *Whitea coniceps* **plant:** *Vernonia africana, Barleria natalensis, Kniphofia littoralis* and **vegetation type:** Zululand Lowveld

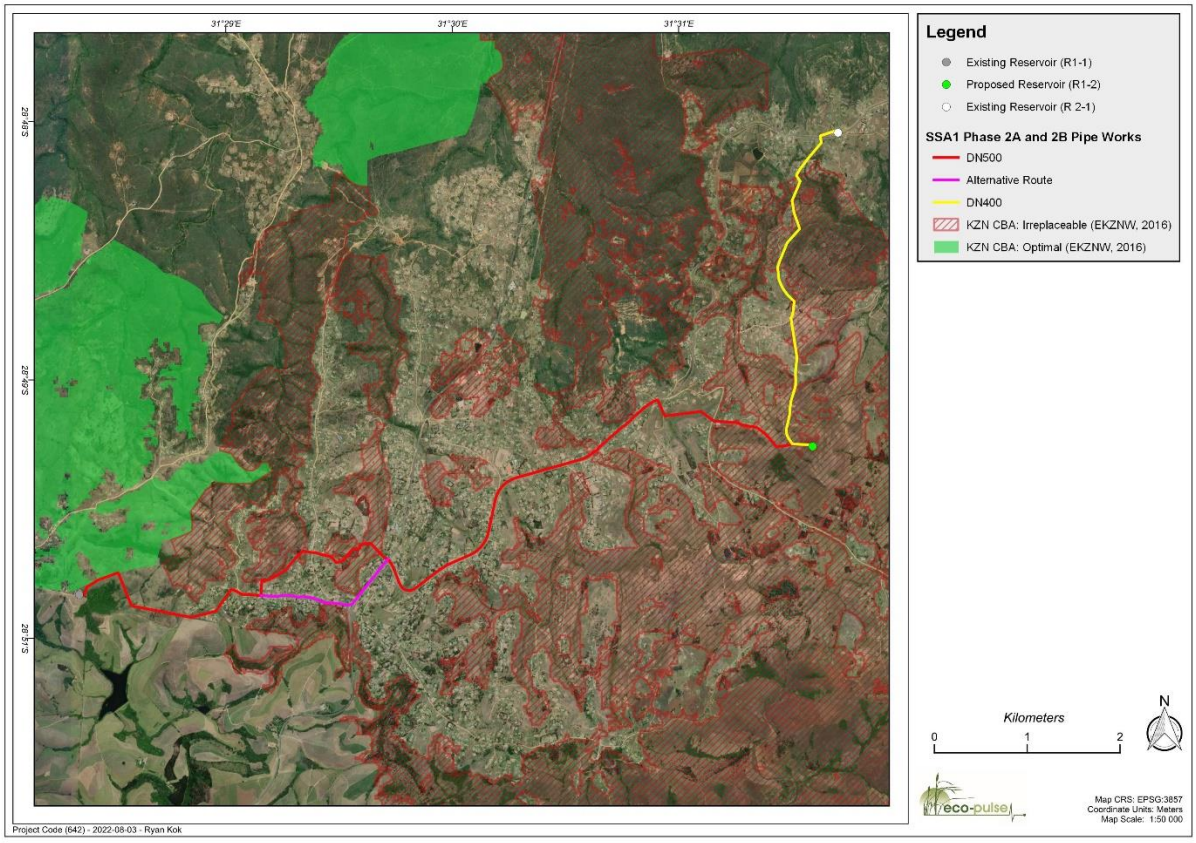

Figure 5 Map showing the location and extent of areas identified as 'CBA: Irreplaceable' (shaded in a hashed 'red') according to the terrestrial CPLAN (EKZNW, 2016), in relation to the study site.

3.3 Historic Land Use & Disturbance Regime

An understanding of historic land use and disturbance at the site was gained by reviewing historical imagery and orthophotos. It appears that despite clearing of vegetation for subsistence agriculture and the development of roads and the construction of houses in the surrounding rural communal areas, the project area has remained relatively the same between 2010 and 2022. Nevertheless, the site does appear to have been impacted by grazing, local encroachment and alien plant infestations and/or plantations since 1937. This is evidenced through the increase in settlements within grassland and thornveld communities in the intervening years (Figure 6 – 9).

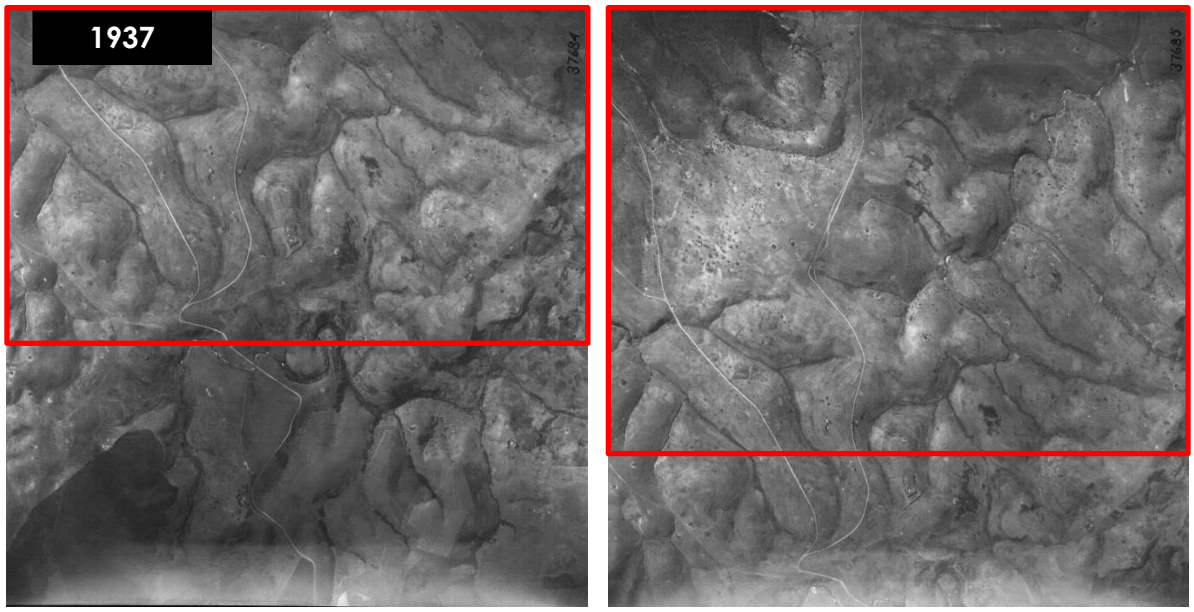

Figure 6 Historical image (aerial photograph) dating back to 1937, the focus area is estimated shown outlined in "red", indicating what has been interpreted as 'open grassland' vegetation cover.

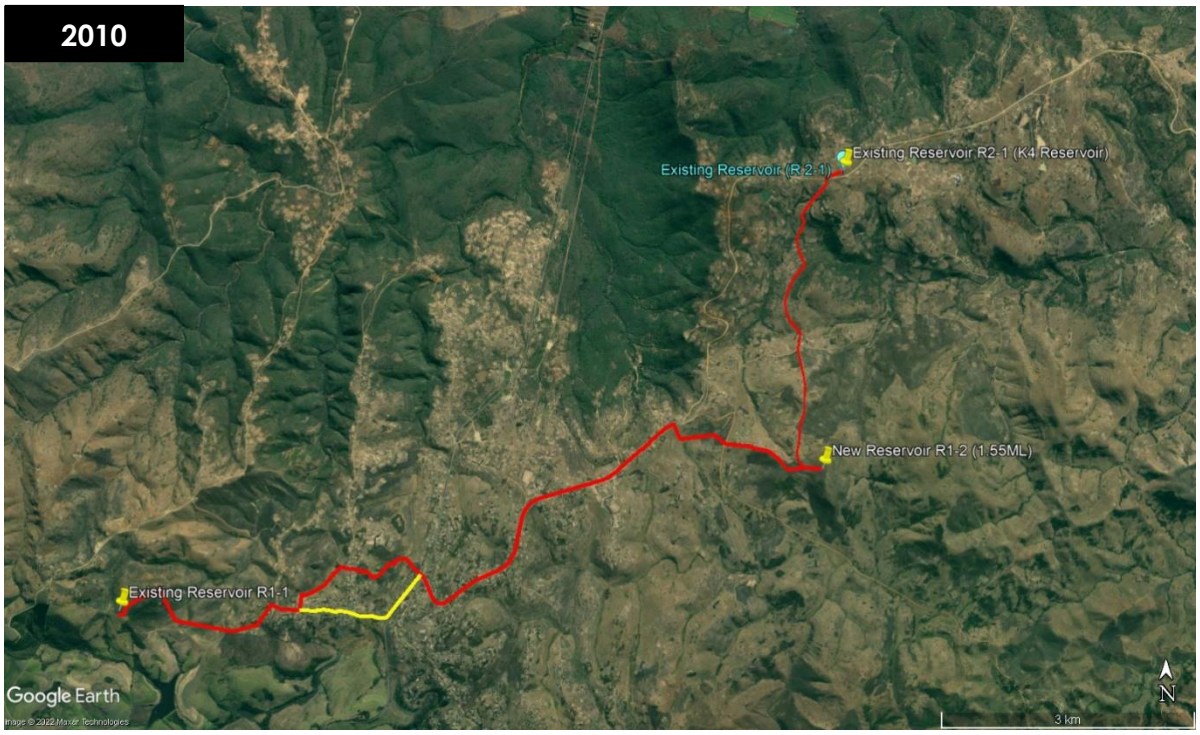

Figure 7 Google Earth™ satellite imagery of the pipeline alignment dating back to 2010, with the alignment shown in "red" and "yellow".

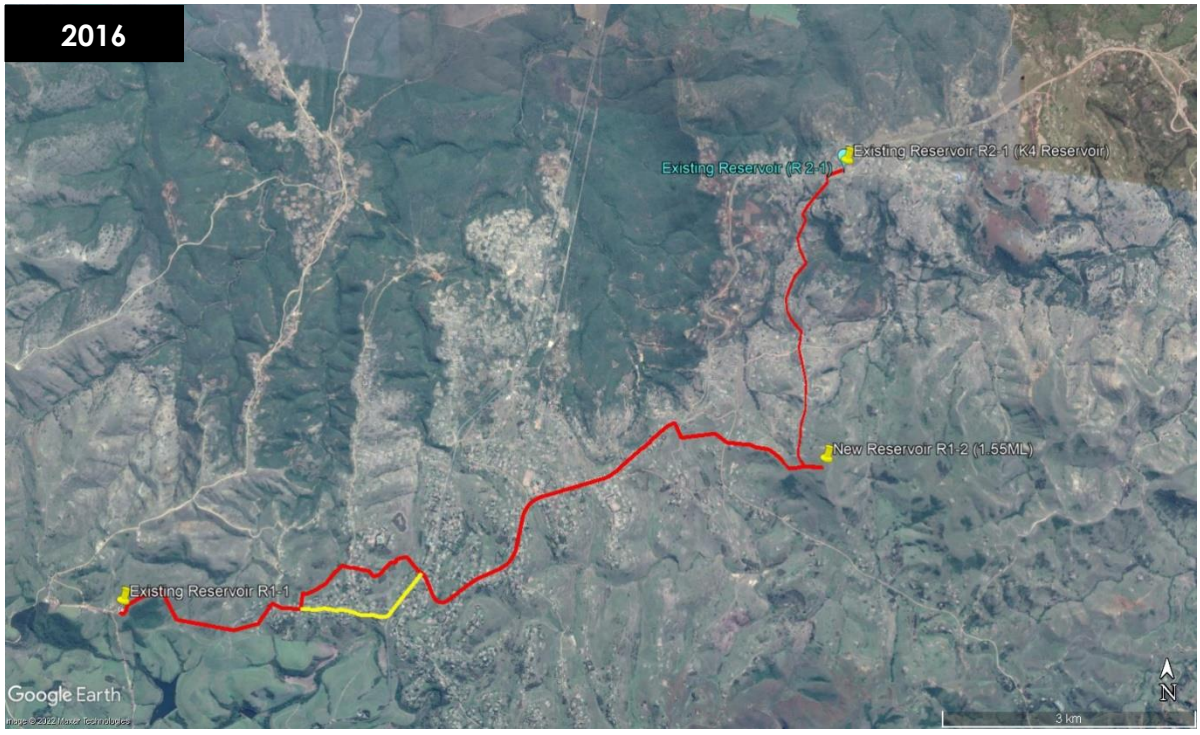

Figure 8 Google Earth™ satellite imagery of the pipeline alignment dating back to 2016, with the alignment shown in "red" and "yellow".

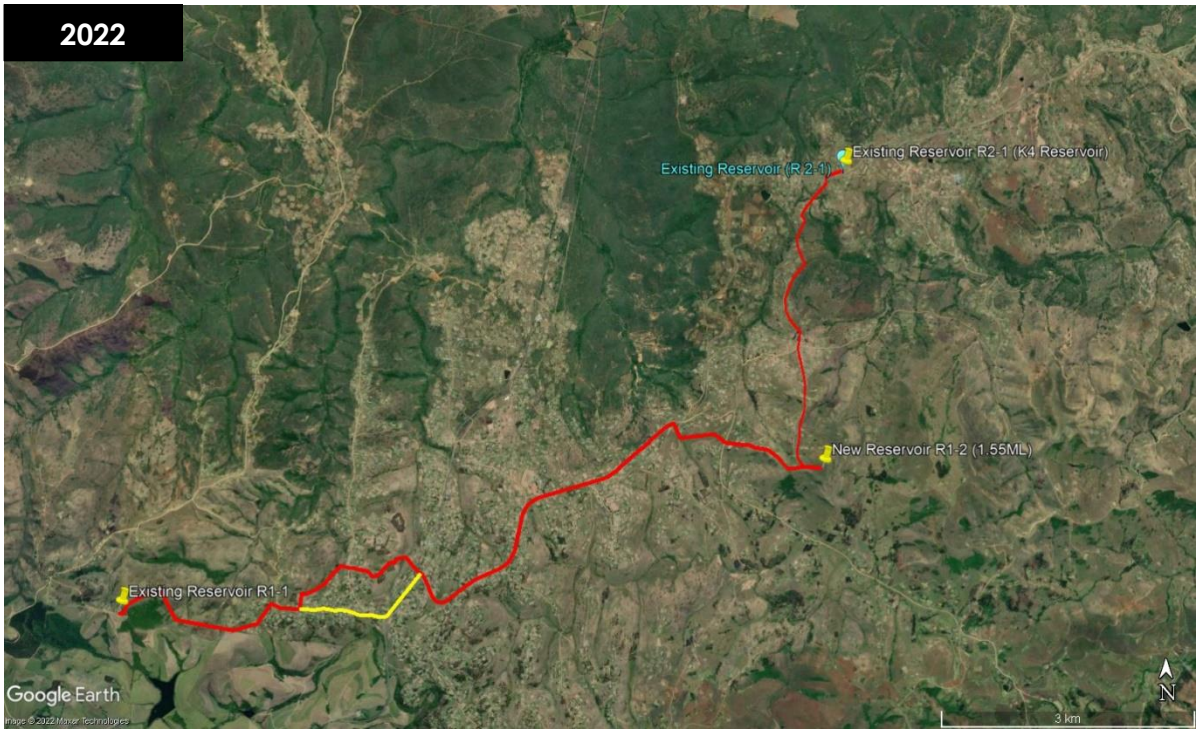

Figure 9 Google Earth™ satellite imagery of the pipeline alignment in 2022, with the alignment shown in "red" and "yellow".

4 BASELINE VEGETATION & HABITAT ASSESSMENT

4.1 Description of the Vegetation Community

Vegetation and habitat was surveyed on the planned development site (proposed footprint of the pipeline construction) and within a 10m servitude (i.e. 5m either side of the pipeline centre-line). The various terrestrial vegetation communities discussed in this report were identified and classified according to topographic location, plant species composition, vegetation structure and level of degradation. These vegetation communities are described in detail below. *A full list of the individual plant species identified within the study area as part of the terrestrial vegetation survey has been provided in* ***Annexure B*** *at the back of this report.*

Table 19. Summary of terrestrial vegetation community types and land use types identified and classified for the site in June/July 2022.

Vegetation Community Type	Threat Status[10]	Condition	Protected Plants Present?
Moist Coast Hinterland Grassland	EN	Fair: moderately modified to degraded	Yes
Mixed Hygrophilous Grassland	LT/CR	Fair: moderately modified to degraded	No

[10] Threat Status (Jewitt, 2016):

CR: Critically Endangered; EN: Endangered; VU: Vulnerable; LT: Least Threatened

Vegetation Community Type	Threat Status[10]	Condition	Protected Plants Present?
Secondary Open Grassland	N/A	Poor: moderately modified to degraded	No
Zululand Lowveld	VU	Fair: moderately modified to degraded	Yes
Woody Riparian	LT	Fair: moderately modified	No
Dense Invasive Alien Plants	N/A	Lost: irreversibly modified	No
Cultivated land*	N/A	Lost: irreversibly modified	No
Transformed*	N/A	Lost: irreversibly modified	No

**Note that 'Transformed areas' (i.e., existing developments, roads and infrastructure, bare ground) and actively 'Cultivated land' were excluded from the vegetation assessment but are shown mapped in Figure 10 as 'transformed' and 'cultivated', respectively.*

Detailed descriptions of each vegetation community are presented below, with the exception of the wetland and riparian vegetation types which have been assessed as part of the **Specialist Freshwater Impact Assessment Report** by Eco-Pulse (refer to Eco-Pulse Report No. EP643-01). Note that alien/exotic plant species are shown in "**red**" text in the vegetation descriptions presented.

4.1.1 Moist Coast Hinterland Grassland

Very little of this grassland occurs anywhere in KwaZulu-Natal in completely natural condition and so all instances in better condition are valuable. Instances which are untransformed are nonetheless usually grazed to some degree and have experienced some overexpression of unpalatable species and diminution of palatable species.

The grassland was observed occurring outside of disturbed areas of the study area and was found to be in a relatively '**fair**' condition and was classified as a primary. While dominated by unpalatable grasses such as *Aristida junciformis*, *Sporobolus africanus* and *S. pyramidalis*, parts contain notable herbaceous species diversity. One threatened species occurs along the route, namely the cycad *Stangeria eriopus*.

In addition, there are some species which are protected by the KwaZulu-Natal Nature Conservation Management, but which are not considered to be threatened. These are *Aloe maculata* (which is widespread in the province), *Eucomis autumnalis* and the climber *Dioscorea cotinifolia (not protected but rare)* amongst rocks.

In the western region near the proposed reservoir the vegetation is mapped in the National Vegetation Map (SANBI 2018) as Zululand Lowveld, but is in fact Moist Coast Hinterland Grassland. Part has been heavily grazed and mostly depleted of herbaceous diversity but improves considerably and is primary if somewhat degraded. The grassland on lower slopes associated with rock outcrops only approx. 60 meters from the route is still in good condition and include some unusual species (such as *Streptocarpus confusus* subsp. *confusus* in the shade of and base of rock outcrops).

Photo 1. A primary Coastal Hinterland Grassland community (fair condition) dominated by *Aristida junciformis*, *Sporobolus africanus* and *S. pyramidalis*

Photo 2. Threatened cycad *Stangeria eriopus* encountered along the pipeline route.

4.1.2 Secondary Open Grassland

This grassland community was observed occurring within untransformed areas of the study area and was found to be in a relatively **'poor'** condition and was classified as a secondary grassland community that has resulted from an unnatural burning regime, disturbance linked to cattle grazing and human movement and encroachment, and road infrastructure construction and solid waste dumping. The community was characterised by a high abundance of weeds, pioneer grasses and typical 'increaser' grass species that dominate under an unnatural disturbance regime linked primarily with over-grazing. The most common/abundant graminoid (grass) species occurring within the secondary open grassland type included a number of indigenous coastal pioneer species and tolerant/increaser grasses such as: *Chloris gayana, Cynodon dactylon, Stenotaphrum secundatum, Eragrostis plana, Imperata cylindrica, Sporobolus africanus* and *Sporobolus pyramidalis.* Other grass species noted at low abundance levels were *Cymbopogon nardus, Digitaria eriantha, Panicum maximum* and *Hyparrhenia hirta.*

The secondary grassland community had a particularly low diversity of indigenous forbs. The provincially protected plant, *Aloe maculata* (common soap aloe) can also likely be found scattered within the grassland community and occurring within small colonies.

A number of ruderal, weed and Invasive Alien Plant (IAP) species were recorded within the grassland community, including *Ageratum conyzoides, Chromolaena odorata, Mimosa pudica, Psidium guajava, Senna didymobotrya* and *Lantana camara.*

Signs of an early stage of bushland/woody plant encroachment were apparent, with species such as *Dichrostachys cinerea* observed, scattered within the grassland.

Photo 3. View of a degraded grassland community with scattered alien plant species, edge effects from existing dirt roads and boarding sugarcane plantations.

Photo 4. View of a degraded grassland community with short grassland and scattered woody thorn tree/shrubs species and woody encroachers.

4.1.3 Zululand Lowveld

The pipeline route traverses an area of semi-continuous Zululand Lowveld, some in fair condition, which is fragmented by proximate settlement, in which there is also significant grazing and browsing. However, this is a vegetation type which contains many unpalatable species and is so resistant to these kinds of impacts. Zululand Lowveld contains numbers of protected species but few species of conservation concern. Along the route this includes a small number of *Sclerocarya birrea* subsp. *caffra* (Marula) trees, but these appear outside the study area. Those seen were damaged by medicinal bark harvesting and protected by the National Forests Act, and *Aloe marlothii*, protected by the KwaZulu-Natal Nature Conservation Management. As it was not possible to access all of the study area through this vegetation, not all instances of *Scleorcarya birrea* and *Aloe marlothii* may have been seen.

Zululand Lowveld is a mainly thicket vegetation type though it may grade into more open areas, but not very extensive, of grassland. Species of *Diospyros, Euclea* and the spiny genus *Gymnosporia* are most common, particularly near settlement and where livestock browses.

Photo 5. View of dense Zululand Lowveld community with an existing dirt road.

Photo 6. View of a degraded Zululand Lowveld which is boarded by local communities utilizing the woody vegetation for firewood etc.

4.1.4 Dense Invasive Alien Plants Infestations

This alien/exotic plant dominated community was found to comprise the largest portion of the non-transformed area within the study area and has essentially been artificially created as a result of anthropogenic disturbance including: unnatural burning regime, disturbance linked to cattle grazing and human movement, power line and road infrastructure construction, burning of waste and solid waste dumping, plantations, cultivation and removal of indigenous plants.

As the name suggests, this community was found to be overgrown with Invasive Alien Vegetation, with a mix of woody and herbaceous plants species recorded, including: *Acacia mearnsii, Agave americana, Ageratum conyzoides, Chromolaena odorata, Canna indica, Cardiospermum grandiflorum, Eucalyptus sp, Ipomea alba, Ipomoea purpurea, Lantana camara, Leucaena leucocephela, Melia azedarach, Mimosa pudica, Psidium guajava, Ricinus communis, Senna didymobotrya, Schinus terebinthifolius, Solanum chrysotrichum, Solanum mauritianum Tecoma stans* and *Tithonia diversifolia.*

Although indigenous vegetation was present, it constituted a small minority of the vegetation type, with mainly tolerant and locally common species of least concern recorded (remnants of the former grassland/forest communities that would have been present historically), including woody tree and shrub species such as *Acacia schweinfurthii, Acacia sieberiana, Dovyalis caffra, Dichrostachys cinerea, Trichilia emetica* and *Phoenix reclinata.* The grass/gramoinoid layer was found to consist mainly of indigenous species of least concern, and mainly disturbance-tolerant and pioneer/increaser grasses such as *Panicum maximum, Cynodon dactylon, Chloris gayana* and *Stenotaphrum secundatum.*

Photo 7. View of dense *Acacia mearnsii* (Black Wattle)

Photo 8. Alien plantations and plants according along the existing dirt roads.

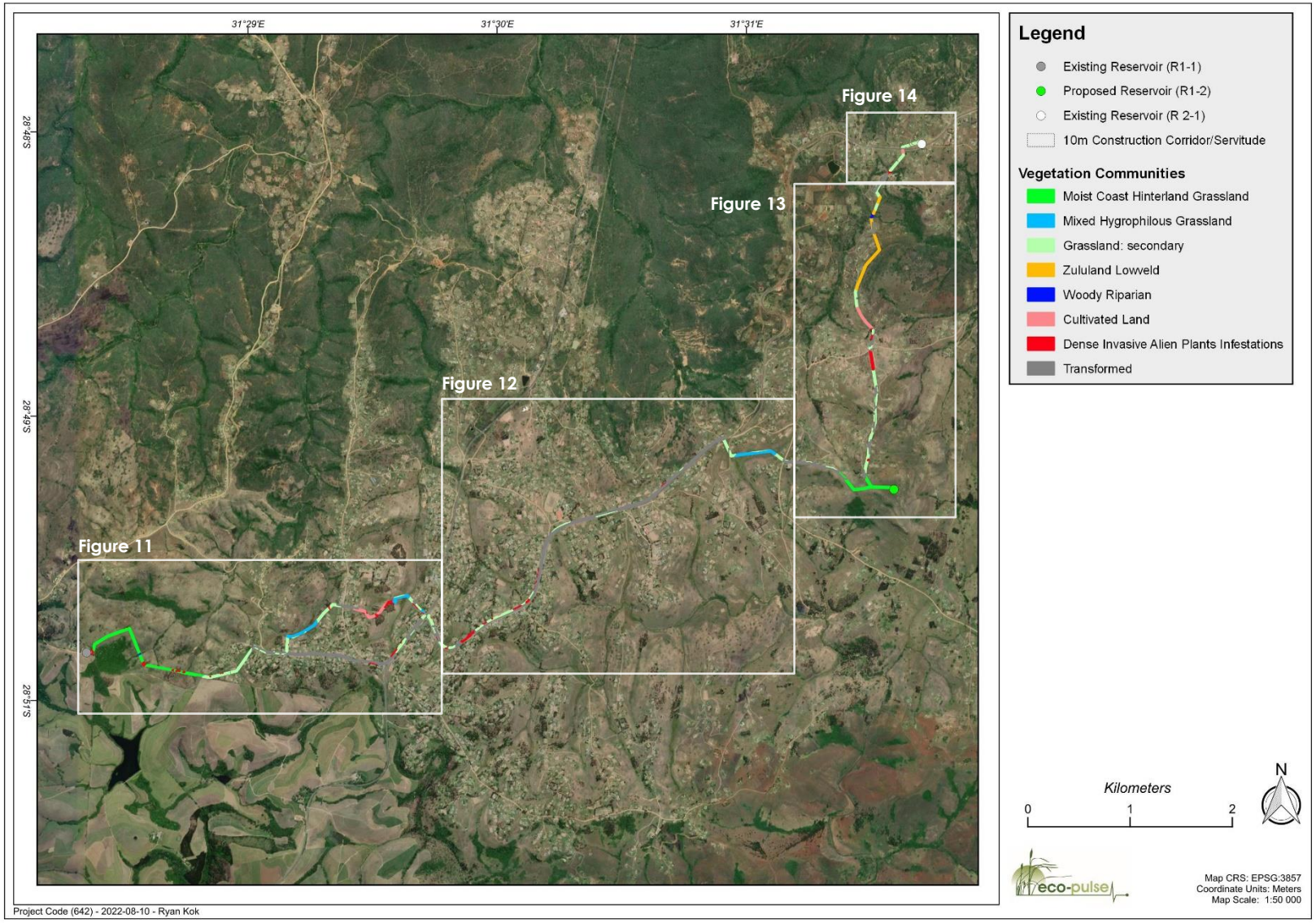

Figure 10 Mapped vegetation communities and habitat types identified and described within 10m pipeline development corridor.

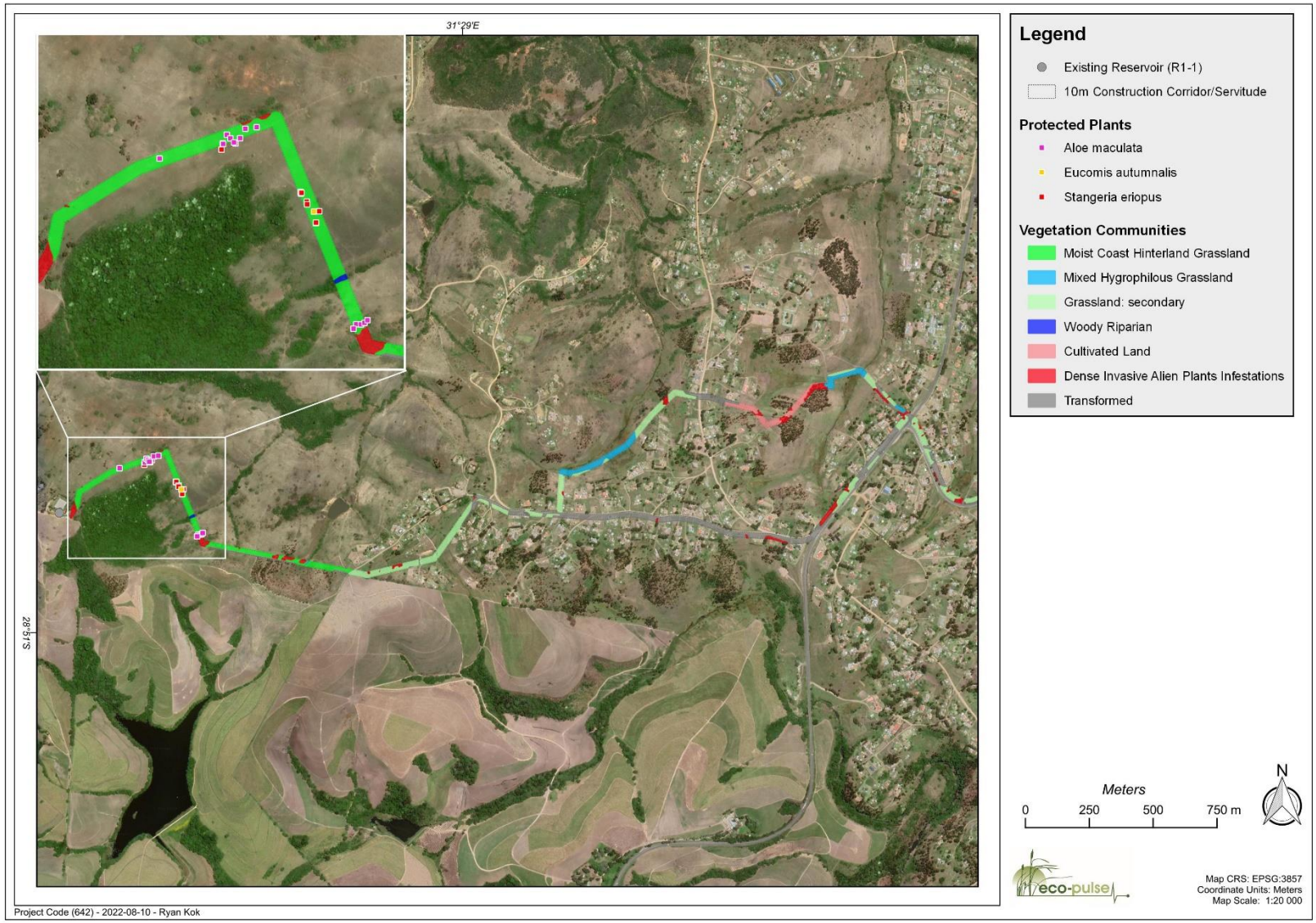

Figure 11 Mapped vegetation communities and habitat types identified and described within 10m pipeline development corridor (western section)

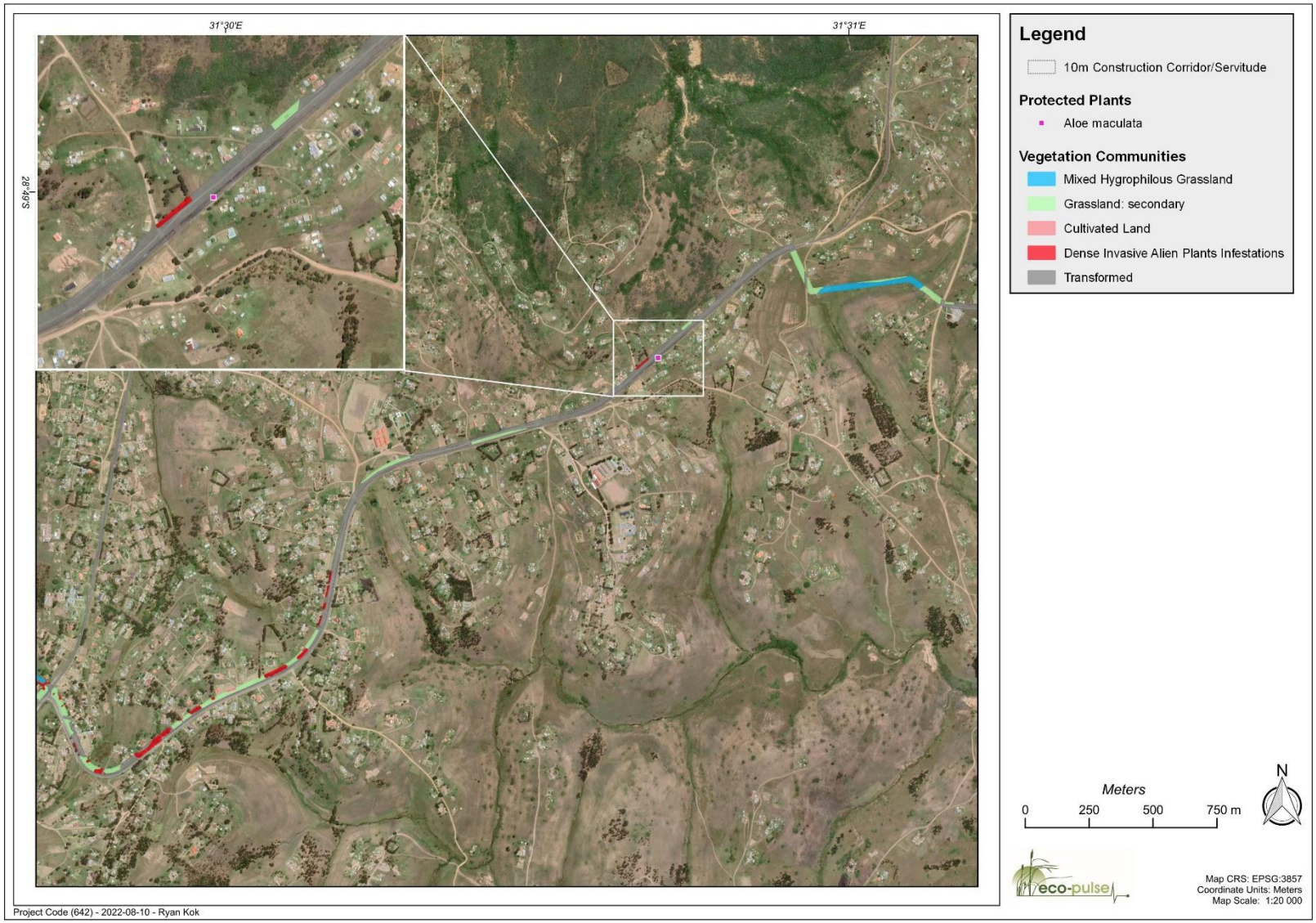

Figure 12 Mapped vegetation communities and habitat types identified and described within 10m pipeline development corridor (western mid-section)

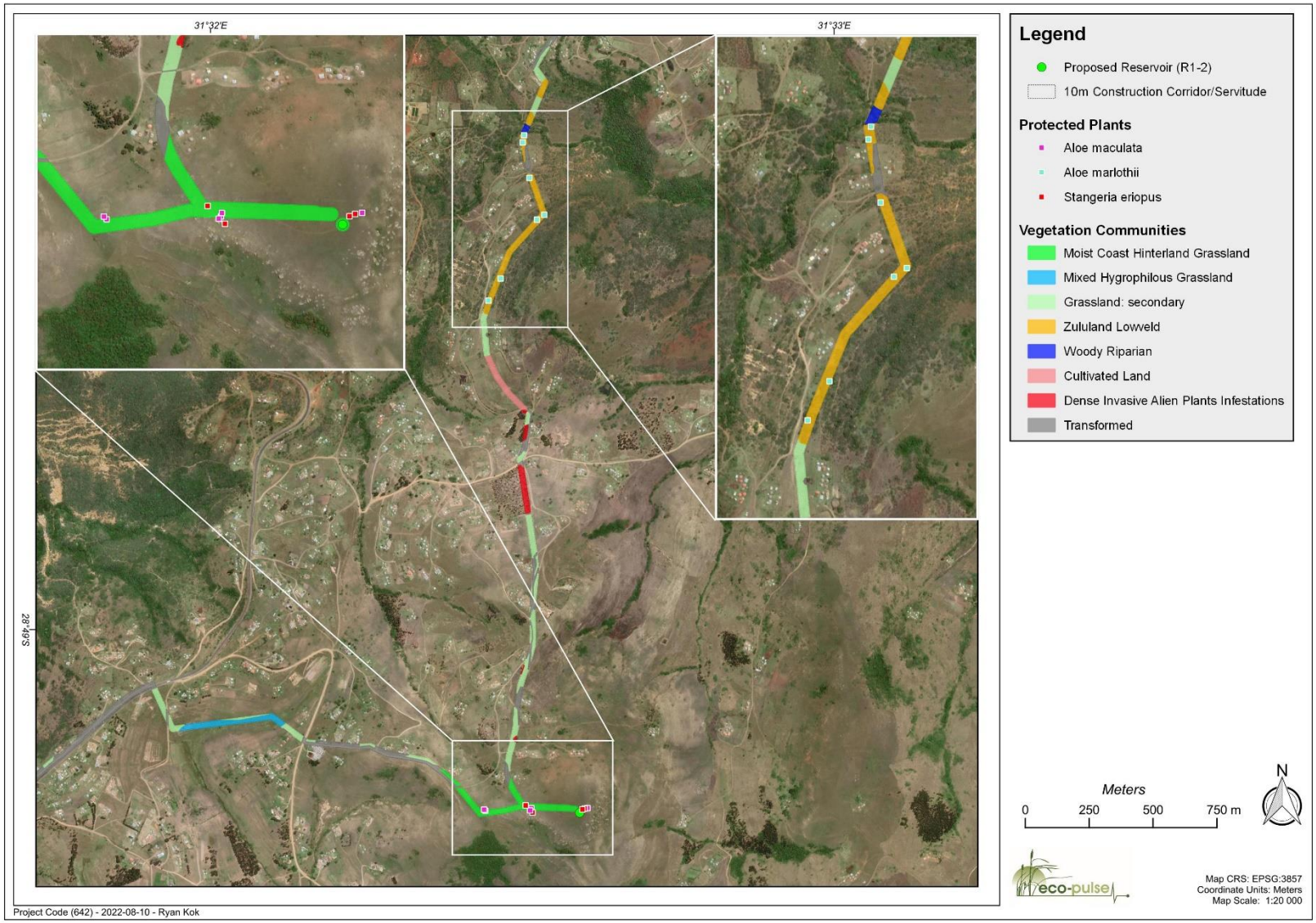

Figure 13 Mapped vegetation communities and habitat types identified and described within 10m pipeline development corridor (eastern & northern section)

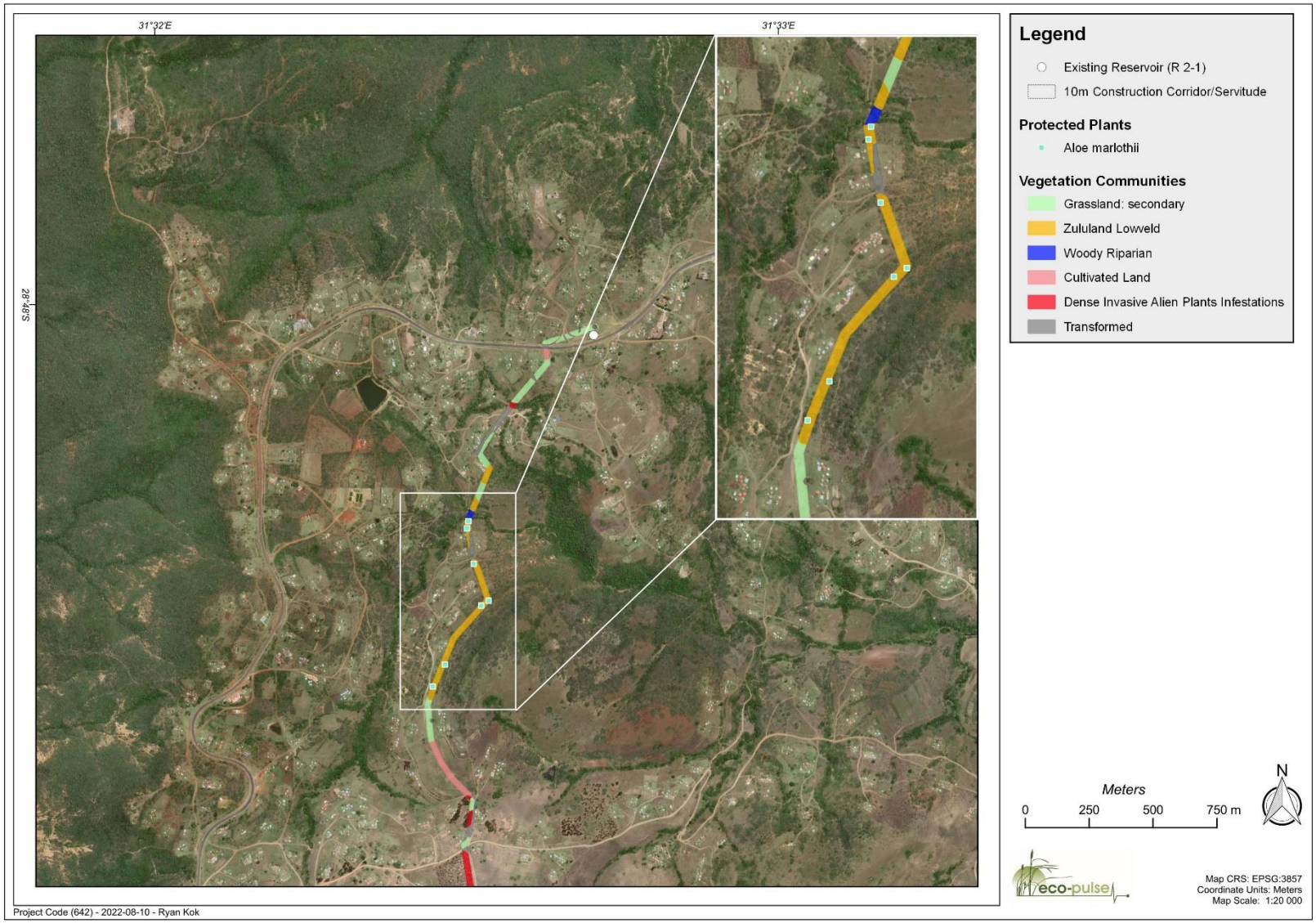

Figure 14 Mapped vegetation communities and habitat types identified and described within 10m pipeline development corridor (northern section)

4.2 Protected Plants Species

Provincially protected plants in terms of Schedule 12 of the KwaZulu-Natal Nature Conservation Management occurring within grassland and thornveld included:

- *Aloe maculata*
- *Aloe marlothii*
- *Eucomis autumnalis*
- *Stangeria eriopus*

Threatened plants identified within sandstone sourveld grassland and coastal belt thornveld habitat included:

- *Stangeria eriopus VU*

4.3 Ecological Importance Assessment

The results of the site ecological importance assessment are shown in Table 20 and shown graphically on the map in Figure 15 – 18. The ecological importance and sensitivity (EIS) of the various vegetation communities and habitat types assessed generally relates back to the ability of the ecosystem to meet conservation targets for and maintain important biodiversity features and the ecosystems sensitivity to ecological change and how significant such change would be.

Table 20. Summary of terrestrial habitat ecological importance ratings.

	1. Moist Coastal Hinterland Grassland (primary)	2. Grassland (secondary	3. Zululand Lowveld (primary)	4. Dense Invasive Alien Plants
CONSERVATION IMPORTANCE	High	Low	Medium	Very Low
FUNCTIONAL INTEGRITY	Medium	Medium	Medium	Low
BIODIVERSITY IMPORTANCE	Medium	Low	Medium	Very Low
RECEPTOR RESILIENCE	Low	High	Medium	Very High
SITE ECOLOGICAL IMPORTANCE RATING	**High**	**Low**	**Medium**	**Very Low**

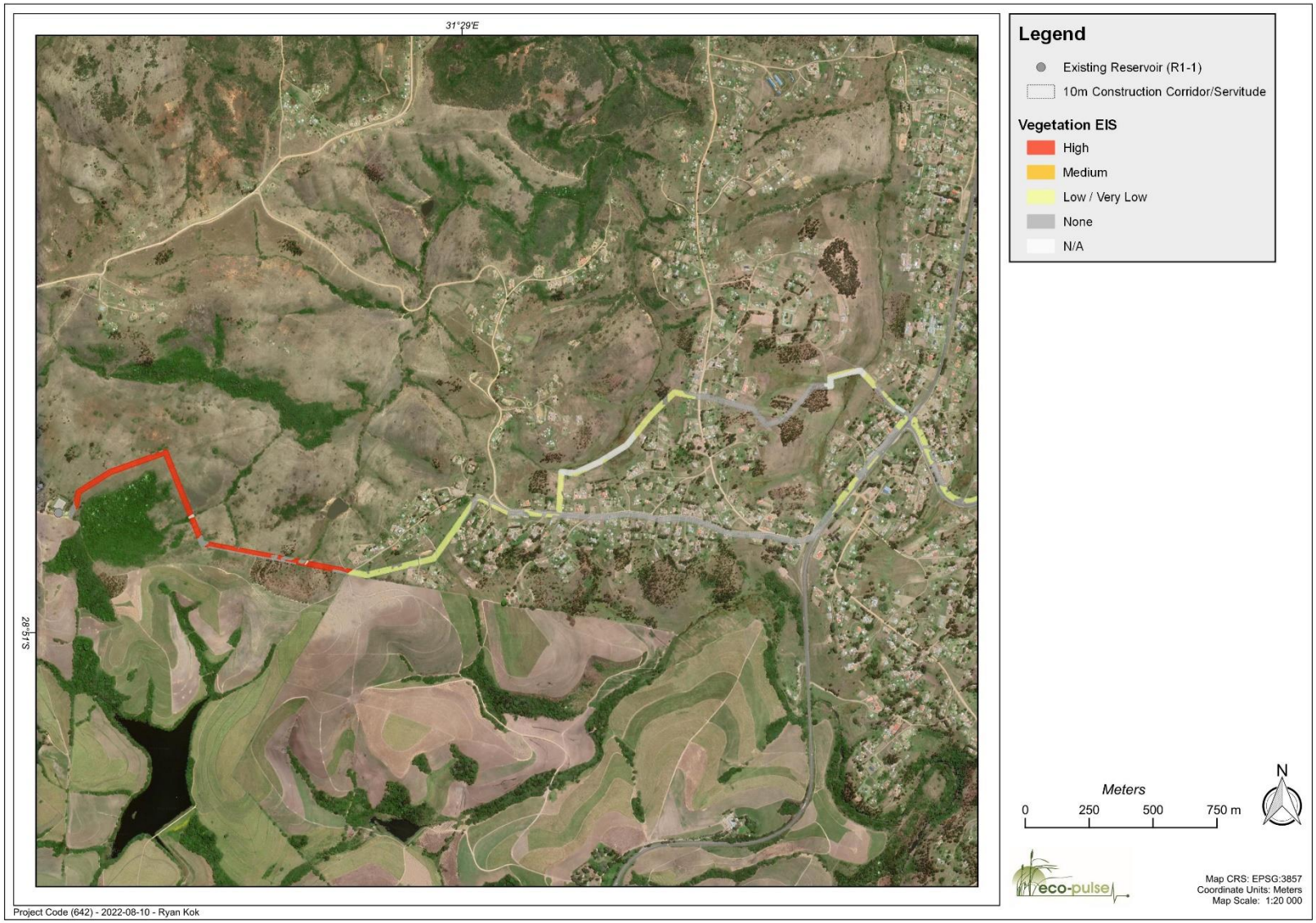

Figure 15 Map showing site ecological importance ratings for terrestrial vegetation communities and habitats (western section)

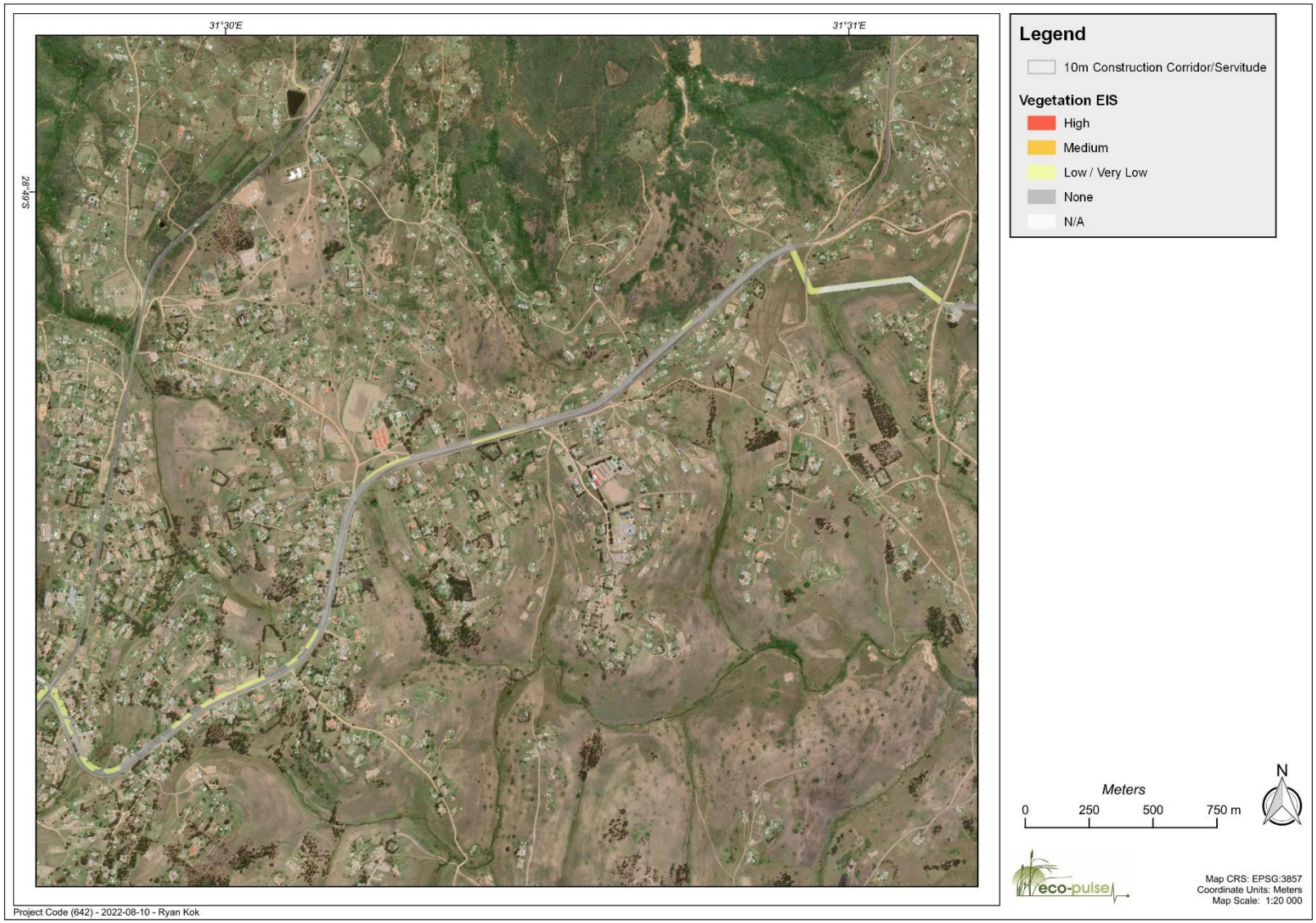

Figure 16 Map showing site ecological importance ratings for terrestrial vegetation communities and habitats (western mid-section)

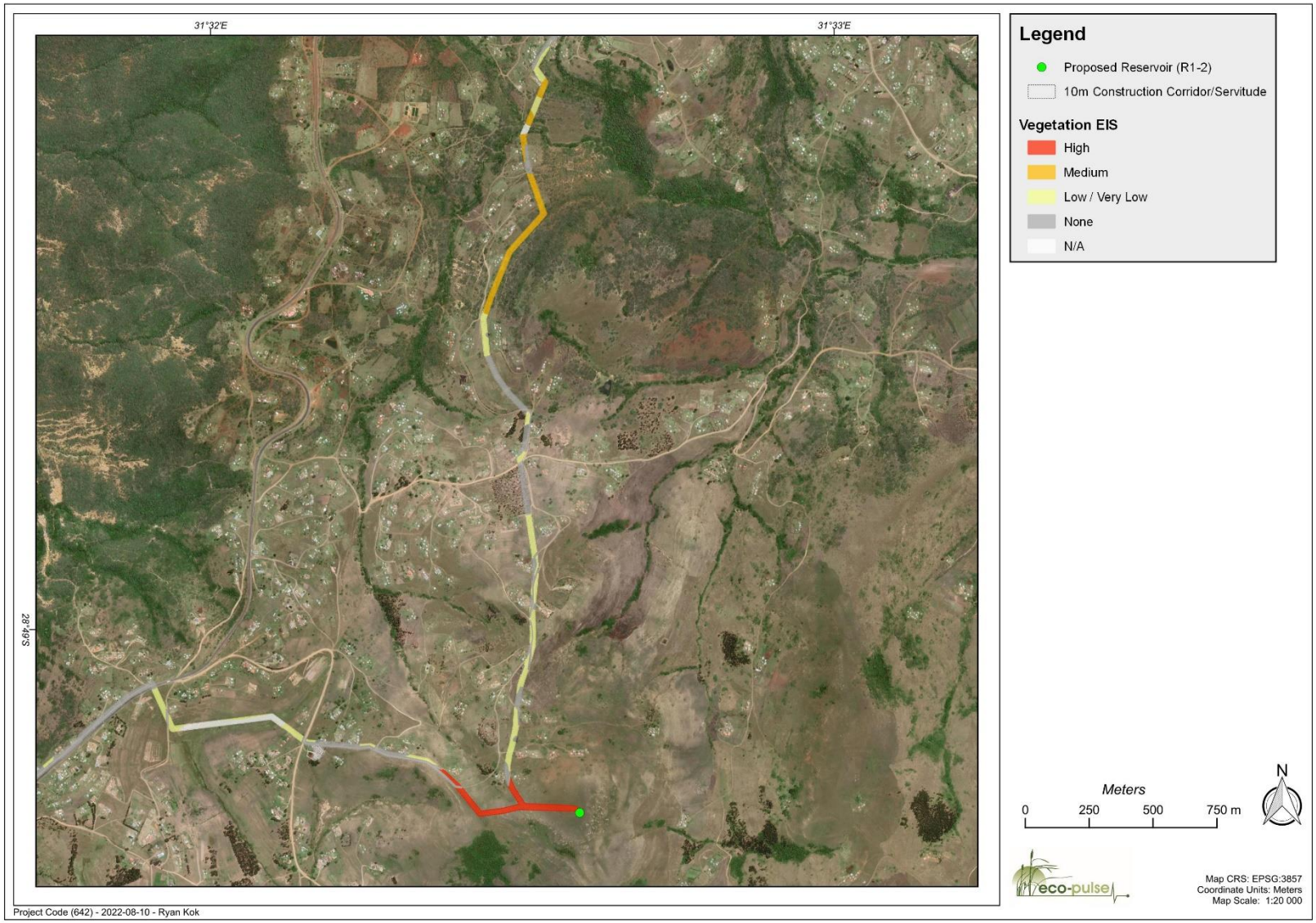

Figure 17 Map showing site ecological importance ratings for terrestrial vegetation communities and habitats (eastern & northern section)

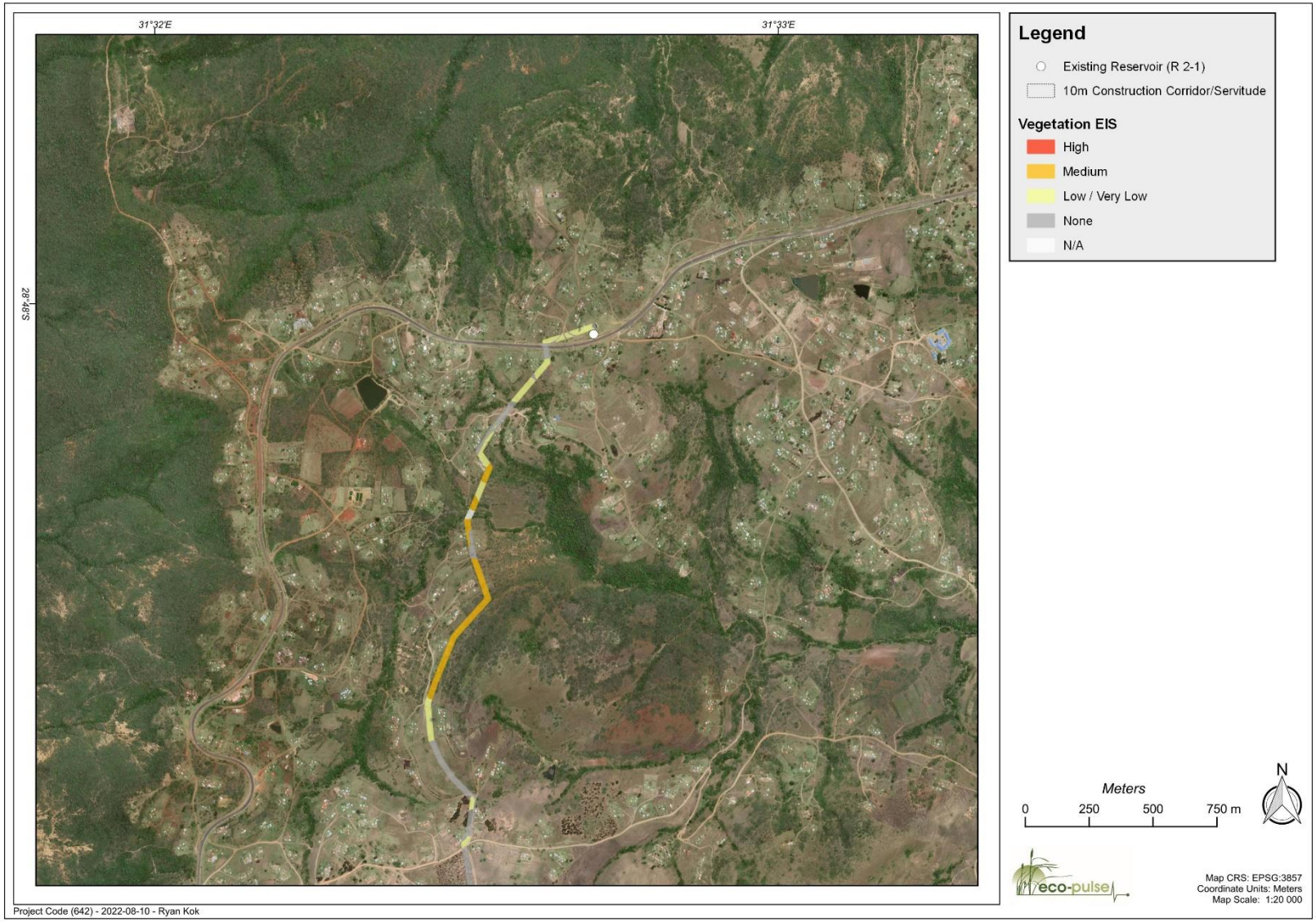

Figure 18 Map showing site ecological importance ratings for terrestrial vegetation communities and habitats (northern section)

4.3.1 Other noteworthy findings and ecological concerns

1. Remaining natural linkages/corridors

Anthropogenic development (informal infrastructure as well as substance / commercial agriculture) in the in the vicinity of Eshowe town has led to the transformation of natural habitat for the purposes of establishing transportation, residential infrastructure as well as clearing of large tracts of land to facilitate agricultural production (mainly vegetables and sugarcane). As such, any remaining intact ecological assets and ecological infrastructure (related to untransformed wetland/riparian areas, grassland habitat in the western and eastern sections and the woody thicket in the northern section of the study area) form important linkages and 'islands' for local biodiversity in a proverbial encroachment and agricultural land use. Riparian habitat maintains longitudinal connectivity between upstream and downstream river reaches as well as lateral connectivity between terrestrial and aquatic habitats. Remaining untransformed grasslands and lowveld thicket communities also form important ecological linkages and provide refugia for local species of flora and fauna, as well as forming important seed dispersal sites/nuclei. It is considered critical that remaining intact natural habitat be preserved wherever possible. Vegetation composition and structure and the condition of natural habitat in these areas should be maintained in as natural a state as possible such that movement of local wildlife is not jeopardized any further.

2. Steep slopes and erodible soils

The majority of the site is characterized by gentle slopes where soil erosion and instability is unlikely to be of great concern. The northern parts of the study area within Zululand Lowveld are characterised by steeper slopes where soil erosion risk is likely to be of concern, however natural terrestrial habitat cover is very lacking to absent in degraded areas as a consequence of human settlement, development and land use transformation.

Erosion and sediment risks are therefore likely to be restricted mainly to watercourses and aquatic environments and this has been dealt with separately in the ***Specialist Freshwater Impact Assessment Report*** *by Eco-Pulse (refer to Eco-Pulse Report No. EP 643-01).*

5 ECOLOGICAL IMPACT ASSESSMENT

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. This chapter of the report deals with the identification, description, prediction and significance assessment of the potential construction and operational impacts and risks posed to terrestrial ecosystems, vegetation, habitat and species by the water pipeline development project.

5.1 Description of Development Activities

In order to anticipate potential risks and impacts to terrestrial biodiversity associated with the project, an understanding of the construction and operational processes and development activities is first required.

5.1.1 Construction Phase Activities and Infrastructure

Construction activities will likely include (i) vegetation stripping and clearing along the pipeline corridor / servitude, (ii) the establishment and clearing of any temporary access roads, (iii) bulk earth works and platforming and (iv) the installation of pipeline and construction of the new reservoir.

Note that construction impacts within and/or crossings watercourses will affect freshwater ecosystems only and have therefore not been addressed in this report.

5.1.2 Operation Phase Activities and Infrastructure

Operationally, this will include the operation of the water pipeline, reservoir and any maintenance/repair work required where needed.

Note that operation impacts within and/or crossings watercourses will affect freshwater ecosystems only and have therefore not been addressed in this report.

5.2 Impact Identification

The general framework for the risk and impact assessment is shown in Table 21, which presents the expected risks, stressors and impacts for the construction and operational phase of the project.

Table 21. Terrestrial biodiversity impact assessment framework.

TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT FRAMEWORK	
DEVELOPMENT TYPE & ACTIVITIES: *Water Supply Project*	
Construction Phase Activities: • Vegetation stripping and clearing • Temporary access roads (where required) • Platforming, installation of pipeline and construction of reservoir	Operational Phase Activities: • Use of pipeline servitude and access roads for pipeline and reservoir maintenance purposes
ENVIRONMENTAL STRESSORS/RISKS	
Construction Phase Stressors/Risks:	**Operational Phase Stressors/Risks:**
• Direct loss of vegetation & habitat • Reduced ground cover, exposed soils • Soil erosion & resultant sedimentation • Noise / light disturbance • Accidental pollution (spills)	• Altered runoff patterns and processes • Colonisation by alien plants / weeds • Reduced vegetation cover, exposed soils
TERRESTRIAL BIODIVERSITY IMPACTS	
1	Impact on vegetation structure and plant species composition
2	Impact on potential populations of species of special concern
3	Impact on targets for threatened ecosystems or vegetation types
4	Impact on ecological processes and functionality of ecosystems
5	Impact on overall species and ecosystem diversity
6	Impact on ecological connectivity

5.3 Impact Significance Assessment

A summary of the terrestrial ecological impact significance assessment for the construction and operational phases of the water supply project is contained in Tables 22 and 23, respectively.

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.

5.3.1 Construction Phase Impact Assessment

Table 22. Summary results of the terrestrial ecological impact significance assessment for construction phase impacts associated with the water supply project and associated infrastructure.

Construction Phase Impact Assessment		Impact Significance	
		'poor' mitigation scenario	'good' mitigation scenario
C1	**Impact on vegetation structure and plant species composition**	**Moderate**	**Moderately Low**
This impact refers to the direct physical destruction and/or modification of terrestrial habitat and includes habitat loss impacts, habitat and vegetation degradation impacts (e.g., species composition and abundances changes) and invasive alien plant invasion. The transformation of terrestrial vegetation and habitat within the development footprint will be inevitable and long-term given the pipeline route through various natural vegetation communities. The intensity of impact will be relatively low for the degraded (fair to poor condition) thornveld and grassland communities. Due to the presence of 'fair' condition Zululand Lowveld and Moist Coastal Hinterland Grassland of moderate and high ecological importance/sensitivity that will be traversed by the pipeline route and where the reservoir is positioned, respectively, the impact intensity will be moderate under a poor mitigation scenario for this vegetation type, with the possibility for disturbance and long-term or even permanent loss of species diversity and vegetation condition. The result is an overall 'moderate' impact significance rating where direct impacts to the 'good to fair' condition grassland cannot be avoided. Should mitigation focusing on the re-alignment of the pipeline to avoid the important and sensitive 'good to fair' condition grassland be implemented, the avoidance of key sensitive habitats will reduce impact intensity from moderate to moderately low levels. There will still be unavoidable impacts to remaining degraded thornveld and grassland vegetation, however given the fair/poor condition and appreciably lower importance/sensitivity of this community type, impacts are likely to be reduced to 'moderately low' levels. Key mitigation recommendations: • Restrict the development to the 10m development servitude. • Avoid impacts to primary grassland areas outside the development footprint which are to be 'no-go' areas for development and construction crews. • No temporary construction site camps, vehicle parking or material stockpiling / laydown areas to be located outside of the development servitude. • Impacts to the surrounding natural grassland must be avoided by staying within the development footprint. Alien vegetation must be removed and managed throughout the construction phase. • Ensure all protected and threaten plants are relocated in accordance to the protected plant rescue and translocation plan.			
C2	**Impact on populations of species of special concern**	**Impact Significance**	
		'poor' mitigation scenario	'good' mitigation scenario
		High	**Moderately Low**
This impact relates to the potential alteration of habitat that supports threatened plant and animal species, including alteration to the ambient environment by nuisance factors such as noise, vibrations, light pollution, etc. produced by people, machinery and vehicles. It also refers to the loss of important habitat that represent sources of food, shelter, etc. for faunal species of conservation concern. **Fauna** of conservation concern highlighted as possibly being present within the more intact habitats are unlikely to be breeding within the degraded habitats, and where foraging at the site, these should be easily flushed-out of their habitats and move to adjacent intact areas during construction, with the arrival of noisy construction machinery and labourers. Impacts to fauna of conservation concern are therefore likely to be unlikely and inconsequential overall. **Flora** of conservation concern include several small colonies of *Stangeria eriopus* (Vulnerable), *Eucomis autumnalis* (Least Concerned) and many of 'Least Concern' provincially protected plants belonging to the species *Aloe*			

maculata and *Aloe marlothii*, which although not currently threatened at a national level are increasingly threatened at a provincial level due to habitat loss, over-harvesting and human population expansion. The pipeline alignment threatens to destroy or damage multiple protected plant species if not avoided. Given the multitude of protected plants that stand to be impacted, and the Red-data (Vulnerable) status of *Stangeria eriopus*, impact intensity is expected to be high, with a high probability of the impact occurring. Impact significance where not mitigated is therefore expected to be relatively 'high'.

The translocation of protected plants species can help mitigate this impact. Should mitigation be implemented to include the re-alignment of the pipeline to avoid the 'good to fair' condition grassland hosting protected plants and avoidance of the small colonies of *Stangeria eriopus,* the probability of the impact occurring will be unlikely and significance can then easily be reduced to a 'Low' level.

Key mitigation recommendations:

- Restrict the development to the 10m development servitude.
- Avoid impacts to primary grassland areas outside the development footprint which are to be 'no-go' areas for development and construction crews.
- No temporary construction site camps, vehicle parking or material stockpiling / laydown areas to be located outside of the development servitude.
- Where protected/threatened plants may be impacted or lost, permits need to be obtained and a protected plant translocation plan must be compiled and implemented to the satisfaction of the provincial conservation authority.

		Impact Significance	
C3	**Impact on targets for threatened ecosystems**	'poor' mitigation scenario	'good' mitigation scenario
		Moderate	**Moderately Low**

This impact refers to the loss of a vegetation unit representative of a rare and/or threatened ecosystem, habitat or vegetation community or a vegetation unit that could be reinstated to such an example with good management and/or rehabilitation.

Since some of the degraded (fair condition) vegetation on site is representative of 'endangered' Moist Coastal Hinterland Grassland and 'vulnerable' Zululand Lowveld, the loss or degradation of onsite grassland and thornveld vegetation and habitat is likely to be considered of 'moderate' impact significance, particularly when considering the rarity of intact grassland ecosystems within the province. This is likely to be considered significant regardless of grassland patch size.

Where threatened species are translocated and rescued successfully and the development footprint is restricted as much as possible in the intact 'fair' condition grassland vegetation communities to avoid permanent loss of this type and restrict impacts to take place within degraded grassland and thornveld vegetation of 'endangered' and 'least concern', respectively, this impact can be considered to be of 'moderately low' significance.

Key mitigation recommendations:

- Avoid impacts to primary grassland areas which are to be 'no-go' areas for development and construction crews.
- No temporary construction site camps, vehicle parking or material stockpiling / laydown areas to be located within the mapped primary grassland areas.
- Engage with the Provincial Conservation Authority around potential biodiversity offset requirements for the loss of primary Moist Coastal Hinterland Grassland and Zululand Lowveld where this occurs.

		Impact Significance	
C4	**Impact on ecological processes and functionality of ecosystems**	'poor' mitigation scenario	'good' mitigation scenario
		Moderately Low	**Moderately Low**

This impact refers to the indirect impacts of adjacent land cover modification and transformation on surface runoff, soil moisture and rates of erosion and sedimentation, and associated ecological impacts like invasion by invasive alien plants and habitat degradation. This impact also includes the alteration or deterioration in the chemical and biological characteristics of soil and water, which inevitably impacts negatively on flora and fauna.

Impacts to the structure and condition of vegetation will likely affect ecological processes and the functioning of intact grassland and thornveld ecosystems which are known to provide a variety of valuable ecosystem goods and services. Impacts to degraded thornveld vegetation will be less significant. Overall impact significance can be regarded as 'moderately low'.

Key mitigation recommendations:

- Avoid impacts to primary grassland areas which are to be 'no-go' areas for development and construction crews.
- No temporary construction site camps, vehicle parking or material stockpiling / laydown areas to be located within the mapped primary grassland areas.
- Rehabilitate any primary grassland that may be accidentally impacted.
- Refer to section 7.1.2 subsection H for stormwater management mitigation measures to be implemented
- Refer to section 7.1.2. subsection I for soil management mitigation measures to be implemented
- Refer to section 7.1.2 subsection J for pollution prevention measures to be implemented
- Refer to section 7.1.2 subsection K for waste management mitigation measures to be implemented

		Impact Significance	
C5	**Impact on overall species and ecosystem diversity**	'poor' mitigation scenario	'good' mitigation scenario
		Moderate	**Moderately Low**

This impact refers to the loss of genetic, species, habitat/ecosystem and/or functional diversity.

Overall species and ecosystem diversity at the site can be considered moderate to moderately low, with key habitat hosting a moderate diversity of plant species. Overall, where poorly managed, impact significance can be considered 'Moderate' should direct impacts to primary grassland habitat be incurred, however where threatened species are translocated and rescued successfully and development footprint into intact grassland areas is restricted as much as possible, this impact can be considered to be of 'moderately low' significance.

Key mitigation recommendations:

- Restrict the development to the 10m development servitude.
- Avoid impacts to primary grassland and thornveld areas which are to be 'no-go' areas for development and construction crews.
- No temporary construction site camps, vehicle parking or material stockpiling / laydown areas to be located within the primary grassland and thornveld areas.
- Engage with the Provincial Conservation Authority around potential biodiversity offset requirements for the loss of primary Moist Coastal Hinterland Grassland and Zululand Lowveld where this occurs.
- Where protected/threatened plants may be impacted or lost, permits need to be obtained and a protected plant translocation plan must be compiled and implemented to the satisfaction of the provincial conservation authority.

		Impact Significance	
C6	**Impact on ecological connectivity**	'poor' mitigation scenario	'good' mitigation scenario
		Moderately Low	**Low**

This impact refers to the potential reduction in ecological connectivity between the study area being assessed and adjacent habitats/ecosystems and the effects this may have on the movement of faunal species.

Whilst the clearing of vegetation along the pipeline corridor will likely result in direct impacts to vegetation and habitat, vegetation and habitat can recover with time. Impacts on habitat connectivity will likely be a temporary impact following construction and since no key wildlife corridors will be severed, the significance of the impact is likely to be 'Moderately Low'.

Once pipeline installation has been completed and construction crews have left the site, there will still be some habitat connectivity between areas on either side of the pipeline alignment, albeit reduced. Conserving the fair condition moist coastal hinterland grassland and Zululand lowveld habitat and riparian corridors will assist with maintaining local level connectivity and reducing impact significance to an overall 'Low' level.

Key mitigation recommendations:

- Avoid impacts to primary grassland areas which are to be 'no-go' areas for development and construction crews.

5.3.2 Operation Phase Impact Assessment

Table 23. Summary results of the terrestrial ecological impact significance assessment for operational phase impacts associated with the water supply project and associated infrastructure.

Construction Phase Impact Assessment		Impact Significance	
		'poor' mitigation scenario	'good' mitigation scenario
O1	**Impact on vegetation structure and plant species composition**	**Moderate**	**Moderately Low**
This impact refers to the direct physical destruction and/or modification of terrestrial habitat and includes habitat loss impacts, habitat and vegetation degradation impacts (e.g., species composition and abundances changes) and invasive alien plant invasion.			
O2	**Impact on populations of species of special concern**	**Impact Significance**	
		'poor' mitigation scenario	'good' mitigation scenario
		Moderate	**Moderately Low**
This impact relates to the potential alteration of habitat that supports threatened plant and animal species, including alteration to the ambient environment by nuisance factors such as noise, vibrations, light pollution, etc. produced by people, machinery and vehicles. It also refers to the loss of important habitat that represent sources of food, shelter, etc. for faunal species of conservation concern.			
O3	**Impact on targets for threatened ecosystems**	**Impact Significance**	
		'poor' mitigation scenario	'good' mitigation scenario
		Moderate	**Moderately Low**
This impact refers to the loss of a vegetation unit representative of a rare and/or threatened ecosystem, habitat or vegetation community or a vegetation unit that could be reinstated to such an example with good management and/or rehabilitation.			
O4	**Impact on ecological processes and functionality of ecosystems**	**Impact Significance**	
		'poor' mitigation scenario	'good' mitigation scenario
		Low	**Low**
This impact refers to the indirect impacts of adjacent land cover modification and transformation on surface runoff, soil moisture and rates of erosion and sedimentation, and associated ecological impacts such as invasion by invasive alien plants and habitat degradation. This impact also includes the alteration or deterioration in the chemical and biological characteristics of soil and water, which inevitably impacts negatively on flora and fauna.			
O5	**Impact on overall species and ecosystem diversity**	**Impact Significance**	
		'poor' mitigation scenario	'good' mitigation scenario
		Low	**Low**
This impact refers to the loss of genetic, species, habitat/ecosystem and/or functional diversity.			
O6	**Impact on ecological connectivity**	**Impact Significance**	
		'poor' mitigation scenario	'poor' mitigation scenario
		Low	**Low**
This impact refers to the potential reduction in ecological connectivity between the study area being assessed and adjacent habitats/ecosystems and the effects this may have on the movement of faunal species.			

Overall Comment for The Above Impacts O1 – O6: Impact Significance 'Poor' And 'Good' Mitigation Scenario
Most operational phase impacts will be linked to post-construction disturbance that could open up key natural areas to further impact by Invasive Alien Plants (IAPs) and weeds, leading to further loss of biodiversity and leading to reduced ecosystem condition and functioning. Under a poor mitigation scenario (no follow-up clearing of IAPs post-construction), impacts are generally expected to be of 'Moderate' significance where poorly mitigated/managed. Through onsite IAP control, eradication and basic rehabilitation of disturbed habitat post-construction and pipeline installation, operational impacts of alien plants on terrestrial biodiversity can be potentially mitigated and reduced from moderate to 'Moderately Low' to 'Low' significance levels. Given the fact that habitats are somewhat already infested by IAPs, the potential success of clearing operations will require a more comprehensive and holistic programme to manage IAPs within the target grassland and thornveld vegetation community.

For further details on impact assessment scores and ratings refer to ***Annexure C*** *of this report.*

6 IMPACT MITIGATION & MANAGEMENT

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 natural resources, biodiversity and the social systems that depend on terrestrial 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.*"

6.1 Mitigation Hierarchy

The protection of terrestrial ecosystems (grasslands and wooded vegetation and habitat 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 19) 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.

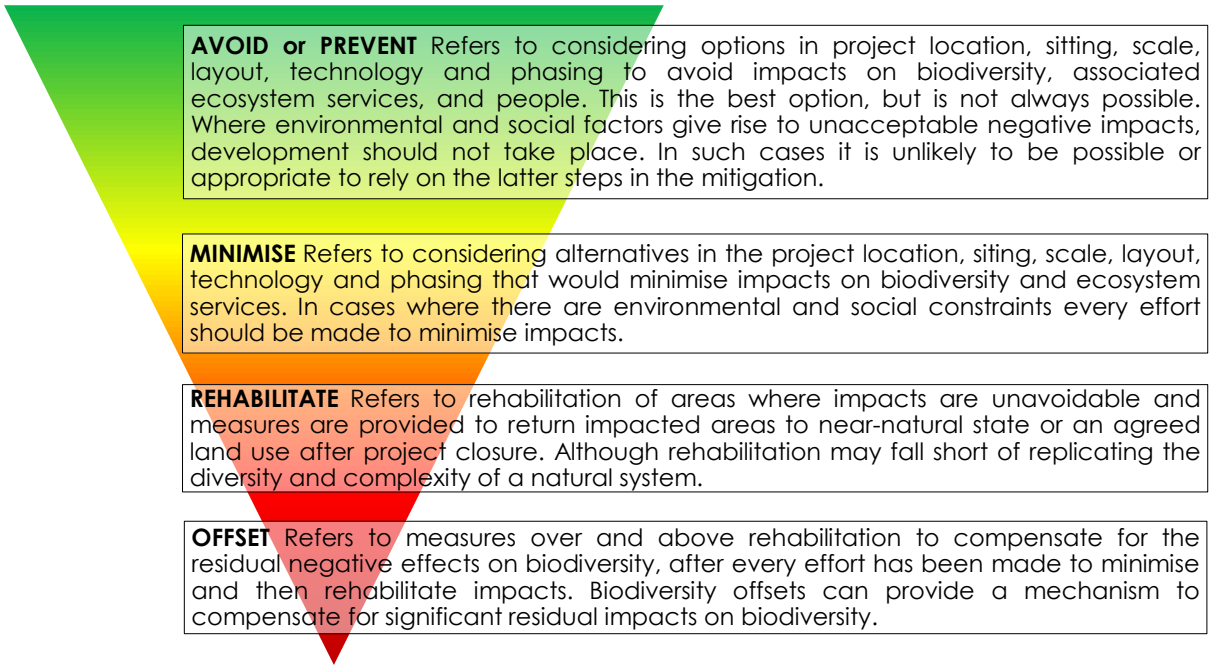

Figure 19 Diagram illustrating the 'mitigation hierarchy' (after DEA *et al*., 2013).

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*".

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. 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 phases or stepped approach to the project which should be implemented as follows:

1. **Avoiding 'direct impacts'** to terrestrial ecosystems wherever possible through appropriate and informed development planning;
2. Secondly, **attempting to reduce the risk of incurring significant 'indirect impacts'** through the integration of appropriate management of storm water, erosion control and pollution control into the development design and through relevant onsite control measures (where relevant);
3. Thirdly**, addressing residual impacts to areas** through onsite post-construction phase **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 vegetation/habitat and/or conservation important species of flora/fauna (*not applicable to this project*).

6.2 Implementation of Mitigation Measures

In terms of Section 2 and Section 28 of NEMA (National Environmental Management Act, 1998), the landowner/developer 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 to, 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 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 and RoD/EA, once issued.

6.3 Development Planning: *Environmental Guidelines and Principles*

At the forefront of mitigating impacts to terrestrial vegetation, habitat and biodiversity 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 sensitive vegetation and habitat 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; and
4. Taking necessary efforts aimed at minimising/reducing potential waste streams.

6.3.1 Protected Plant Rescue and Translocation

There are three key pieces of legislation in South Africa applicable to the Province of KwaZulu-Natal that provide for the protection of threatened plant species in need of protection to ensure their survival in the wild. Furthermore, they provide for the protection of ecosystems that are threatened or in need of protection. These include the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), the National Forest Act, 1998 (Act No. 84 of 1998) and the KwaZulu-Natal Nature Conservation Management Amendment Act, 1999 (No. 5 of 1999).

Four (4) conservation important plant species were recorded within the corridor of the pipeline that was assessed (see map in Figure 20). These include: *Aloe maculata, Aloe marlothii, Eucomis autumnalis, Stangeria eriopus* which are provincially protected in accordance with the Nature Conservation Management Amendment Act, 1999 (No. 5 of 1999). An appropriate protected plant rescue and translocation plan will need to be developed with a focus on rescuing and transplanting >50 protected plants if the original pipeline alignment is authorised without re-alignment.

Note that Ordinary Permits will be required from Ezemvelo KZN Wildlife if protected species listed are to be handled in any manner during construction of the proposed development. These permits must be acquired prior to plant translocation proceeding.

Stangeria eriopus is also a Red Data listed species which has a threat status of 'Vulnerable' and was observed on-site in a number of small colonies within the 'fair' condition Moist Coastal Hinterland Grassland. Disturbance of these colonies will need to be avoided where possible to best preserve these colonies. Where this is not achievable, permits will be required and adequate motivation to translocate these specimens will need to be provided to the relevant enforcing authority.

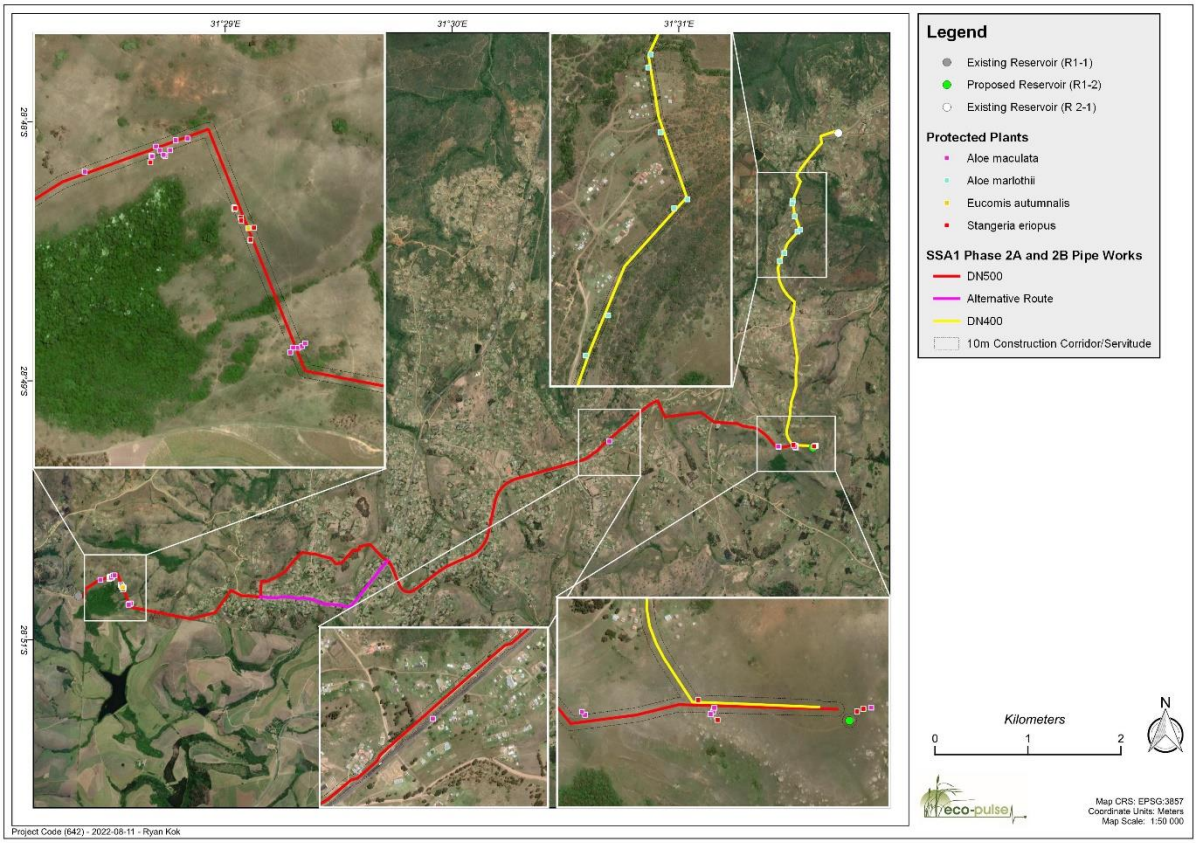

Figure 20 Map showing the spatial distribution of provincially protected and red-listed plant species identified along the pipeline corridor. Note that some protected plant species locations within the 'fair' condition Zululand Lowveld community are not shown due inaccessibility to the individual plants.

Photographs of protected plants taken in the field:

Aloe maculata

Aloe marlothii

Eucomis autumnalis

Stangeria eriopus

6.3.2 Pipeline Re-alignment Recommendations

In order to avoid impacts to ecologically important and sensitive grassland and thornveld habitats and protected plant species and colonies of Red-data listed plants, pipeline realignment has been recommended. A standard 10m buffer zone from the protected plant species and Red-data Cycad colonies has been recommended as a first course of action. Thereafter, a number of possible pipeline realignments have been recommended which seek to avoid direct impacts to primary grassland patches and protected plants.

Four (4) preliminary pipeline realignment options (A-B) have been documented below for consideration by the client, and are shown on the map in Figure 21:

- The first realignment (route A: 'green' line on the map in Fig 21) is simply a small alignment change from the original pipeline alignment that seeks to avoid the protected plants observed.
- The second option (route B: 'blue' line) considers the option of taking a route linking up to existing dirt roads and/or tracks. **The existing disturbance along this existing access road makes this route most preferable from a terrestrial ecological perspective and the lower elevation avoids steep slopes and potential erosion risks.**

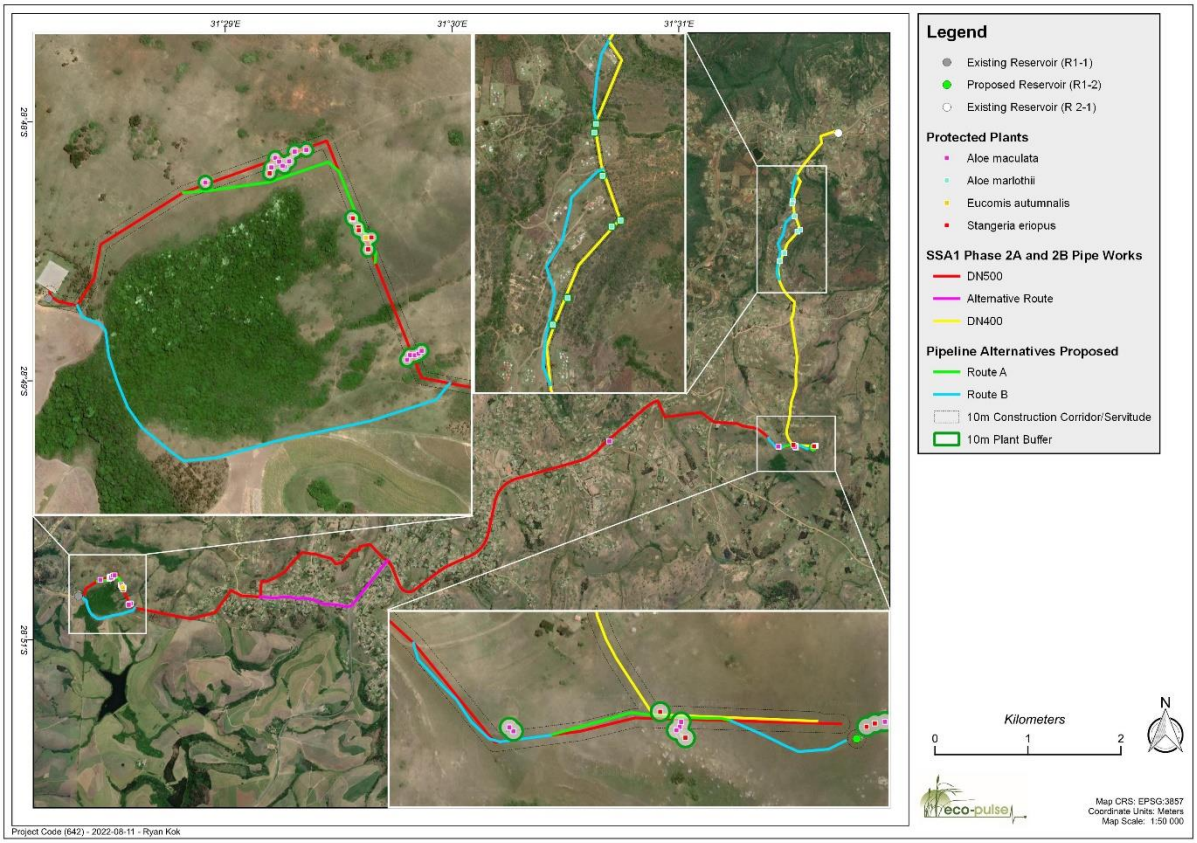

Figure 21 Map indicating alternative pipeline alignment recommendations A – B along with the original pipeline alignment and 10m plant buffer areas shown. Note that some protected plant species locations within the 'fair' condition Zululand Lowveld community are not shown due inaccessibility to the individual plants.

6.4 Construction Phase Impact Mitigation Measures

The following project-specific mitigation measures are recommended during the construction phase of the project. The following mitigation measures must be implemented in conjunction with any generic measures provided in the Environmental Management Programme (EMPr).

6.4.1 'No-Go' Areas and Working Area Demarcations

- 'No-Go' areas to be shown on a site layout map and demarcated on the ground (where practically possible).
- 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.
- All areas outside of this demarcated working servitude must be considered 'no-go' areas for the entire construction phase.
- No equipment laydown or storage areas must be located outside of the development footprint.
- Access to and from the development area should be either via existing roads or within the construction servitude/development footprint.

- Any contractors found working inside the 'no-go' areas (areas outside the construction/ working servitude) should be fined as per a fining schedule/system setup for the project.

6.4.2 Vegetation Management

- Vegetation removal/stripping must be limited to the construction footprint.
- No clearing of indigenous vegetation outside of the defined working servitudes is permitted for any reason (i.e., for firewood or medicinal use).
- 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 where practically possible.
- Vegetation clearing/stripping must only be done as the construction front progresses.

6.4.3 Invasive Alien Plant control

- All alien invasive vegetation that colonises the construction site must be removed, preferably by uprooting. The contactor should consult the ECO regarding the method of removal.
- All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling/uprooting and adequately disposed of.
- Herbicides should be utilised where hand pulling/uprooting is not possible. ONLY herbicides which have been certified as safe for use by an independent testing authority are to be used. The ECO must be consulted in this regard.

6.4.4 Management of Wildlife

- Education of workers/employees onsite focused on avoiding unnecessary harm to wildlife 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.

6.4.5 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.

6.4.6 Nuisance Management

- Temporary noise pollution associated with construction works should be minimized by ensuring the proper maintenance of equipment and vehicles, including the tuning of engines and mufflers as well as employing low noise equipment where possible.
- Water trucks will be required to suppress dust by spraying water on affected areas producing dust. This will likely be required daily.
- No lights must be established within the construction area near the watercourses and buffer zones.
- No activities should be permitted at the site after dark (between sunset and sunrise), except for security personnel guarding the development site.

6.4.7 Rehabilitation of accidental / unintended physical disturbance

Any damage to 'no-go' areas that takes place during the construction phase must be rehabilitated immediately. A site-specific rehabilitation plan would need to be developed in this instance and a terrestrial ecologist consulted in this regard should such disturbance occur.

6.4.8 Construction phase monitoring measures

- 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.
- A photographic record of the state of the terrestrial ecosystems prior to the commencement of clearing/construction must be kept for reference and rehabilitation monitoring purposes.
- The ECO must undertake weekly compliance monitoring audits. Terrestrial ecosystem aspects that must be monitored related to monitoring freshwater ecosystem impacts include:
    - The condition of the demarcation fence/barrier.
    - Evidence of any 'no-go' area incursions.
    - The condition of the temporary runoff, erosion and sediment control measures and evidence of any failures or sediment deposits within watercourses.

- Evidence of erosion.
- The condition of waste bins and the presence of litter within the working area.
- Evidence of solid waste within the no-go areas.
- Evidence of hazardous materials spills and soil contamination.
- Presence of alien invasive and weedy vegetation within the working area.
- Rehabilitation and re-vegetation methods and success.

- Once the construction and rehabilitation has been completed, the ECO should conduct a close-out site audit within a month of completion of rehabilitation.

6.4.9 Stormwater Management

Construction phase storm water management measures are documented in the Specialist Freshwater Impact Assessment Report compiled for the project (Eco-Pulse 2022, Report No. EP643-01) and should be referred to in all instances. These have not been duplicated here.

6.4.10 Soil Management & Erosion Control

Construction phase soil management and erosion control measures are documented in the Specialist Freshwater Impact Assessment Report compiled for the project (Eco-Pulse 2022, Report No. EP643-01) and should be referred to in all instances. These have not been duplicated here.

6.4.11 Pollution Prevention

Hazardous substances management is documented in the Specialist Freshwater Impact Assessment Report compiled for the project (Eco-Pulse 2022, Report No. EP643-01) and should be referred to in all instances. These have not been duplicated here.

6.4.12 Management of Solid Waste

Solid waste management is documented in the Specialist Freshwater Impact Assessment Report compiled for the project (Eco-Pulse 2022, Report No. EP643-01) and should be referred to in all instances. These have not been duplicated here.

6.5 Post-Construction Rehabilitation Guidelines (disturbed terrestrial habitat)

The clearing of vegetation during construction will require some form of rehabilitation, at the very least to produce a temporary vegetation cover that can assist with controlling erosion and inhibiting alien plant colonisation of the site whilst the vegetation recovers naturally. This is also 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 strategy and guidelines provide a clear and practical means of implementing basic / simple post-construction revegetation of affected thornveld habitat along the pipeline servitude once construction activities have ceased:

1. <u>General Land preparation measures</u>

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 need to be removed from the construction area and disposed of at licensed 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 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 may be 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

The following is recommended for stabilisation of slopes:

Prior to revegetation:

- Prior to rehabilitation the site must be stabilised where necessary using soft interventions including Grass Fences, Sandbags, 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.
- Where necessary, 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.

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 is to be implemented for 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 *Aristida junciformis, Digitaria eriantha, Chloris gayana, Cynodon dactylon* and *Eragrostis curvula* can be obtained from a commercial source.
- 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 the 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. Recommended pioneer grasses for attaining an initial cover at disturbed sites (based on the climate and soil occurring at the site) may include a number of fast-growing and mat-forming

(stoloniferous or rhizomatous) runner grasses such as *Cynodon dactylon*[11] (Couch grass), *Chloris gayana* (Rhodes grass) and/or *Eragrostis tef*.

- No exotic/alien plants are to be used in re-vegetation.

4. <u>Post-revegetation</u>

- Immediately after planting the recommended seed mix (hydroseeding / broadcasting of seed), slopes may be covered with an erosion control blanket such as a SoilSaver, which 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.

6.6 Operational Phase Impact Mitigation Measures

The following mitigation measures are recommended to address the operational impacts.

6.6.1 Invasive Alien Plant Control

Regular alien plant control along the pipeline alignment, servitude and associated access roads is necessary to ensure that revegetated and disturbed areas affected during the construction phase are not colonised by invasive alien plants during the operational phase of this project. Initial clearing which takes place during the construction phase should be supplemented by periodic follow-up IAP clearing phases every 3 months for the first year of operation and thereafter on a quarterly to annual basis depending on IAP infestation levels observed on-site which should be determined by the relevant appointed ECO for the project. Recommendations regarding IAP clearing outlined in the construction phase mitigation measures should likewise be adhered to and are applicable also to the operational phase.

6.6.2 Ecosystem Rehabilitation & Management

Where pipeline maintenance and repair work may be needed and requires access to the pipeline servitude, disturbance of areas may require rehabilitation and the guidelines provided in 6.5 should be referred to in this regard.

6.7 Biodiversity Offsets

Biodiversity offsets are typically required in certain situations to compensate for residual impacts to ecosystems and biodiversity once all other forms of mitigation have been considered. Should pipeline realignment be possible to avoid sensitive grassland and thornveld ecosystems and protected plants, direct impacts of 'high' significance will be avoided, such that the only impacts will be incurred by

[11] Note that *Cynodon dactylon* has recently been listed as an "invasive" species in terms of NEMBA and requires a plant permit to be obtained for the use this species in planting projects. A sterile (non-invasive) cultivar should be sourced if this species is to be used and the relevant permit obtained.

degraded primary grassland which is 'endangered and Zululand lowveld (thornveld) of 'least concern'. Given that impacts to grassland and thornveld is unlikely to negate meeting conservation targets set for this type at this stage, biodiversity offsets are not considered relevant to this project.

Note that where the avoidance of intact 'good' condition grassland habitat through appropriate pipeline realignment is not implemented, a biodiversity offset may be required by the relevant environmental authorities to compensate for the loss of ecologically important habitat.

Likewise, where protected plants will be affected and plant rescue and translocation efforts are either not practically possible or are unsuccessful, an appropriate biodiversity offset for plant species will be required.

The need for biodiversity offsets can therefore be avoided appropriate through pipeline realignment to avoid impacting on grassland, thornveld and protected plants altogether

7 CONCLUSION

The Specialist **Terrestrial Biodiversity Impact Assessment** contained in this report was undertaken by Eco-Pulse Consulting in June/July 2022 to inform the application for environmental approval in terms of the NEMA: EIA Regulations (2014, as amended in 2017) for the proposed Kwahlokohloko Sub-Supply Area (SSA) 1, Phase 2, Water Supply Project.

Terrestrial vegetation communities identified and assessed along the proposed water pipeline alignment included Primary Moist Coastal Hinterland Grassland, Primary Zululand Lowveld, Secondary Open Grasslands, and Dense Invasive Alien Plants patches. Key ecological sensitivities identified along the pipeline corridor assessed included a relatively 'fair' condition grassland patch hosting over 50 protected plants (individuals belonging to four species) as well as a four species of provincially protected plants, one being Red-data listed (vulnerable) – i.e., *Stangeria eriopus,* that occurs as several small colonies along the western valley section, mainly.

A key recommendation is to avoid the grassland and protected plants through appropriate plant rescue and translocation efforts and pipeline realignment, with relocation permits and alternative pipeline alignment options provided by the ecologists from Eco-Pulse for consideration. Biodiversity offsets can be avoided where impacts to protected plants and representative grassland patches are avoided through a process of pipeline realignment to avoid ecological sensitivities. A protected plant permitting, rescue and translocation plan will need to be compiled and implemented where impacts to protected plants cannot be avoided.

8 REFERENCES

Avian Demographic Unit. 2017. 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.

Bromilow, C. (2012). Problem Plants and Alien Weeds of South Africa, Third Edition. Pretoria: Briza Publishers.

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

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

Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum and South African Biodiversity Institute. 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Pretoria.

DWAF (2007) A Level II River Ecoregion classification System for South Africa, Lesotho and Swaziland. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.

Ezemvelo KZN Wildlife (EKZNW). (2010). KZN Terrestrial Systematic Conservation Plan (MINSET). P.O. Box 13053, Cascades, Pietermaritzburg, 3202: Ezemvelo KZN Wildlife.

EKZNW. (2016). KZN Systematic Conservation Assessments (SCAs). Pietermaritzburg: Ezemvelo KwaZulu-Natal Wildlife.

EKZNW. (2013a). Guidelines for Biodiversity Impact Assessments in KZN. Available [Online]: http://www.kznwildlife.com/Documents/conservation/ekznw_handbookbiodiversityassess_130213_ab.pdf [20/09/2020].

EKZNW. (2013b). Concise Guideline: Biodiversity Offsets in KwaZulu-Natal. Version 4 Final. February 2013.

Endangered Wildlife Trust (EWT). (2012) Red Data Book of the Mammals of South Africa: A Conservation Assessment.

Jewitt, D. 2016. Conservation Targets and Status for Vegetation Types in KZN.

Lawrence, D. (2007). Impact Significance Determination - Design Approach. In Environmental Impact Assessment Review 27 (pp. 730 - 754).

McCourt, S., Armstrong, R.A., Grantham, G.H. and Thomas, R.J., 2006. Geology and evolution of the Natal belt, South Africa. Journal of African Earth Sciences, 46(1-2), pp.71-92.Mucina, L., & Rutherford, M. (. (2006). The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. Pretoria: South African National Biodiversity Institute.

Mucina, L. & Rutherford, M.C. (eds) Reprint 2011. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria. ISBN: 978-1919976-21-1

South African National Biodiversity Institute. 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 22 September 2020.

South African National Biodiversity Institute (SANBI). 2020. Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.0.

Newman K (2002) Newman's birds of southern Africa, Struik, Cape Town

SANBI, S. A. (2010). Threatened Species: A guide to Red Lists and their use in conservation. Pretoria.

Skowno, A.L., Raimondo, D.C., Poole, C.J., Fizzotti, B. & Slingsby, J.A. (eds.). 2019. South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm. South African National Biodiversity Institute, Pretoria

South African National Biodiversity Institute (SANBI). 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 2.1 2021.Scott-Shaw, R., & Escott, B. (2011). KwaZulu-Natal Provincial Pre-transformation Vegetation Type. Pietermaritzburg: Ezemvelo KZN Wildlife.

Scott-Shaw, R., & Escott, B., 2011. KwaZulu-Natal Provincial Pre-transformation Vegetation Type. Pietermaritzburg: Ezemvelo KZN Wildlife.

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

Van Oudtshoorn, F. (2012) Guide to Grasses of Southern Africa, Revised Edition. Briza Publishers. Pretoria

9 ANNEXURES

ANNEXURE A: List of Species encountered during rapid site walkover

- *Acacia mearnsii**
- *Acacia caffra*
- *Acacia nilotica*
- *Acacia robusta*
- *Acalypha punctata*
- *Acokanthera oppositifolia*
- *Agave americana**
- *Ageratum conyzoides**
- *Alectra sessiliflora var. sessiliflora*
- *Aloe maculata*
- *Aloe marlothii*
- *Anthospermum herbaceum*
- *Anthospermum rigidum subsp. pumilum*
- *Apodytes dimidiata*
- *Argyrolobium rotundifolium*
- *Aristea abyssinica*
- *Aristea torulosa*
- *Asclepias albens*
- *Asparagus sp.*
- *Asparagus sp.*
- *Aster bakerianus*
- *Athrixia phylicoides*
- *Berkheya erysithales*
- *Berkheya rhapontica subsp. rhapontica*
- *Berkheya setifera*
- *Berkheya speciosa subsp. speciosa*
- *Berkheya umbellata*
- *Boophone disticha*
- *Callilepis laureola*
- *Canna indica**
- *Catharanthus roseus**
- *Cardiospermum grandiflorum**
- *Centella asiatica*
- *Cephalaria oblongifolia*
- *Chaetacanthus burchellii*
- *Chamaecrista capensis var. flavescens*
- *Chamaecrista mimosoides*
- *Chamaecrista plumosa*
- *Chlorophytum cooperi*
- *Chromolaena odorata**
- *Clutia cordata*
- *Coddia rudis*
- *Coddia rudis*
- *Commelina africana*
- *Conostomium natalense*
- *Crabbea hirsuta*
- *Crotalaria globifera*
- *Cyanotis speciosa*
- *Dalbergia armata*
- *Dalechampia capensis*
- *Delosperma sp.*
- *Desmodium dregeanum*
- *Desmodium gangeticum*
- *Desmodium setigerum*
- *Dichrostachys cinerea*
- *Diclis reptans*
- *Dicoma anomala subsp. cirsioides*
- *Dicoma zeyheri subsp. argyrophyllum*
- *Diospros dichrophylla*
- *Diospyros lycioides subsp. sericea*
- *Diospyros simii*
- *Diospyros simii*
- *Diosypros dichrophylla*
- *Ehretia rigida*
- *Eriosema cordatum*
- *Eriosema kraussianum*
- *Eriosema salignum*
- *Erythroxylum delagoense*
- *Eucalyptus sp**
- *Euclea daphnoides*
- *Euclea daphnoides*
- *Euclea divinorum*
- *Euclea divinorum*
- *Euphorbia ingens*
- *Euphorbia tirucalli*
- *Gazania krebsiana*

*Note alien/exotic plant species are shown in '**red**' text

- *Gerbera ambigua*
- *Gerbera natalensis*
- *Gerbera piloselloides.*
- *Gnidia splendens*
- *Grewia occidentalis*
- *Gymnosporia glaucophylla*
- *Gymnosporia maranguensis*
- *Gymnosporia maranguensis*
- *Gymnosporia senegalensis*
- *Gymnosporia senegalensis*
- *Helichrysum allioides*
- *Helichrysum aureonitens*
- *Helichrysum krebsianum*
- *Helichrysum longifolium*
- *Helichrysum nudifolium nudifolium*
- *Helichrysum nudifolium var. pilosellum*
- *Helichrysum rugulosum*
- *Hibiscus aethiopicus var. ovatus*
- *Hibiscus calyphyllus*
- *Hippobromus pauciflorus*
- *Hippobromus pauciflorus*
- *Hypericum aethiopicum subsp. sonderi*
- *Hypoxis argentea*
- *Hypoxis hemerocallidea*
- *Indigofera sp.*
- *Ipomea alba**
- *Ipomoea carnosa subsp. Fistulosa**
- *Ipomoea purpurea**
- *Jasminum multipartitum*
- *Jasminum multipartitum*
- *Justicia protracta subsp. protracta*
- *Kalanchoe rotundifolia*
- *Kalanchoe rotundifolia*
- *Kohautia virgata*
- *Kraussia floribunda*
- *Kraussia floribunda*
- *Laggera crispata*
- *Lantana camara**
- *Lantana rugosa*
- *Ledebouria zebrina*
- *Leucaena leucocephala**
- *Lippia javanica*
- *Lippia javanica*
- *Melhania didyma*
- *Melia azedarach**
- *Mimosa pudica**
- *Ocimum obovatum subsp. obovatum*
- *Orthosiphon suffrurescens*
- *Pelargonium alchemilloides*
- *Pentanisia prunelloides*
- *Phoenix reclinata*
- *Polygala hottentota*
- *Psidium guajava**
- *Rhoicissus tridentata*
- *Rhynchosia carribaea*
- *Rhynchosia nervosa*
- *Ricinus communis**
- *Ruellia cordata*
- *Ruellia cordata*
- *Sansevieria hyacinthoides*
- *Scabiosa columbaria*
- *Schinus terebinthifolius**
- *Schotia brachypetala*
- *Schotia brachypetala (no large trees seen)*
- *Sclerocarya birrea subsp. caffra*
- *Searsia dentata*
- *Searsia pentheri*
- *Sebaea sedoides*
- *Senecio coronatus*
- *Senecio erubescens*
- *Senecio glaberrimus*
- *Senecio latifolius*
- *Senecio polyanthemoides*
- *Senecio variabilis*
- *Senecio viminale*
- *Senna didymobotrya**
- *Smilax anceps*
- *Solanum chrysotrichum**
- *Solanum mauritianum**
- *Spermacoce natalensis*
- *Stachys sp.*
- *Stangeria eriopus*
- *Striga bilabiata subsp. bilabiata*
- *Stylochaeton natalense*
- *Stylochaeton natalensis*
- *Tecoma stans**
- *Tephrosia macropoda var. macropoda*
- *Thunbergia atriplicifolia*
- *Tithonia diversifolia**
- *Turraea obtusifolia*
- *Vernonia hirsuta*
- *Vernonia natalensis*
- *Vernonia oligocephala*
- *Vigna unguiculata*

- *Wahlenbergia krebsii subsp. krebsii*
- *Yucca sp.**
- *Zinnea peruviana**
- *Ziziphus mucronata*
- *Ziziphus mucronata*
- *Zornia capensis subsp. capensis*

ANNEXURE B: Desktop Species of Conservation Concern Likelihood of Occurrence Assessment

The determination of ecological importance requires the consideration of whether the vegetation communities described and classified in this assessment provide habitat for rare or threatened flora and fauna. As the field work involved a relatively rapid walkover assessment of the vegetation onsite with no formal and floral sampling, and because the assessment is based on a two-day walkover, a comprehensive search for evidence of the presence of threatened flora and fauna could not be undertaken. Therefore, in order to inform the EIS assessment and flag the need for additional floral or faunal surveys, a desktop likelihood of occurrence assessment of threatened flora and fauna was undertaken based on available data on species records and distributions, habitat preference and the recorded vegetation condition that acted as proxy for habitat condition and suitability.

Flora Likelihood of Occurrence

Interrogation of SANBI's online threatened species database for the quarter degree grid square (QDGS) 2831CD & 2831DC highlighted the potential occurrence of several threatened species within the study area. Review of the habitat preference of threatened species against vegetation communities recorded within the study area highlighted that the potential presence of three species which have a threat status of Vulnerable, Near-Threatened or Data Deficient. Details of the assessment results are provided in Table 24

Table 24. Flora of conservation significance: POC assessment

Scientific Name	Threat Status[12]	Habitat Preference	Rationale	POC	Source
Aloe umfoloziensis	LC	It occurs in river valleys with savanna and wooded grassland.	Yes – study area has the appropriate vegetation types present	Possible	POSA
Dierama dubium	VU	Midlands Mistbelt Grassland, Moist Coast Hinterland Grassland - Grassland, 1200-1500 m.	Yes – study area has the appropriate vegetation types present	Possible	EIA Screening Tool
Disperis woodii	VU	It occurs in damp grassland, usually in open places with sandy soils, sometimes	No – sandstone lithologies absent at site	Unlikely	EIA Screening Tool

[12] Key: CR PE – Critically Endangered Possibly Extinct; CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; DD – Data Deficient; ER – Extremely Rare; R – Rare

Scientific Name	Threat Status[12]	Habitat Preference	Rationale	POC	Source
		within grass tussocks, from sea level to 800 m.			
Erianthemum dregei	LC	In riverine fringes, miombo woodland at higher altitudes, and along forest edges.	Yes – study area has the appropriate vegetation types present	Possible	POSA
Erianthemum ngamicum	LC	In Acacia, mopane and mixed deciduous woodland and wooded grassland.	Yes – study area has the appropriate vegetation types present	Possible	POSA
Pavonia dregei	VU	Coastal grasslands along forest margins, sometimes in disturbed places.	No – not suitable vegetation types	Unlikely	EIA Screening Tool
Salpinctium natalense	R	Savanna, in partially shaded sites on the margins of acacia scrub.	No – vegetation type absent	Unlikely	EIA Screening Tool
Selago zuluensis	LC	Lower stony slopes with clay soils.	No – lack of clay soils	Unlikely	EIA Screening Tool
Tephrosia inandensis	EN	Moist Coast Hinterland Grassland - Grassland and forest margins, 600-900 m	Yes – study area has the appropriate vegetation types present	Possible	EIA Screening Tool
Thesium polygaloides	VU	Swamps on coastal flats.		Unlikely	EIA Screening Tool

Fauna Likelihood of Occurrence

The findings of the desktop faunal likelihood of occurrence (LOC) assessment have been summarised in this section of the report. Potential amphibians, avifauna (birds), mammals, reptiles and invertebrates of conservation concern (i.e. Red-Dated Listed Species: CR: Critically Endangered, EN: Endangered, VU: Vulnerable, NT: Near Threatened) are documented below. *Note that species of Least Concern (LC), endemic species and species with restricted ranges have been excluded from the assessment, with the focus being on Red-Data species.*

A. Mammals

Review of the available Red List databases highlighted 6 mammal species of conservation concern modelled to occur within and around the study area. Conservation important small mammal species are unlikely to occur within transformed habitats in the study area, although some species may potentially utilise the more intact remnant primary grassland patches (see Table 25 below for details). Larger mammal species have either been eradicated or have moved away from the area due to the presence of human activity and disturbance associated with human occupation in the area. A Scrub Hare (*Lepus saxatilis* – Least Concern) was observed on the north-eastern edge of the site amongst rock outcrops, no other mammal species were confirmed to occur within the study area during the rapid site visit.

Table 25. Potential occurrence of mammal species within the study area.

Species Name	Status	Habitat Requirements/Preferences (after Stuart & Stuart, 2007; Child et al. 2016)	Onsite Habitat Requirements Met?	Potential Occurrence	Source
Blue duiker (*Philantomba monticola bicolor*)	VU	Thrives in a variety of forested and wooded habitats including primary and secondary forests, gallery forests, dry forest patches, coastal scrub farmland and regenerating forest. Can also survive in degraded or modified thicket.	Within distribution range and thicket vegetation in fair to near natural condition may provide suitable habitat.	Possible	EWT Regional Red List status (2016)
Maquassie Musk Shrew (*Crocidura maquassiensis)*	VU	It's found in rocky, mountain habitats. It may tolerate a wider range of habitats and individuals have been collected in Kwa-Zulu Natal from a garden, and in mixed bracken and grassland alongside a river.	Grassland/ Savannah on site could provide suitable habitat and within distribution range.	Possible	EWT Regional Red List status (2016)
Samango Monkey (*Cercopithecus albogularis labiatus*)	VU	Samango Monkeys are primarily arboreal, utilising the canopy of evergreen forests, and their present distribution is indicative of very broad forest habitat tolerances. Within the assessment region, Samango Monkeys are associated with high-canopy, evergreen forests and are South Africa's only forest dwelling guenon. They inhabit a variety of indigenous forest types namely Afromontane Forests (including Mistbelt Forests), Coastal Forests (including Dune Forests), Scarp Forests as well as Riverine Forests.	Within distribution range/on edge of distribution range and habitat preferences not met.	Unlikely	EWT Regional Red List status (2016)
Southern Tree Hyrax *Dendrohyrax arboreus*	EN	In Afromontane, scarp and coastal forests of the KwaZulu-Natal and Eastern Cape provinces.	On edge of distribution range. Habitat preferences may be met in any remaining intact scarp forest patches within the northern block which still needs to be ground-truthed and habitat condition verified.	Unlikely	EWT Regional Red List status (2016)

B. Avifauna (birds)

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 pentads: 2845_3125, 2845_3130, 2850_3125, 2850_3130. Whilst the majority of species recorded by the SABAP2 are considered locally common birds, there are 12 bird species that are considered to be of conservation concern based on their threat status (Table 26, below). Of these species, eight may frequent the more intact vegetation communities on the property include the **Tawny Eagle** (Endangered), **African marsh-harrier** (Endangered), **European Roller**

(Near Threatened), **Lanner Falcon** (Vulnerable), **Southern Bald Ibis** (Vulnerable), **Martial Eagle** (Endangered), **Secretary bird** (Vulnerable) and **Crowned Eagle** (Vulnerable).

Table 26. Summary of the potential occurrence of bird species within the study area.

Species Name	Status[13]	Habitat Requirements/Preferences (after Roberts, 2015; Chittenden, 2009; Newman, 2002; IUCN, 2017)	Onsite Habitat Requirements Met?	Potential Occurrence on Site	Source
Half-collared Kingfisher (*Alcedo semitorquata*)	NT	Within the region, the Half-collared Kingfisher is widespread but generally sparsely distributed throughout high-rainfall areas of the east and extreme south (Fry et al. 1988, Allan 2000). A strictly water-associated kingfisher, restricted to the immediate vicinity of fast-flowing, clear, perennial streams and rivers offering secluded conditions and dense marginal vegetation (Turpie 2005). It also frequents well-vegetated banks of lakes, dams, estuaries and coastal lagoons (Fry et al. 1988), and occasionally fishes in salt water in Eastern Cape Province (Maclean 1993).	Within distribution range and habitat requirements partially met.	Unlikely	SABAP2
Tawny Eagle (*Aquila rapax*)	EN	Tawny Eagles are found in lightly wooded savannah and thornveld, as well as semi-desert (Simmons 1997), but avoid dense forest and highlands. Adults maintain a year-round territory of approximately 70 km2 (Tarboton and Allan 1984). Scavenging and piracy aretwo of their most important foraging strategies (Watson et al. 1984). Breeding occurs in winter (Hustler and Howells 1989). The Tawny Eagle in southern Africa, is largely concentrated in protected areas in the north-east and central parts of the region (Simmons 1997). Outside of protected areas, the Tawny Eagle has disappeared from large parts of its former range.	Within distribution range and foraging habitat may be available in areas that are still considered natural or near-natural in certain steeper portions of the study area.	Possible	SABAP2
Southern Ground Hornbill (*Bucorvus leadbeateri*)	EN	The EoO in South Africa has declined by approximately 66% in 115 years, or less than 3 generations (Kemp and Webster 2008), with about half of the regional population found in large protected areas, primarily Kruger National Park and Adjacent Private Nature Reserves. Groups outside this stronghold are patchily distributed in areas unaffected by expansion of rural communities, afforestation, bush encroachment, livestock diseases and cultivation (Morrison et al. 2005, Jordan 2011).Throughout the species'	Within distribution range, however given the presence of rural communities, afforestation, bush encroachment, livestock and cultivated areas	Unlikely	SABAP2

[13] Key: CR PE – Critically Endangered Possibly Extinct; CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; DD – Data Deficient; ER – Extremely Rare; R – Rare

Species Name	Status[13]	Habitat Requirements/Preferences (after Roberts, 2015; Chittenden, 2009; Newman, 2002; IUCN, 2017)	Onsite Habitat Requirements Met?	Potential Occurrence on Site	Source
		range, it occurs in habitats broadly classified as grassland and savannah, but it is absent from arid semi-deserts and extensive forests (Kemp 1995, Jordan 2011).	across large portions of the study area it is unlikely that this species frequents the study area.		
African marsh-harrier (*Circus ranivorus*)	EN	Inland and coastal wetlands as well as adjacent moist grassland. Breeding demands a stretch of undisturbed long grass with concealed clearings.Within the region, it occurs in high densities in higher rainfall coastal regions from Zululand down to Western Cape, as well as in Mpumalanga, Gauteng, Limpopo and North West provinces (Simmons 2005). It is absent from the drier parts of Northern Cape and inland areas parts of Western Cape.	Within distribution range, however limited wetlands on site that provide suitable habitat, although some intact moist grassland may provide some foraging opportunities for the species.	Possible	SABAP2
European Roller (*Coracias garrulus*)	NT	The European Roller is a non-breeding migrant. Birds arrive in the austral spring between October/November and depart again in March/April (Kovács et al. 2008). Within the region, the species is concentrated in the upper-middle Limpopo River drainage, the Lowveld region of Mpumalanga and Limpopo, and coastal KwaZulu-Natal (Herremans 1997). Occurs in woodland, bushveld and even grassland where it perches on powerlines.	Within distribution range, and habitat requirements largely met.	Possible	SABAP2
Lanner Falcon (*Falco biarmicus*)	VU	It generally favours open grassland, cleared or open woodland and agricultural land. While breeding it is most common around cliffs used as nesting and roost sites, although it may also use buildings, electricity pylons and trees.	Within distribution range, and habitat requirements fully met.	Possible	SABAP2
Southern Bald Ibis (*Geronticus calvis*)	VU	It prefers high rainfall (>700 mm p.a.), sour and alpine grasslands, characterised by an absence of trees and a short, dense grass sward. It also occurs in lightly wooded and relatively arid country. It forages preferentially on recently burned ground, also using unburnt natural grassland, cultivated pastures, reaped maize fields and ploughed areas. It has a varied diet, mainly consisting of insects and other terrestrial invertebrates. It has high nesting success on safe, undisturbed cliffs.	May visit open grassland and there is suitable breeding habitat present.	Possible	SABAP2
White-backed Night Heron (*Gorsachius leuconotus*)	VU	A secretive and easily overlooked species that is widespread but generally sparse throughout its range. Within the region, the species occurs very sparsely in low-lying, high-rainfall areas of northern and	On edge of species distribution range and	Unlikely	SABAP2

Species Name	Status[13]	Habitat Requirements/Preferences (after Roberts, 2015; Chittenden, 2009; Newman, 2002; IUCN, 2017)	Onsite Habitat Requirements Met?	Potential Occurrence on Site	Source
		eastern South Africa and Swaziland, extending westwards along the south coast to about Knysna, Western Cape (Martin 1997). Mostly along clear, swift- or slow-flowing perennial rivers and streams with forested banks and overhanging vegetation, chiefly in Woodland and Savannah biomes but also in more open country (Allan 2005), below 1 500 m (Parker and Barnes 2000). Occurs on both large rivers (especially where dissected by islands, or near rapids) and smaller streams (Tarboton et al. 1987). May also be encountered in mangrove swamps, along coastal lagoons with thick fringing cover, and along wooded margins of lakes. Has bred on small dams and crocodile farms (Randall 1994).	habitat preferences may only be partially met.		
White-backed Vulture (*Gyps africanus*)	CR	In South Africa, it is only absent from two of the nine provinces, i.e. Western Cape and Eastern Cape provinces, and from Lesothohe White-backed Vulture inhabits the woodland regions of southern Africa (Mundy et al. 1992, Mundy 1997). Its feeding and foraging habits are similar to those of the congeneric Cape Vulture and it relies primarily on large mammalian carcasses and feeds communally (Piper 2005). It is reported to very occasionally take live prey, e.g. young Springbok Antidorcas marsupialis and Warthog Phacochoerus aethiopicus (Mundy et al. 1992). This vulture is capable of long-distance movements, as evidenced by ring recoveries (Oatley 1998), re-sightings of marked birds (Monadjem et al. 2013) and GPS-GSM tracked birds (Phipps et al. 2013) but is not migratory (Mundy 1997, Piper 2005). Movements can be on a sub-continental scale and GPS-GSM tracked immatures made daily movements up to about 200 km (Phipps et al. 2013). White-backed Vultures typically roost in trees and on pylons (Mundy et al. 1992).	Study area occurs within distribution range/on edge of distribution range, however unlikely to be a lot of large mammalian carcasses available to feed on in the area aside from livestock. Therefore, although the species may occasionally pass through the area it is unlikely to occur with the exception of a few opportunistic scavenging events.	Unlikely	SABAP2
Martial Eagle (*Polemaetus bellicosus*)	EN	Martial Eagles occur in a variety of habitats but seem to prefer arid and mesic savannah but are also commonly found at forest edges and in open shrubland (Simmons 2005). Birds will occupy most habitats provided there are adequate tall trees or pylons for nesting and perching (Machange et al. 2005). It rarely occurs in mountainous areas. It is known to nest on human-made structures, such as pylons and wind-pumps, and in alien trees (Tarboton and Allan 1984).	Within distribution range and habitat requirements partially to largely met.	Possible	SABAP2
Secretary bird *(Sagittarius serpentarius)*	VU	The species prefers open grassland and scrub, with the ground cover shorter than 50 cm and with sufficient scattered trees as roost/nest sites. It extends into savannah where sufficiently open areas exist (Boshoff and	Within distribution range and habitat largely met.	Possible	SABAP2

Species Name	Status[13]	Habitat Requirements/Preferences (after Roberts, 2015; Chittenden, 2009; Newman, 2002; IUCN, 2017)	Onsite Habitat Requirements Met?	Potential Occurrence on Site	Source
		Allan 1997, Dean and Simmons 2005). It is absent from Mountain Fynbos, forest, dense woodland and very rocky, hilly or mountainous woodland (Boshoff and Allan 1997). It occurs from sea-level to montane grasslands over 2000 m. Nests are large, stick platforms usually built on top of isolated flat-crowned trees, and particularly Vachellia (acacias); where indigenous thorny trees are not available, alien pines or wattles may also be used (Tarboton 2011).			
Crowned Eagle (*Stephanoaetus coronatus*)	VU	In southern Africa, it is restricted to Zimbabwe, central Mozambique and eastern South Africa and Swaziland. The species is found mostly in forest, including gallery and riverine forest, but also occurs in woodland and forested gorges in savannah and grassland (Simmons 2005). Crowned Eagles are readily found in plantations of exotic trees. They normally perch for long periods, resting inside the forest canopy, but will sometimes soar high above the canopy.	Within distribution range and habitat requirements partially to largely met.	Possible	SABAP2

C. Reptiles

All reptile species are sensitive to major habitat alteration and fragmentation. As a result of human presence in the area coupled with disturbance, alterations to the original reptilian fauna are expected to have already occurred and reptiles of conservation concern are therefore less likely be present within the degraded secondary habitat on site. However, there is a possibility that some reptile species may occur within the more intact open savannah/grassland and thicket habitat on site where anthropogenic impacts are limited. One reptile species was assessed as being potentially present on site based on the available habitat and its reported distribution range namely, the Southern African Python (Least Concern – Protected).

Table 27. Potential occurrence of reptile species within the study area.

Species Name	Status[14]	Habitat Requirements/Preferences (SANBI, 2021)	Onsite Habitat Requirements Met?	Potential Occurrence on Site	Source
Southern African Python (*Python natalensis*)	LC **(protected)**	Variety of habitats but usually in riverine or rocky areas and often in association with large animal burrows.	All vegetation communities provide habitat for this species	Possible	Atlas and Red List of Reptiles of South Africa, Lesothos and Swaziland
Dhlinza Dwarf Chameleon (Bradypodion caeruleogula)	EN	Found in three forest patches (Ntumeni, Dlinza and Ongoya) in KwaZulu-Natal, South Africa (Tilbury and Tolley 2009, Bates et al. 2014), where it prefers the high canopy, or high perches in smaller trees.	Outside known distribution range.	Low	Atlas and Red List of Reptiles of South Africa, Lesothos and Swaziland
Zululand Dwarf Chameleon (*Bradypodion nemorale*)	NT	This species is endemic to Qudeni and Nkandla Forests, two patches of indigenous forest in KwaZulu-Natal, South Africa (Tolley and Burger 2007, Bates et al. 2014), with an EOO of 184 km2 Confined to isolated patches of Afromontane and scarp forest. Usually found high in the canopy, although smaller individuals have been observed in the understorey (Tolley and Burger 2007).	Outside known distribution range.	Low	Atlas and Red List of Reptiles of South Africa, Lesothos and Swaziland

[14] Key: CR PE – Critically Endangered Possibly Extinct; CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; DD – Data Deficient; ER – Extremely Rare; R – Rare

D. Amphibians

One frog SCC may occur within specific freshwater habitats on site ***Natalobatrachus bonebergi*** (Endangered).

Table 28. Potential occurrence of frog species within the study area.

Species Name	Status[15]	Habitat Requirements/Preferences (IUCN, 2017)	Distribution/Range	Onsite Habitat Requirements Met?	Potential Occurrence on Site	Source
Kloof Frog (*Natalobatrachus bonebergi*)	EN	This species is restricted to southeastern South Africa, where it ranges from Manubi State Forest Reserve (Venter and Conradie 2015) in the Eastern Cape Province, to southern and central KwaZulu-Natal Province. It is restricted to lowland riparian forest patches within this range. Its elevational range is between 50 and 900 m asl. Its extent of occurrence (EOO) is 11,631 km^2 and its area of occupancy (AOO) is 188 km^2.	KZN midlands and KZN Province	Not Met – Outside of species distribution habitat	Unlikely	EIA Screeening Tool

E. Invertebrates

Very few formal surveys of invertebrates have been carried out in the study area. A review of the EIA Screening Tool Report for the site, LepiMap, SpiderMap, ScorpionMap, OdonataMap accessed from http://vmus.adu.org.za/; highlighted seventeen (17) species that could potentially occur in vegetation communities that are in good ecological condition on site.

[15] Key: CR PE – Critically Endangered Possibly Extinct; CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; DD – Data Deficient; ER – Extremely Rare; R – Rare

Table 29. Summary of noteworthy invertebrates that could occur within the study area

Scientific & Common Name	Type	Status[16]	Habitat	Relevant Onsite Habitat	POC	Source
Maritzburg slender-spined millipede (*Spinotarsus maritzburgensis*)	Millipede	EN	Under rocks, in leaf litter or top 30cm of soil	Could occur in thicket vegetation occurring on site in the leaf litter perhaps.	Unlikely	KZN SCA
Two-toothed slender spined millipede (*Patinatius bidentatus simulator*)	Millipede	Unknown	Leaf litter, often at base of trees, may also be in top 30cm of soil	Could occur in thicket vegetation occurring on site in the leaf litter perhaps.	Unlikely	KZN SCA
Gulella euthymia	Mollusc	Unknown	Information not available	Unknown	Unlikely	KZN SCA
Gulella separata	Mollusc	Unknown	Information not available	Unknown	Possible	KZN SCA
Spinotarsus destructus	Millipede	EN	Under rocks and cattle dung	Unknown	Unlikely	KZN SCA
Sickle-shaped Black Millipede (*Doratogonus falcatus)*	Millipede	Unknown	Information not available	Unknown	Unlikely	KZN SCA
Arytropteris basalis	Grasshopper	Unknown	Information not available	Unknown	Unlikely	KZN SCA
Complex keeled millipede (*Allawrencius complex*)	Millipede	Unknown	Information not available	Unknown	Unlikely	KZN SCA
Wandering black millipede (*Doratogonus peregrinus*)	Millipede	Unknown	Information not available	Unknown	Possible	KZN SCA
Natal black millipede (*Doratogonus natalensis*)	Millipede	Unknown	Information not available	Unknown	Possible	KZN SCA
Wrinkled red millipede (*Centrolobus rugulosus*)	Millipede	Unknown	Information not available	Unknown	Unlikely	KZN SCA
Dlinza Forest pinwheel (*Trachycystis clifdeni*)	Mollusc	CR	The Dlinza Forest pinwheel (Trachycystis clifdeni) is a species of very small, air-breathing, land snail. This species is endemic to South Africa. Its	Could occur in thicket vegetation occurring on site in the leaf litter perhaps.	Unlikely	KZN SCA

[16] Key: CR PE – Critically Endangered Possibly Extinct; CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; DD – Data Deficient; ER – Extremely Rare; R – Rare

Scientific & Common Name	Type	Status[16]	Habitat	Relevant Onsite Habitat	POC	Source
			natural habitat is subtropical or tropical dry forests. The common name is a reference to the Dlinza Forest Nature Reserve.			
Bifid red millipede (*Centrolobus bifidus*)	Millipede	Unknown	Information not available	Unknown	Unlikely	KZN SCA
Gulella aliciae	Mollusc	Unknown	Information not available	Unknown	Unlikely	KZN SCA
Gulella barbarae	Mollusc	Unknown	Information not available	Unknown	Unlikely	KZN SCA
Eunonyma lymnaeformis	Mollusc	Unknown	Information not available	Unknown	Unlikely	KZN SCA
Edouardia conulus	Mollusc	Unknown	Information not available	Unknown	Unlikely	KZN SCA

ANNEXURE C: Impact Significance Assessment Summary Tables

Terrestrial Biodiversity Impact Significance Assessment: Construction Phase								
IMPACT SIGNIFICANCE: Realistic Poor Mitigation Scenario								
No.	**Description**	**Status**	**Extent**	**Intensity**	**Duration**	**Probability**	**Significance**	**Confidence**
C1	Impact on vegetation structure and plant species composition	Negative	Regional	Moderate	Permanent	Highly Probable	Moderate	Medium
C2	Impact on populations of species of special concern	Negative	Provincial / National	Moderately-High	Permanent	Highly Probable	High	Medium
C3	Impact on targets for threatened ecosystems	Negative	Provincial / National	Moderate	Permanent	Probable	Moderate	Medium
C4	Impact on ecological processes and functionality of ecosystems	Negative	Local	Moderate	Long-term	Highly Probable	Moderately-Low	Medium
C5	Impact on overall species and ecosystem diversity	Negative	Local	Moderate	Permanent	Highly Probable	Moderate	Medium
C6	Impact on ecological connectivity	Negative	Local	Moderate	Medium-term	Probable	Moderately-Low	Medium
IMPACT SIGNIFICANCE: Realistic Good Mitigation Scenario								
No.	**Description**	**Status**	**Extent**	**Intensity**	**Duration**	**Probability**	**Significance**	**Confidence**
C1	Impact on vegetation structure and plant species composition	Negative	Regional	Moderately-Low	Long-term	Probable	Moderately-Low	Medium
C2	Impact on populations of species of special concern	Negative	Provincial / National	Moderately-High	Immediate	Possible	Moderately-Low	Medium
C3	Impact on targets for threatened ecosystems	Negative	Provincial / National	Moderately-Low	Permanent	Unlikely	Moderately-Low	Medium
C4	Impact on ecological processes and functionality of ecosystems	Negative	Local	Moderately-Low	Permanent	Probable	Moderately-Low	Medium
C5	Impact on overall species and ecosystem diversity	Negative	Local	Moderately-Low	Permanent	Highly Probable	Moderately-Low	Medium
C6	Impact on ecological connectivity	Negative	Local	Moderately-Low	Short-term	Probable	Low	Medium

Terrestrial Biodiversity Impact Significance Assessment: Operational Phase								
IMPACT SIGNIFICANCE: Realistic Poor Mitigation Scenario								
No.	**Description**	**Status**	**Extent**	**Intensity**	**Duration**	**Probability**	**Significance**	**Confidence**
O1	Impact on vegetation structure and plant species composition	Negative	Regional	Moderate	Long-term	Probable	Moderate	Medium
O2	Impact on populations of species of special concern	Negative	Provincial / National	Moderate	Long-term	Probable	Moderate	Medium
O3	Impact on targets for threatened ecosystems	Negative	Provincial / National	Moderate	Long-term	Probable	Moderate	Medium
O4	Impact on ecological processes and functionality of ecosystems	Negative	Local	Moderately-Low	Long-term	Possible	Low	Medium
O5	Impact on overall species and ecosystem diversity	Negative	Local	Moderately-Low	Long-term	Possible	Low	Medium
O6	Impact on ecological connectivity	Negative	Local	Moderately-Low	Long-term	Possible	Low	Medium
IMPACT SIGNIFICANCE: Realistic Good Mitigation Scenario								
No.	**Description**	**Status**	**Extent**	**Intensity**	**Duration**	**Probability**	**Significance**	**Confidence**
O1	Impact on vegetation structure and plant species composition	Negative	Regional	Moderately-Low	Long-term	Possible	Moderately-Low	Low
O2	Impact on populations of species of special concern	Negative	Provincial / National	Moderate	Long-term	Possible	Moderately-Low	Low
O3	Impact on targets for threatened ecosystems	Negative	Provincial / National	Moderately-Low	Long-term	Possible	Moderately-Low	Low
O4	Impact on ecological processes and functionality of ecosystems	Negative	Local	Moderately-Low	Long-term	Possible	Low	Low
O5	Impact on overall species and ecosystem diversity	Negative	Local	Moderately-Low	Long-term	Possible	Low	Low
O6	Impact on ecological connectivity	Negative	Local	Moderately-Low	Long-term	Possible	Low	Low

CURRICULUM VITAE

Ryan Bradley Kok

Eco-Pulse Consulting

eco-pulse
environmental consulting services
26 Mallory Road, Hilton
3245, South Africa

PERSONAL DETAILS

Date of Birth: 1 March 1991
Identity Number: 9103015100087
Nationality: South African
Languages: English (Primary), Afrikaans (Secondary)

TERTIARY QUALIFICATIONS

Attendance	Certificate / Qualification
2014 - 2016	**Masters of Science (M.Sc.) Biological Science,** University of KwaZulu-Natal, Graduated *Summa Cum Laude* (Finishing Top 1% of the University), Specialized in Biodiversity and Conservational Research; Environmental Niche Modelling; and Ecology
2013	**Bachelor of Honours (B.Sc. Hon.) Biological Science,** University of KwaZulu-Natal, Specialized in Ecology (Certificate of Merit for Conservation Ecology).
2010 - 2012	**Bachelor of Science (B.Sc.) Environmental Science,** University of KwaZulu-Natal.

RECORD OF EMPLOYMENT

Year(s)	Position	Company
2017 – 2018	Intern	Eco-Pulse Consulting
2018 – 2020	Junior Scientist	Eco-Pulse Consulting
2018 – Present	Scientist	Eco-Pulse Consulting

POSITION AND RESPONSIBILITIES

Scientist, wetland/terrestrial ecologist and GIS Specialist at Eco-Pulse Consulting, with 5 years' experience in environmental consulting and undertaking specialist wetland/aquatic assessments. Current responsibilities include:

- Undertaking specialist wetland, river and biodiversity related assessments for a range of clients
- Specialist reporting
- Drafting rehabilitation plans for wetlands, rivers/riparian areas
- Terrestrial ecological/biodiversity, invasive alien plant and vegetation surveys
- Geographic Information Systems (GIS) analysis for range of strategic projects
- Compiling Water Use License Applications (WULAs)
- Liaising with clients
- Project management

RELEVANT EXPERTISE

Project Experience in the Environmental Sciences, Specialist Aquatic/Wetland Science/Ecology and Environmental Management fields:

- **Wetland related assessments and research:** Experience in wetland-related studies for a number of wetland systems in KwaZulu-Natal, Eastern Cape and Gauteng including: wetland delineation, Wet-Health functional assessments and Wet-Ecoservices assessments.
- **Water Use Licensing:** Experience in assisting and completing numerous WULAs in KZN.
- **River-related studies:** Involved in projects where specialist fluvial geomorphology assessments were required; responsible for conducting baseline riparian vegetation (VEGRAI) and riparian habitat (IHI) for the R61 road development project between Margate and Port Shepstone.
- **Aquatic Bio-monitoring**: Involved/assisting in surveying of river channels, geomorphology assessments, water-quality monitoring and analysis, as well as wetland assessments for the various river and wetland systems impacted.
- **Biodiversity Assessments**: Involved/assisting in undertaking desktop and field-based terrestrial biodiversity studies for various project in KZN and Eastern Cape; part of the team responsible for assessment around KZN and Mpumalanga.
- **Invasive Alien Plants (IAPs) surveys**: Involved field surveys required for eThekwini's selected open spaces managed areas.
- **Development of EMFs** (Environmental Management Framework) for the Msunduzi Municipality (Biodiversity and wetlands).
- **Development of SEAs** (Stagetic Environmental Assessment), forming part of the team as biodiversity specialists (terrestrial and freshwater) for the Kokstad Greater Municipality.
- **Geographic Information Systems (GIS):** Experienced in undertaking large GIS studies and analysis, for example undertaking wetland inventory and prioritization exercise for the City of Mbombela Municipality (3-year project), a desktop PES assessment for the Ekurhuleni Bioregional Plan, Msundusi Environmental Management Framework (EMF), part of the project team for the Greater Kokstad Municipality Strategic Environmental Assessment (SEA), and part of the project team for the OR Tambo District Municipality Biodiversity Sector Plan (BSP), amongst others.

PROFESSIONAL MEMBERSHIPS AND AFFILIATATIONS

- Registered **Professional Natural Scientist** (*Pr. Sci. Nat*.) with SACNASP (South African Council for Natural Scientific Professions) under the following fields of practice: Ecological Science; Reg. No.: 122290
- Member of the **South African Wetland Society (SAWS)**; membership No. 941381
- Member of the **Society of Wetland Scientists** membership No. 084810
- Member of the **Society for Ecological Restoration**
- Member of the **KZN Wetland Forum**
- Member and regular participant of the **Pickersgill's Reed Frog Forum**
- Part of the Provincial and SANParks working group for the National Wetland Database

HONOURS, AWARDS AND SPECIAL ACHIEVEMENTS

- Graduated Masters (MSc) *Summa Cum Laude* and in the Top 1% of UKZN in 2016 (final year mark 93%)
- Presented Masters work at The 12th African Small Mammals Symposium 2015 (Mantasoa, Madagascar) in 2015
- Attended and presented Masters work at the Zoological Society of Southern Africa Conference 2015 – ZSSA/ESSA Conference (Grahamstown, South Africa) (2015)
- Received the University of KwaZulu-Natal College Postgraduate Bursary (2014 - 2015)
- Received the NRF Innovation bursary (2013)
- Awarded Certificate of Merit for Conservation Ecology (2013)
- Awarded KwaZulu-Natal Colours by Mind Sports South Africa (2012)
- Awarded best environmental impact assessment group project submitted for Environmental Management course, book prize (2012)
- Awarded Olaf Wirminghaus commemorative award: for submitting the best project, awarded a Certificate of Merit for Behavioral and Reproduction Ecology, coupled a book prize and bursary (2012)

OTHER RELEVANT INFORMATION (E.G. PUBLICATIONS & CONFERENCES)

Publications include:

- Kok, R.B. et al. (2017). Does the removal of finder's share influence the scrounging decisions of herbivores?. Animal Behaviour. 133. 10.1016/j.anbehav.2017.09.023.

Conferences, Training and Workshops attended:

- National Wetland Indaba – online conference – Presented (2021)
- SWS International Chapter African Region Webinar – Wetland Rehabilitation Course (2021)
- Wetland Legislation Law application in wetland management (2020)
- An Introduction on How to Map and Groundtruth Wetlands (2020)
- How to align existing policies and green infrastructure for climate consciousness (2020)
- Pickersgill's Reed Frog Forum meeting held at Ushaka Education Centre, KZN (2019)
- Hakskeenpan and surrounding Kalahari pans tour facilitated by Betsie Milne, Northern Cape (2018)
- National Wetlands Indaba – 3-day conference held at Mittah Seperepere Convention Centre, Kimberley, Northern Cape (2018)
- Pickersgill's Reed Frog Forum meeting held at Twinstreams Environmental Education Centre, KZN (2018)
- One-day tree identification and forest ecology course run by Prof Eugene Moll, Hawaan Forest, Umhlanga, KZN (2018)
- WET-EcoServices field assessment held at the new Mpophomeni Tourism Centre, KZN (2018)
- Training course on the Department of Environmental Affairs Screening tool held at Ezemvelo KZN Wildlife Auditorium PMB, Queen Elizabeth Park, Pietermaritzburg, KZN (2018)
- WET-EcoServices seminar given by Donovan Kotze held at UKZN Main Campus, Pietermaritzburg, KZN (2018)
- World Wetlands day Workshop at the Esihle Science Discovery Centre, Northern KZN (2018)
- Training course on Soil Classification and Land Capability held at Cedara College, KZN (2018)
- National Wetlands Indaba – 4-day conference held at the Wild Coast Sun, KZN (2017)

Other skills (e.g., computer literacy, etc.):

- GIS Systems: Very Competent in ArcGIS 10, QGIS and Google Earth – Mapping, modelling and data analysis.
- Microsoft Windows: Highly competent – Full functionality and file storage.
- Microsoft Excel: Competent – Data handling & manipulation. Calculations, Pivot tables, Graphs, higher level functionality.
- Microsoft Word: Very competent – Report writing skills including general documentation, scientific reports and popular publications (Graphs, graphics, tables).
- Microsoft Power Point: Highly competent – Good presentation skills.
- Competent in topographic surveying using a standard dumpy level and staff.

RELEVANT PROJECT EXPERIENCE

PROJECT	TASKS/RESPONSIBILITIES & DELIVERABLES	Date Completed
Wetland Inventory for North West Province (DEDECT)	• Desktop Wetland Mapping and Modelling • Characterise and Classify Wetlands • Field data collection and site verification	Ongoing
Aloes Landfill Site and Leachate Dam Freshwater Impact Assessment	• Wetland delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2022
Rhino Onshore O&G ER - Freshwater and Terrestrial Assessment	• GIS Support	Ongoing

PROJECT	TASKS/RESPONSIBILITIES & DELIVERABLES	Date Completed
Brookdale Wetland Rehabilitation Plan and Specialist Oversight	• Onsight oversight • Historic wetland delineation • Specialist recommendations • Rehabilitation recommendations and Report	Ongoing
Ethelbeth Rd Development Water Use Licence Application	• Public Participation Process • Information Gathering & Compilation of Outstanding Environmental Specialist Studies • Completion of Relevant WULA Forms • Compilation of the IWWMP	Ongoing
Rossmin Limestone Mine - External Water Use License Audit	• WULA reports review • Site inspection • External Audit Report	2022
Cator Ridge Offset Planning Assmang	• Offset ratio calculation • GIS specialist support and analysis • GIS mapping and collaboration	2022
Greater Kokstad Municipality Strategic Environmental Assessment (SEA)	• Infield data collection and refinement • GIS specialist support and analysis • GIS mapping and collaboration	2022
Telecommunication Mast in Uvongo - Ecological Assessment (Compliance Statement)	• Infield verification • Species identification • Report review and sign-off	2022
P419 Road Upgrade - Ecological Assessment	• Report review and sign-off	2022
Cato Ridge Container Storage – DWS Risk Assessment Matrix	• Risk Assessment to inform Section 21 (c) and (i) Water Uses	2022
Soil Spoil Site - Specialist Freshwater Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2022
Khuba Secondary School - Freshwater Compliance Statement	• Infield verification • Compliance statement	2022
New Poultry Facility near Maclear EC – Freshwater Impact Assessment	• Wetland delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2022
Existing Quarry Wetland Compliance Statement and Assessment	• Infield verification • Compliance statement	2022
OR Tambo Biodiversity Sector Plan – Eastern Cape	• Data collection • GIS specialist support and analysis • GIS mapping and collaboration	2021
Thornridge Waste PARCC - Freshwater Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS).	2021
Transnet Pipeline Mapleton Diesel Spill	• Infield environmental impacts and extent • Data capture • Wetland impact summary report	2021
Kwamfana Road Culvert Upgrade – DWS Risk Assessment Matrix	• Risk Assessment to inform Section 21 (c) and (i) Water Uses	2021
Tugela Asphalt Plan Freshwater Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2021

PROJECT	TASKS/RESPONSIBILITIES & DELIVERABLES	Date Completed
Umlaas Gate Development Water Use Licence Application	• Public Participation Process • Information Gathering & Compilation of Outstanding Environmental Specialist Studies • Completion of Relevant WULA Forms • Compilation of the IWWMP • Surface and ground water monitoring programme • Environmental Contingency Plan	2021
uMshwati Phase 6 Pipeline - Freshwater Baseline Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS).	2021
P368 Road Upgrade – Freshwater Baseline Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS).	2021
Schaapkraal - Biodiversity Offset Support	• Offset ratio calculation • GIS specialist support and analysis • GIS mapping and collaboration	2021
PG Bison Forest Roads - Freshwater Impact Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2021
Mageza Mall – Wetland Baseline Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS).	2021
Transnet Pipeline Newcastle Fuel Spill – Wetland Assessment	• Infield environmental impacts and extent • Data capture • Wetland impact summary report • Wetland rehabilitation plan and method statements	2021
Portion 40 of Erf 818 Wetland Delineation	• Detailed wetland delineation and classification.	2021
SANRAL R61 Road Upgrade - WULA	• Water Use License Application for R61 Road upgrade	2021
Pelican Park Phase 2 Housing - Offset Support	• Offset ratio calculation • GIS specialist support and analysis • GIS mapping and collaboration	2021
Transnet Pipeline Bethlehem Fuel Spill – Wetland Assessment	• Infield environmental impacts and extent • Data capture • Wetland impact summary report • Wetland rehabilitation plan and method statements	2021
Western Waste Management Facility – Specialist Aquatic Studies	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2021
Richards Bay 400mW Gas to Power Energy Facility	• Risk Assessment to inform Section 21 (c) and (i) Water Uses	2021
Ethekwini IAP Survey 2020	• Field based surveys • Invasive plant identification • Data capture • GIS data capture	2021
Kei Mouth Eco-Estate Aquatic Assessment	• Baseline aquatic assessment (IHI and EIS). • Setting management objectives for water resources/ freshwater ecosystems. • Identification, description and assessment of freshwater ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2020
Metso Isithebe Dump Site	• River/riparian zone delineation and classification	2020
Waaihoek Battery Storage Facility – Freshwater Impact Assessment	• Wetland zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Setting management objectives for water resources/ freshwater ecosystems. • Identification, description and assessment of freshwater ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2020

PROJECT	TASKS/RESPONSIBILITIES & DELIVERABLES	Date Completed
Engen Cato Ridge Development	• Wetland and river/riparian zone delineation and classification.	2020
Transnet Pipeline Kendal 3 Diesel Spill – Wetland Assessment	• Infield environmental impacts and extent • Data capture • Wetland impact summary report • Wetland rehabilitation plan and method statements	2020
Transnet Pipeline Balfour ULP Spill – Wetland Assessment	• Infield environmental impacts and extent • Data capture • Wetland impact summary report • Wetland rehabilitation plan and method statements	2020
Transnet Pipeline Grey 2 Diesel Spill – Wetland Assessment	• Infield environmental impacts and extent • Data capture • Wetland impact summary report • Wetland rehabilitation plan and method statements	2020
Transnet Pipeline Kibler Diesel Spill – Wetland Assessment	• Infield environmental impacts and extent • Data capture • Wetland impact summary report • Wetland rehabilitation plan and method statements	2020
Conduct A Wetlands Inventory and Ecological Integrity Assessment for The City of Mbombela (Phase 4)	• Desktop Wetland Mapping • Characterise and Classify Wetlands • Wetland PES, EIS and Ecosystem Services Assessment • Wetland Prioritisation for Rehabilitation • Provision of Landownership Information • Identify areas for Possible Community-Based Adaptation Projects and/or Partnerships	2020
SANRAL N2 Mthatha Community Access Road Upgrades	• Project Leader • Wetland delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2020
Mthlathuze Foskor Gypsum Spill Wetland Rehabilitation Plan	• Water and soil sampling & reporting • Infield environmental impacts and extent • Data capture • Wetland and terrestrial impact summary report • Wetland and terrestrial rehabilitation plan and method statements	2020
Brookdale Housing Project – Wetland Assessment (Section 24G)	• Wetland zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Section 24G application in terms of rectification of illegal listed activities under NEMA. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction and monitoring guidelines • Conceptual Rehabilitation and Management Plan.	2020
Ekurhuleni Bioregional Plan	• GIS support • Desktop Wetland PES, EIS and Ecosystem Services Assessment	2020
Supporting investment in wetland rehabilitation in the City of Kigali (Rwanda)	• GIS support	2020
oHlanga Catchment Management Plan	• Desktop landcover mapping • GIS support	2020
Conduct A Wetlands Inventory and Ecological Integrity Assessment for The City of Mbombela (Phase 3)	• Desktop Wetland Mapping • Characterise and Classify Wetlands • Wetland PES, EIS and Ecosystem Services Assessment • Wetland Prioritisation for Rehabilitation • Provision of Landownership Information • Identify areas for Possible Community-Based Adaptation Projects and/or Partnerships	2020
Mondi Underground Fire Procedure	• Document review	2020
Cotswold Square Retail Centre Wetland Study	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts	2020

PROJECT	TASKS/RESPONSIBILITIES & DELIVERABLES	Date Completed
	• Provision of planning, construction, operation, rehabilitation and monitoring guidelines	
Proposed Expansion of Parks Paddock Farm in Fort Nottingham, KwaZulu-Natal	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2020
Greenlands Water Use Licence Application	• Public Participation Process • Information Gathering & Compilation of Outstanding Environmental Specialist Studies • Completion of Relevant WULA Forms • Compilation of the IWWMP • Surface and ground water monitoring programme • Environmental Contingency Plan	2020
Wetland Rehabilitation Offset for TradeZone 2 Mapping	• GIS support	2019
Kindlewood Estate Ecological Assessment	• Ecological Audit and Environmental Recommendation • Presentation to the Client and Committee	2019
DTP ASP Wetland Rehabilitation Plan & Offset Support	• GIS Support	2019
Specialist Wetland Delineation Study and Risk Assessment for the property Rem of Portion 444 and Portion 442 of 862, at Tongaat, eThekwini Municipality, KwaZulu-Natal	• Wetland and river/riparian zone delineation and classification. • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning guidelines	2019
Water Use Licence Application (WULA) for the Existing One Logix WWTW At Umlaas Road, KZN	• Public Participation Process • Information Gathering & Compilation of Outstanding Environmental Specialist Studies • Completion of Relevant WULA Forms • Compilation of the IWWMP • Surface and ground water monitoring programme • Environmental Contingency Plan	2019
Tronox Everglades Expansion	• Wetland delineation and classification. • Frog surveys	2019
Hazelmere Water & Sanitation Project	• Field Work • Wetland and river/riparian zone delineation and classification.	2019
Specialist Freshwater Ecosystem and Terrestrial Vegetation Impact Assessments to Inform The BA/WULA for the Proposed Nonoti Coastal Beach Resort Between Blythedale And Zinwazi, KZN North Coast	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2019
Adam's Mission Ecological Assessment (EWT)	• Vegetation survey plots	2019
Specialist Freshwater Wetland & Riparian Habitat Delineation Study	• Wetland and river/riparian zone delineation and classification. • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2019
Specialist Aquatic Risk Assessment to Inform WULA Requirements for the Existing Gravel Quarry at Ashburton, KZN	• Wetland and river/riparian zone delineation and classification. • DWS Risk Matrix Assessment	2019
Simuma Oil Spill Aquatic Biomonitoring	• River biomonitoring • Reporting	2019
Vulindlela Draft Status Quo	• POC assessment • GIS checking and Mapping • Analysis & Draft SEA Report	2019

PROJECT	TASKS/RESPONSIBILITIES & DELIVERABLES	Date Completed
	• Data Refinement	
Conduct A Wetlands Inventory and Ecological Integrity Assessment for The City of Mbombela (Phase 2)	• Desktop Wetland Mapping • Characterise and Classify Wetlands • Wetland PES, EIS and Ecosystem Services Assessment • Wetland Prioritisation for Rehabilitation • Provision of Landownership Information • Identify areas for Possible Community-Based Adaptation Projects and/or Partnerships	2019
SANRAL R61 Road, between (1) Mthamvuna River & Port Edward, (2) Port Edward & Mpenjati River & (3) Mpenjati River & Mbizana River within the KwaZulu-Natal Province	• Wetland and river/riparian zone delineation and classification. • Rapid wetland assessment (PES, ecosystem services and EIS). • Rapid river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2019
Improving the management of peatlands in the Zululand / Maputaland coastal region - Peatland Fire Management	• Field Work • Updating Trench/Drain Map and Database • Defining Preliminary Management Prescriptions for Peatlands	2018
Conduct A Wetlands Inventory and Ecological Integrity Assessment for The City of Mbombela (Phase 1)	• Desktop Wetland Mapping • Characterise and Classify Wetlands • Wetland PES, EIS and Ecosystem Services Assessment • Wetland Prioritisation for Rehabilitation • Provision of Landownership Information • Identify areas for Possible Community-Based Adaptation Projects and/or Partnerships	2018
Greenlands Wetland & Aquatic Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2018
Umlaas Road Development Wetland & Aquatic Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2018
726 Town Bush Road Oak Park Parkview Estate	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2018
La Mercy Cemetery Wetland Assessment	• Wetland delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Setting management objectives for wetlands. • Identification, description and assessment of aquatic ecological impacts. • Provision of planning, construction, operation, rehabilitation and monitoring guidelines.	2018
KSIA Emergency Access Roads Ecological Impact Assessment	• Wetland delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Setting management objectives for wetlands. • Identification, description and assessment of aquatic ecological impacts. • Provision of planning, construction, operation, rehabilitation and monitoring guidelines.	2018
Buffelsdraai Biodiversity Assessment 2018	• Field Work • Vegetation surveys • Invertebrate surveys	2018
ERF746 Queensburgh Wetland Report Update	• Updating the wetland report to include aquatic impact assessment and DWS Risk Matrix	2018
Draycott Roads Wetland Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS).	2018

PROJECT	TASKS/RESPONSIBILITIES & DELIVERABLES	Date Completed
	• Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	
Durnacol Dannhauser Pipeline Wetland Demarcation	• Demarcation of all wetlands along the construction route	2018
Darvill WWTW Constructed Wetland Specialist Freshwater Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines • Frog Surveys	2018
Collisheen Estate Wetland Delineation	• Detailed wetland and river/riparian zone delineation and classification.	2018
OneLogix_ERF 30 Umlaas Rd Wetland Assessment	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2018
Wetland Habitat Impact Assessment to inform the requirements of the Directive issued by eThekwini Municipality for Southway Freight concerning unauthorized activities within a watercourse (wetland) in the Prospecton area (south Durban basin), eThekwini Municipality, KZN.	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of offset requirements	2018
Specialist Wetland Assessment and Protected Plant Survey for the Crude Import Pipeline Replacement at South Durban, eThekwini Municipality, KZN	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2018
Verulam Mall	• Wetland and river/riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline river/ aquatic assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts • Provision of planning, construction, operation, rehabilitation and monitoring guidelines	2018
THD Open Plan Master Plan	• Desktop Wetland Mapping • Characterise and Classify Wetlands • Integration of wetland data	2018
Triple A Beef	• Field Work • Assisting with fish surveys • Water sampling • Wetland delineation and classification	2018
Mvoti River Sand Mining Wetland Aquatic Assessment	• Field Work • Assisting with fish surveys • Wetland delineation and classification.	2018
DTPC Offset Planning Support for the TradeZone 2 development	• Field Work • GIS mapping	2018
P125 Road Upgrade	• Wetland delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Setting management objectives for wetlands.	2018

PROJECT	TASKS/RESPONSIBILITIES & DELIVERABLES	Date Completed
	• Identification, description and assessment of aquatic ecological impacts. • Provision of planning, construction, operation, rehabilitation and monitoring guidelines.	
South Africa-Swaziland-Mozambique Border Patrol Road Aquatic & Terrestrial Ecological Assessments	• Potential Occurrence Assessment	2018
Portion 377 of 247 Cottonlands Wetland Assessment	• Wetland and river/ riparian zone delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS). • Baseline aquatic/ river assessment (PES and EIS). • Setting management objectives for water resources/ aquatic ecosystems. • Identification, description and assessment of aquatic ecological impacts. • Provision of planning, construction, operation, rehabilitation and monitoring guidelines.	2018
Tongaat Hulett Inyaninga Wetland Offset Site	• Wetland delineation and classification. • Well Monitoring • Frog surveys	2018
LAB Wetlands SA Implementation Project Amathole	• Desktop GIS analysis	2018
Improving the management of peatlands in the Zululand / Maputaland coastal region	• Consolidate and expand on the available baseline dataset on peatland distribution, fire disturbance history and the distribution of drains in wetlands to inform further planning. • Initial mapping of fires and drains in open areas • Undertaking a benchmarking field trip • Consolidation of field data and reporting • Wetland delineation and classification	2018
National Wetland Indaba Case Study	• Wetland delineation and classification. • Baseline wetland assessment (PES, ecosystem services and EIS).	2017
Msunduzi EMF	• Land-cover mapping and development of species layers. • GIS mapping and interpretation. • Liaising with specialists and compiling updated species data. • Assistance in the conservation planning process. • Report production.	2017

KWAZULU-NATAL PROVINCE
ECONOMIC DEVELOPMENT, TOURISM AND ENVIRONMENTAL AFFAIRS
REPUBLIC OF SOUTH AFRICA

	(For official use only)
Provincial Reference Number:	
NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Submitted in terms of section 24(2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or for a waste management licence in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

KINDLY NOTE:

1. This form is current as of **May 2021**. It is the responsibility of the Applicant / Environmental Assessment Practitioner ("EAP") to ascertain whether subsequent versions of the form have been released by the Department.

PROJECT TITLE

Basic Assessment for the Proposed Upgrading of Bulk Water Supply, Kwahlokohloko Water Sub-Supply Area (SSA) 1, Phase 2, King Cetshwayo District Municipality, KwaZulu Natal

DISTRICT MUNICIPALITY

King Cetshwayo District Municipality,

1. SPECIALIST INFORMATION

Specialist name:	Eco-Pulse Environmental Consulting Services		
Contact person:	Ryan Kok		
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Professional affiliation(s) (if any)	SACNASP Registered Professional Natural Scientist (Pr.Sci.Nat.) Reg No. 122290		

Project Consultant / EAP:	Terratest (Pty) Ltd		
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2. DECLARATION BY THE SPECIALIST

I, **RYAN KOK** are that --

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist:

Eco-Pulse Consulting cc

Name of company:

06/09/2022

Date: