

**PERSERVERANCE QUARRY APPLICATION, POWER  
CONSTRUCTION**

**DRAFT AQUATIC ASSESSMENT**

**FOR**

**Power Construction (Pty) Ltd**

**BY**



**EnviroSci (Pty) Ltd**

**Dr Brian Colloty**

1 Rossini Rd

Pari Park

Gqeberha

6070

**DATE**

17 April 2026

**REVISION 1**

## TABLE OF CONTENTS

1	Introduction.....	6
1.1	Location.....	6
1.2	Relevant legislation and policy .....	6
1.3	National web-based sensitivity.....	7
2	Terms of Reference .....	8
3	Knowledge Gaps .....	8
4	Study Area .....	9
4.1	Climate .....	9
4.2	Geology.....	9
4.3	Vegetation.....	10
4.4	Drainage network .....	10
4.5	South African Inventory of Inland Aquatic Ecosystems.....	11
4.6	Conservation context.....	12
5	Expertise of the specialist.....	13
6	Aims and objectives.....	14
7	Methodology .....	14
7.1	Wetland identification and mapping.....	14
7.2	Wetland delineation .....	15
7.3	Wetland functional assessment.....	16
7.4	Determining the ecological integrity of wetlands .....	21
7.5	Determining the Present Ecological State of wetlands .....	22
7.6	Determining the Ecological Importance and Sensitivity of wetlands.....	23
7.7	Ecological classification and description.....	25
8	Results.....	25
8.1	Aquatic delineation.....	25
8.2	Aquatic unit identification .....	25
8.3	Aquatic unit setting.....	27
8.4	Wetland soils.....	27
8.5	Description of aquatic types .....	28
8.6	General functional description of aquatic types .....	28
8.7	Aquatic ecological functional assessment .....	28
8.8	The ecological health assessment of the project area .....	28
8.9	The PES assessment .....	29
8.10	The EIS assessment .....	29
9	Impact assessment discussions .....	30
9.1	Loss of aquatic units, and or habitats .....	30
9.2	Changes to the surface water hydrology.....	30
9.3	Aquatic buffer zone.....	31
10	Conclusions and Recommendations .....	33
11	References.....	34
12	Appendix 1 CV.....	36

## LIST OF TABLES

Table 1: Utilised data and associated source relevant to the proposed project .....	9
Table 2: Description of A – F ecological categories based on Kleynhans et al., (2005).....	21
Table 3: Health categories used by WET-Health for describing the integrity of wetlands (after Macfarlane et al., 2008).....	23
Table 4: Summary of direct and indirect ecoservices provided by wetlands from Kotze et al., 2008	24
Table 5: Summary of screening assessment.....	27
Table 6: VEGRAI Level 3 rating results .....	29
Table 7: Hydrological changes due to mining activities.....	30
Table 8: Cumulative impact upon aquatic biodiversity .....	31

## LIST OF FIGURES

Figure 1: Google satellite imagery showing the location in relation to the general environment .....	6
Figure 2: DFFE screening tool sensitivity results for the Aquatic Biodiversity Theme .....	7
Figure 3: The VEGMAP 2024 vegetation units of the area (SANBI, 2025).....	10
Figure 4: The site is located within N14A quaternary catchment .....	11
Figure 5: The site in relation to the national wetland and river inventories.....	12
Figure 6: The sites in relation to the ECBCP freshwater CBA map .....	13
Figure 7: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change as one moves along a gradient of decreasing wetness, from the middle to the edge of the wetland. Source: Donovan Kotze, University of KwaZulu-Natal.....	16
Figure 8: Illustration of wetland types and their typical landscape setting (From Ollie <u>et al.</u> 2013) ..	17
Figure 9: Basic structure of the NWCS, showing how ‘primary discriminators’ are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with ‘secondary discriminators’ applied at Level 5 to classify the tidal/hydrological regime, and ‘descriptors’ applied .....	19
Figure 10: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis et al., 2013).....	20
Figure 11: The aquatic features present within the study area .....	26

**LIST OF PHOTO PLATES**

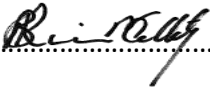
Plate 1: Downstream view of HGM1 - minor watercourse below the proposed site after rains.....26  
Plate 2: Upstream view of the Kraai River, dominated by Vachellia karroo riparian areas, and alluvial fan depositions.....27  
None were taken due to the lack of wetlands.....27

## SPECIALIST REPORT DETAILS

**Report prepared by:** Dr. Brian Colloty Pr.Sci.Nat. (Ecology 400268/07) / Member SAEIES.

**Expertise / Field of Study:** BSc (Hons) Zoology, MSc Botany (Rivers), Ph.D Botany Conservation Importance rating, and has worked as an independent consulting specialist from 1996 to present.

I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs Fisheries and Forestry and or Department of Water and Sanitation

Signed:.....  ..... Date:....17 April 2026.....

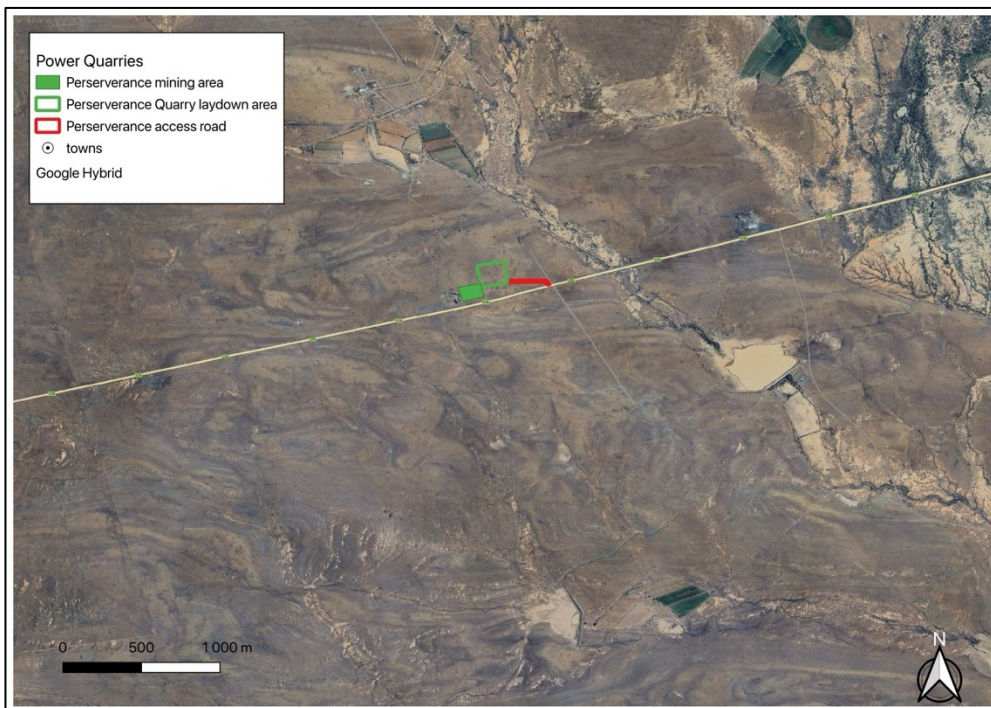
This document contains intellectual property and proprietary information that is protected by copyright in favour of EnviroSci (Pty) Ltd. The document may therefore not be reproduced, or used without the prior written consent of EnviroSci (Pty) Ltd. This document is prepared exclusively for Power Construction and their client and is subject to all confidentiality, copyright, trade secrets, and intellectual property law and practices of SOUTH AFRICA.

# 1 Introduction

EnviroSci (Pty) Ltd was appointed by Power Construction (Pty) Ltd, to undertake an aquatic assessment for the proposed development of a quarry in the Eastern Cape. This assessment is to inform the Water Use License Authorisation (WULA) application/ General Authorisation (GA) registration, as well as the Mining Permit Applications. This was based on desktop analysis followed by a short site inspection to confirm the information contained in this assessment. The site visit, conducted on the 14 April 2026, occurred after significant rainfall aiding in the confidence of this assessment.

## 1.1 Location

The proposed sites located west of Aberdeen, along the R61 road and will be used in the construction projects within the region.



**Figure 1: Google satellite imagery showing the location in relation to the general environment**

## 1.2 Relevant legislation and policy

The following is pertinent to this study:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA);
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- Nature and Environmental Conservation Ordinance (No. 19 of 1974);
- National Forest Act (No. 84 of 1998); and

- National Heritage Resources Act (No. 25 of 1999).

### 1.3 National web-based sensitivity

The National Web-Based Environmental Screening Tool (Screening Tool) was used for informative purposes. The DFFE Screening Tool results, shown in Figure 2 below, rated the majority of the area as having Very High sensitivity for the aquatic biodiversity theme, this due to being within an Ecological Support Areas. A 0.6ha area also falls within a Critical Biodiversity Area (CBA).



Figure 2: DFFE screening tool sensitivity results for the Aquatic Biodiversity Theme

## 2 Terms of Reference

Based on the request by Power Construction the Wetland Assessment Report contains the following (minimum):

- Delineate the wetlands and or aquatic systems within 500m of the site according to relevant DWS guidelines.
- Provide the required watercourse and wetland buffers, where relevant.
- Determine ecological status of the receiving aquatic environment, including the identification of endangered or protected species. Determine the PES and REC of affected watercourses.
- Provide a concise description of the importance of the affected wetlands in terms of pattern and process, ecosystem goods and services, as appropriate.
- Identify potential impacts of the project on the aquatic environment and suggest suitable mitigation measures to address the identified impacts.
- The report must include the appropriate mapping.
- Prepare a sensitivity map (GIS-based), based on the findings of the study. All SHP files must be provided by the Specialist.

## 3 Knowledge Gaps

To obtain a comprehensive understanding of the dynamics of both the flora and fauna communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not always feasible and are thus mostly based on instantaneous sampling. This limitation is common to many impact assessment type studies, but the findings are deemed adequate for the purposes of decision-making support regarding project acceptability, unless otherwise stated.

Therefore, due to the scope of the work presented in this report, a long-term investigation of the proposed site was not possible and as such not perceived as part of the Terms of Reference. However, a concerted effort was made to assess as much of the potential site, as well as make use of any available literature, species distribution data and aerial photography (Table 1).

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

**Table 1: Utilised data and associated source relevant to the proposed project**

Data / Information	Source	Date	Type	Description
National Biodiversity Assessment	South African National Biodiversity Institute	2018	Report and Spatial	Latest assessment of South African biodiversity and ecosystems, including, vegetation types, wetlands and rivers.
Review of available data for a South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Water SA 44 (2) 184-199	van Deventer H., Smith-Adao, L. Petersen C., Mbona N., Skowno A., Nel, J.L.	2018	Report	Assessment of available spatial data regards aquatic ecosystems
Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.	Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S.	2011	Report	NFEPA
FrogMAP. 2019.	Animal Demography Unit. Accessed from <a href="http://frogmap.adu.org.za/?sp=400">http://frogmap.adu.org.za/?sp=400</a> ; on 2020-10-09	2024	Spatial databases	Frog distribution map
Freshwater Biodiversity Information System (FBIS)	<a href="https://freshwaterbiodiversity.org/">https://freshwaterbiodiversity.org/</a>	Accessed 2 June 2025	Spatial species locality database	A spatial data inventory on species observations, that includes various other sources such as FishBase INaturalist

## 4 Study Area

### 4.1 Climate

The region features a dry, Karoo climate with hot summers and cold winters, characterized by roughly 260mm of annual rainfall. Situated on the plains of the Camdeboo, it experiences significant diurnal temperature variations, with warm days (> 30°C in summer) often turning cold at night (3°C in winter), with rare snow on nearby mountains.

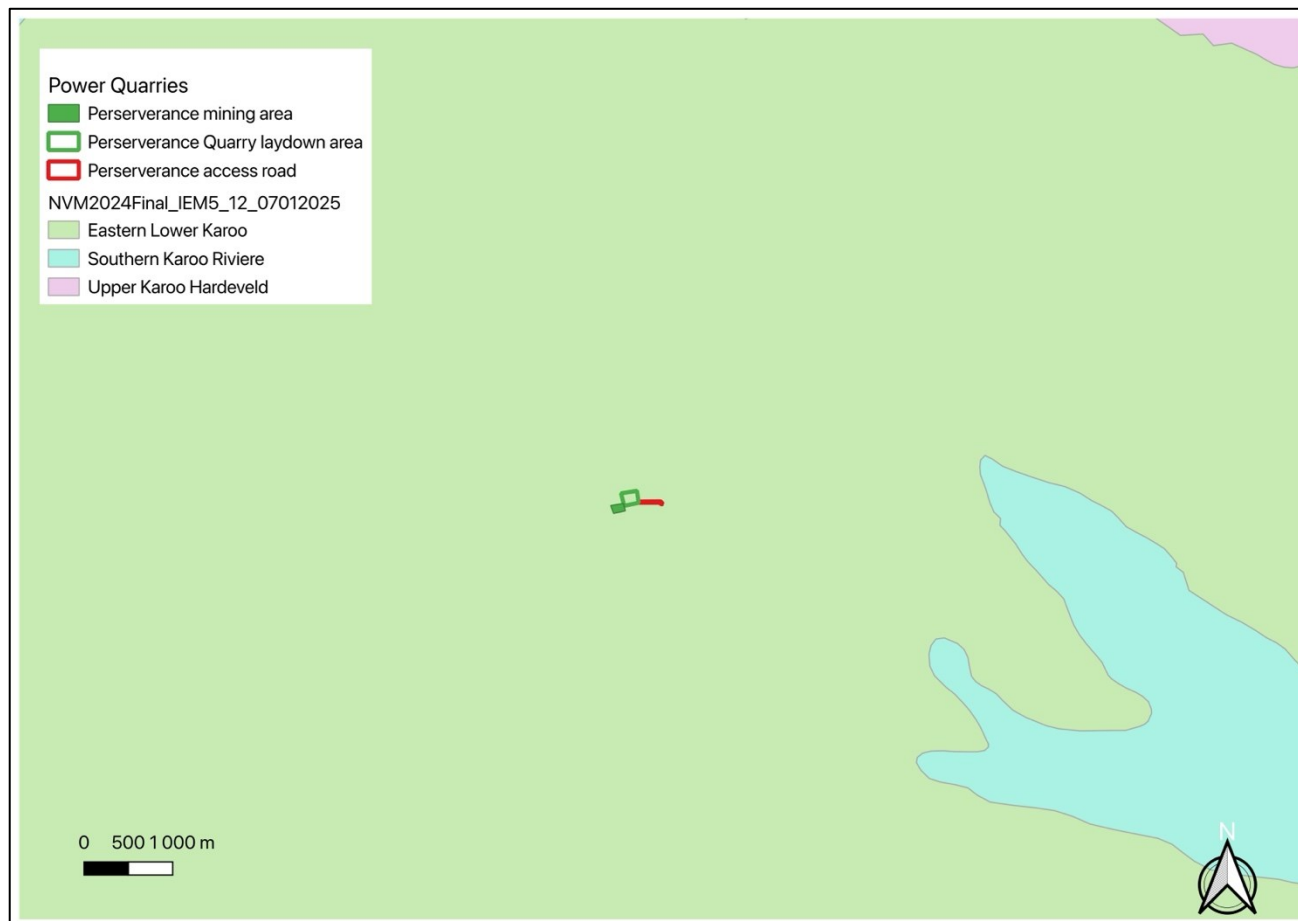
### 4.2 Geology

The geology is dominated by the sedimentary deposits of the Karoo Supergroup, which underlie the entire area. The site is therefore dominated by mudrock, and subordinate sandstones of this group associated with the Adelaide and Beaufort subgroups

According to the National Soil Classes database, the site is underlain by imperfectly drained soils, often shallow and often with a plinthic horizon. These soils may be seasonally wet. Soils have a marked clay accumulation, are strongly structured and a non-reddish colour.

### 4.3 Vegetation

According to the national vegetation type data, shown by VEGMAP (SANBI, 2025) in Figure 3, the site is located within the Eastern Lower Karoo (NKI 2) unit (Least Threatened). Mucina and Rutherford (2006), describe this vegetation unit as “Low shrubland with sparse, emergent tall shrubs and dominated by grasses in the undergrowth and scattered karroid shrubs.



**Figure 3: The VEGMAP 2024 vegetation units of the area (SANBI, 2025)**

### 4.4 Drainage network

The study area is situated within quaternary catchment N14A (Figure 4), in the Fish to Tsitsikamma Water Management Catchment Management Agency), specifically within the Tsitsikamma Sub-Water Management Area. The study area falls within the Great Karoo Ecoregion. The quarry is not located within any known Wetland Clusters or Strategic Water Resource Areas namely the Tsitsikamma Surface Water area (Le Maitre *et al.* 2018).

The proposed site is more than 240m from the edge of the riparian zone of the Kraai River, however the proposed areas are located within the 100m regulated zone of a small watercourse (Figure 5), which were considered Ecological Support Areas in the Eastern Cape Biodiversity Conservation Plan (ECBCP, 2019) (Figure 6), which were then used to described the area has having a Very High sensitivity in the DFFE Screening Tool report.

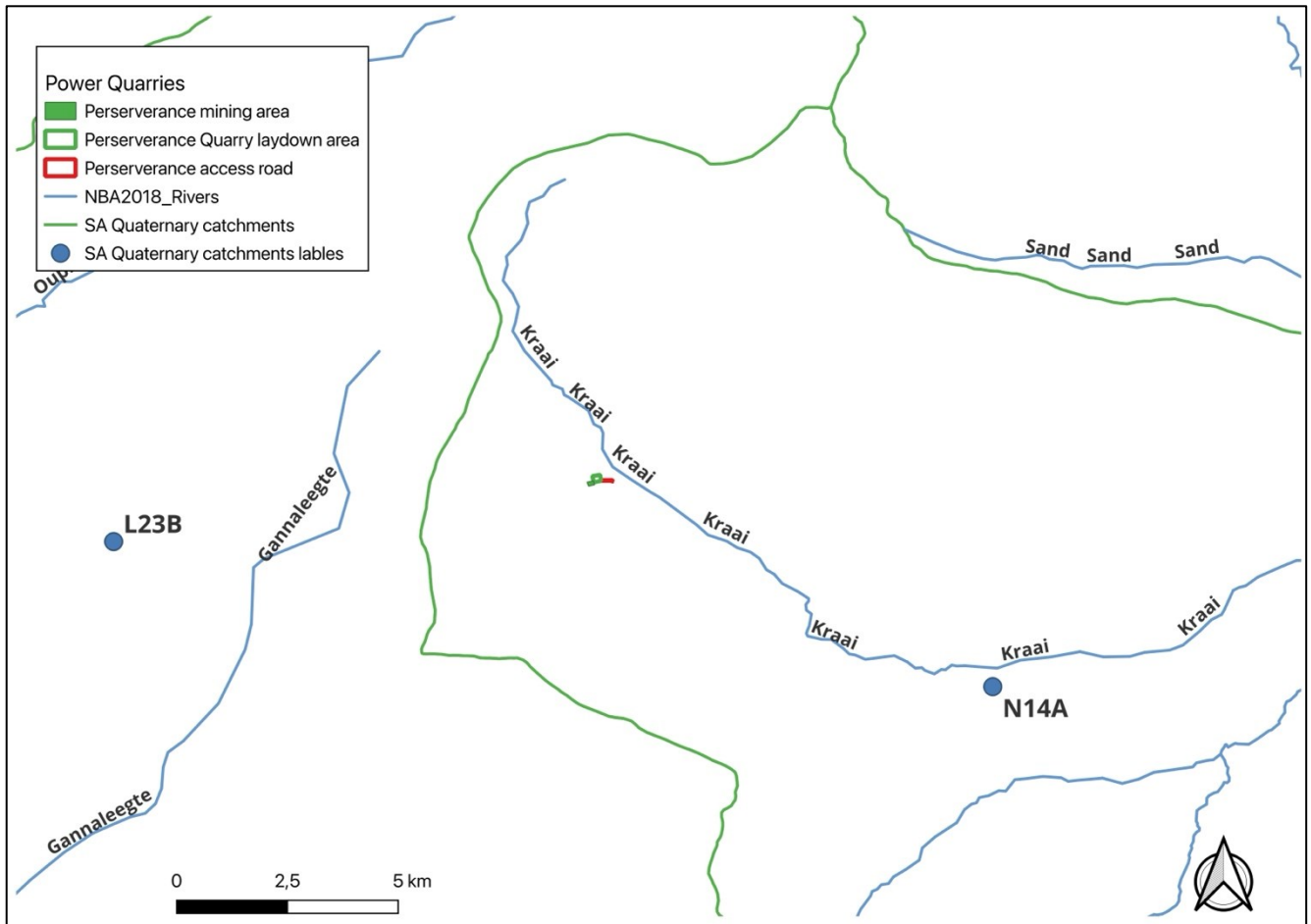


Figure 4: The site is located within N14A quaternary catchment

#### 4.5 South African Inventory of Inland Aquatic Ecosystems

The latest available river and wetland spatial datasets (Van Deventer *et al.* 2018) were used to identify the aquatic features likely to be present on site, on a desktop level, prior to groundtruthing and field delineation. The National Rivers Map and South African National Wetland Map 5 are GIS layers produced as part of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) during the National Biodiversity Assessment (SANBI 2025). Figure 5 shows the project sites in relation to the above-mentioned wetland and river inventories.

According to the National Wetland Map 5 (Van Deventer *et al.* 2018), there are no wetlands, artificial wetlands (dams) or several depressions within a 500m radius of the site. Further the site and its access were shown to not cross any form of watercourse either.

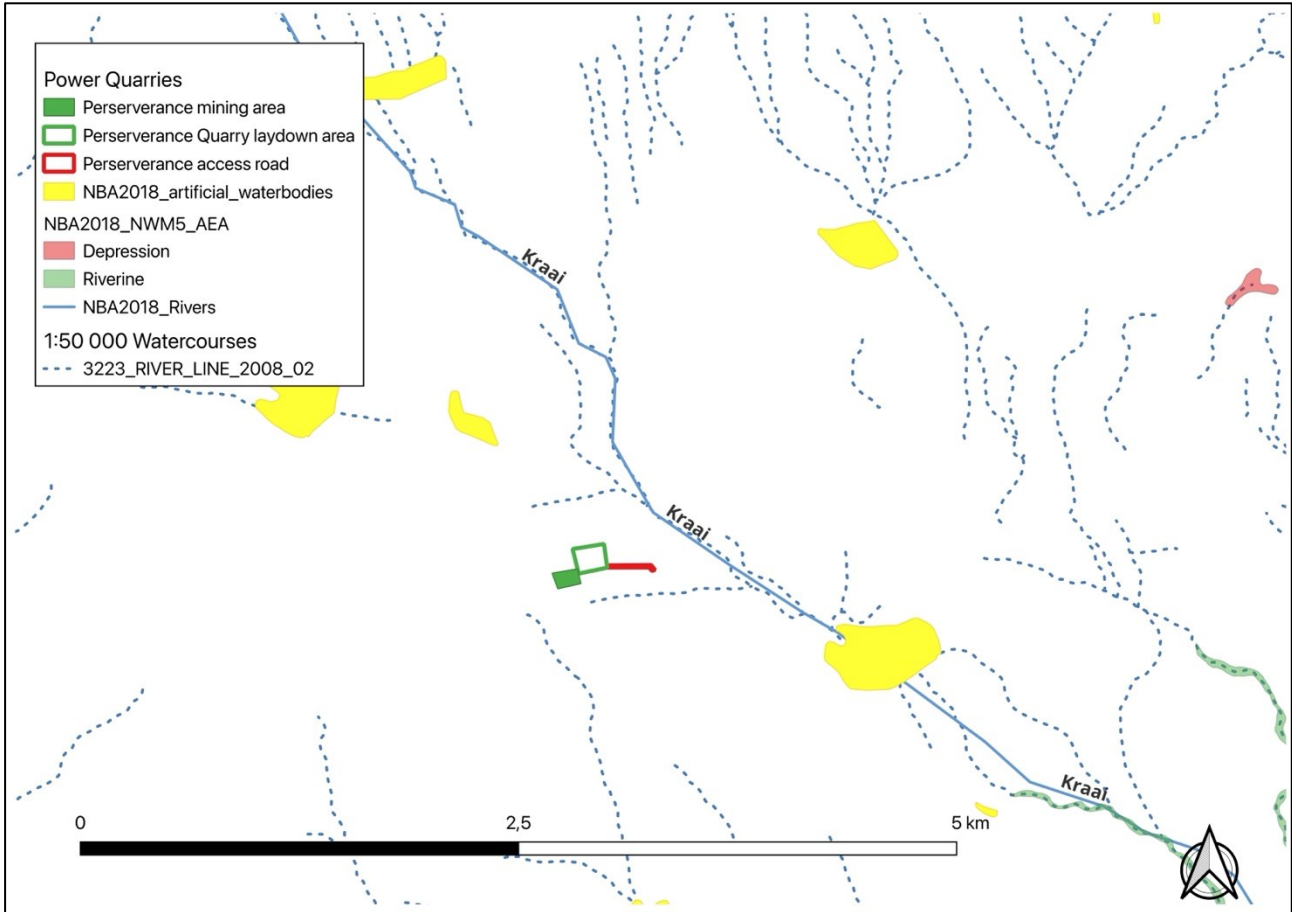
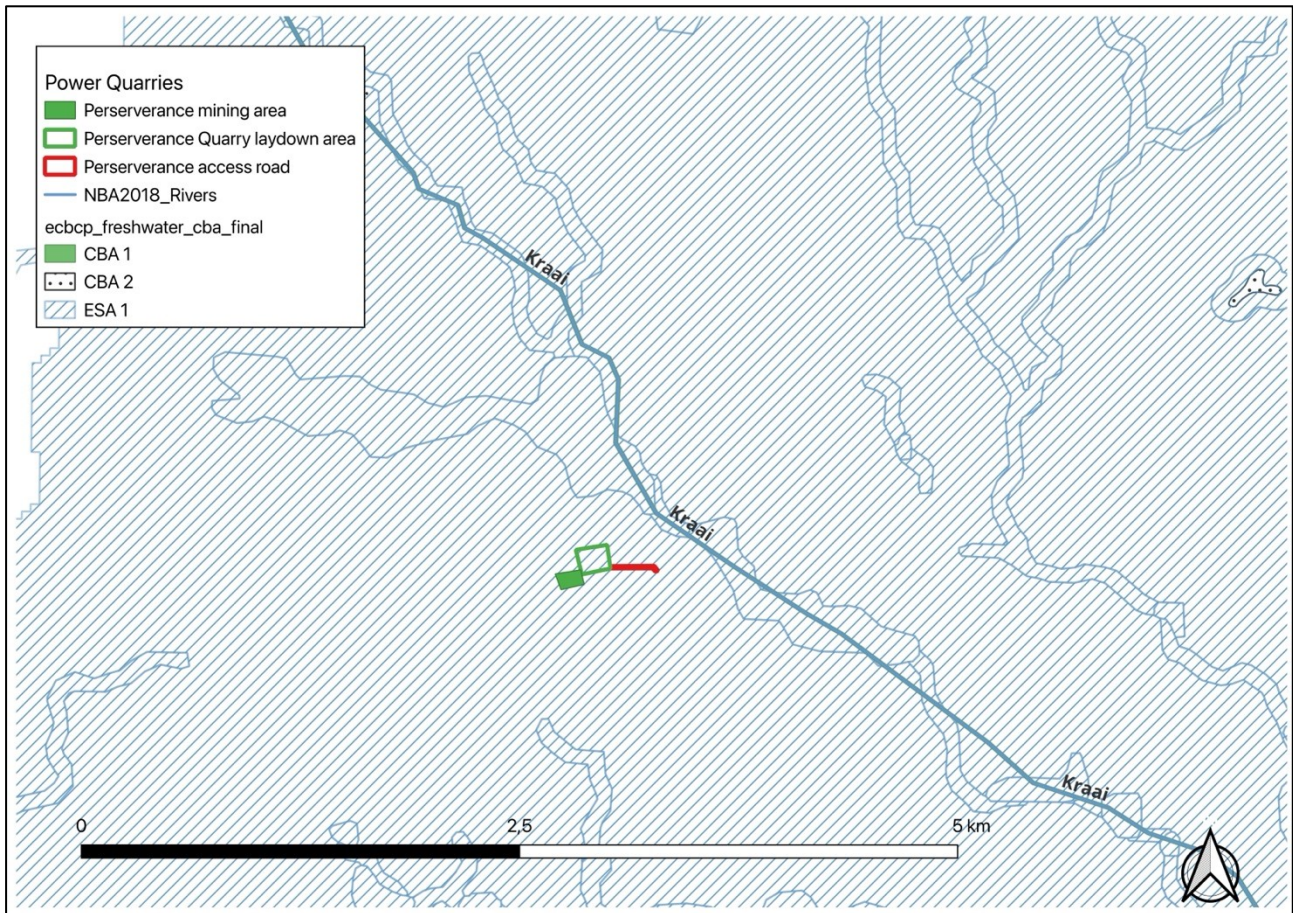


Figure 5: The site in relation to the national wetland and river inventories

4.6 Conservation context

The vegetation type is classified as Least Threatened. The latest Eastern Cape Biodiversity Conservation Plan (ECBCP) shown no aquatic Critical Biodiversity Area (CBA) within the study area (Desmet & Hawley 2019). (Figure 6). The quarry area is thus only located within Ecological Support Areas (ESA1).

No endemic or conservation worthy species (Listed or Protected) were observed or have been recorded within the during the time of the survey.



**Figure 6: The sites in relation to the ECBCP freshwater CBA map**

## 5 Expertise of the specialist

Dr Brian Michael Colloty is a SACNASP registered Ecologist & Environmental Assessment Practitioner (Pr. Sci. Nat. 400268/07). He is a member of South African Wetland Society and specialises in ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries. Specialist CV is attached in Appendix 1.

Brian has over 25 years' experience in environmental sensitivity and conservation assessment of aquatic and terrestrial systems inclusive of Index of Habitat Integrity (IHI), WET Tools, Riparian Vegetation Response Assessment Index (VEGRAI) for Reserve Determinations, estuarine and wetland delineation throughout Africa. He also has 15 years' experience in the coordination and management of multi-disciplinary teams, such as specialist teams for small to large scale EIAs and environmental monitoring programmes, throughout Africa and inclusive of marine, coastal and inland systems.

### TERTIARY EDUCATION

- 1994: B Sc Degree (Botany & Zoology) - NMU
- 1995: B Sc Hon (Zoology – Mammal behaviour) - NMU
- 1996: M Sc (Botany - Rivers) - NMU
- 2000: Ph D (Botany – Estuaries & Mangroves) – NMU

## 6 Aims and objectives

The aim of this report is to provide an assessment of the aquatic habitats and provide suitable mitigation to minimise potential impacts. The potential impacts associated with the mining activities were formally assessed, and where possible, means to avoid these are also provided (i.e., rehabilitation management recommendations based on aquatic considerations). This assessment is based on a site visit conducted in April 2026.

## 7 Methodology

This study followed the approaches of several national guidelines with regards to wetland assessment. These have been modified by the author, to provide a relevant mechanism of assessing the present state of the study area aquatic systems, applicable to the specific environment and, in a clear and objective manner, identify and assess the potential impacts associated with the proposed development site based on information collected within the relevant farm portions. See Appendix 2. For reference the following definitions are as follows:

**Drainage line:** A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.

**Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.

**Riparian:** the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

**Wetland:** land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al.*, 1979).

**Water course:** as per the National Water Act means -

- (a) a river or spring;
- (b) a natural channel in which water flows regularly or intermittently;
- (c) a wetland, lake or dam into which, or from which, water flows; and
- (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

### 7.1 Wetland identification and mapping

Terminology currently strives to characterise a wetland not only on its structure (visible form), but also to relate this to the function and value of any given wetland. The Ramsar Convention definition of a wetland is widely accepted as “*areas of marsh, fen, peatland or water, whether natural or*

*artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres”* (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications. The adapted definition for the NWCS is, therefore, as follows (Ollis *et al.*, 2013):

*WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.*

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as *“land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil.”* This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition

Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAf, 2005):

- A high-water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

## **7.2 Wetland delineation**

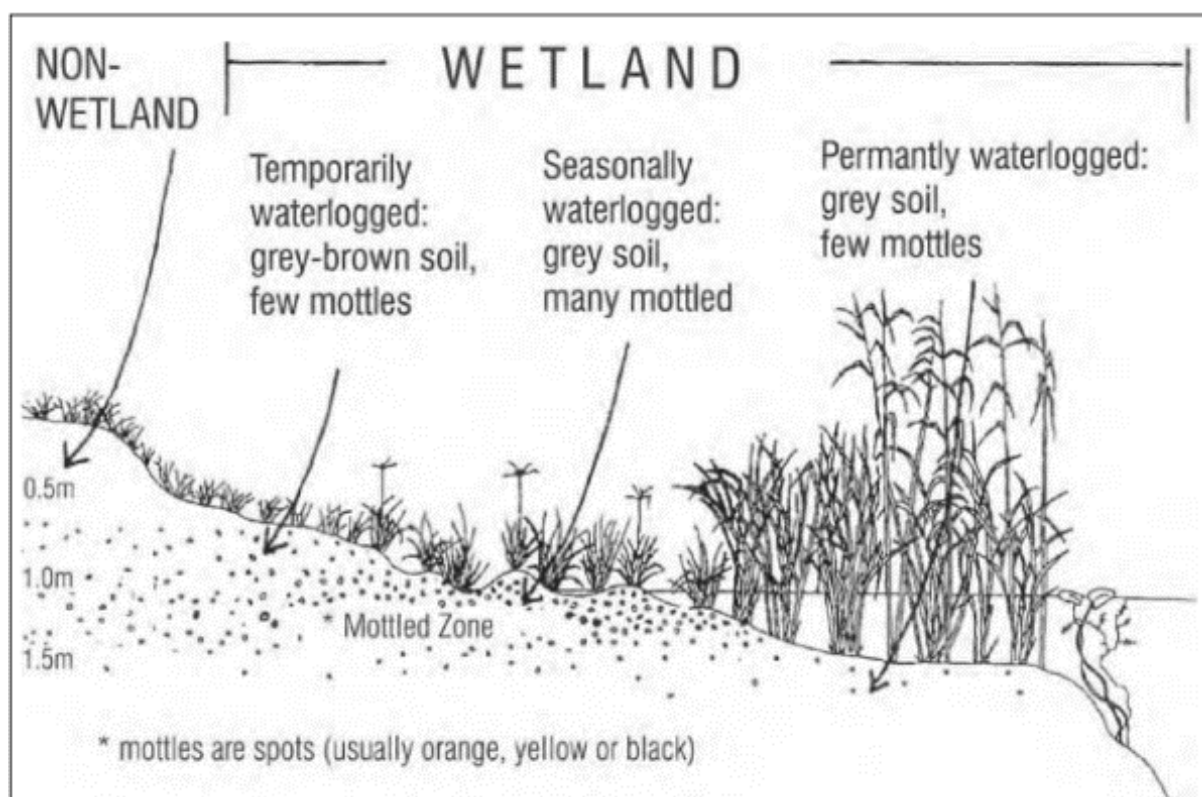
Wetland delineation includes the confirmation of the occurrence of wetland and a determination of the outermost edge of the wetland. The outer boundary of wetlands was identified and delineated according to the Department of Water Affairs wetland delineation manual ‘A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas’ (DWAf, 2005a).

Wetland indicators were used in the field delineation of the wetlands: position in landscape, vegetation and soil wetness (determined through soil sampling with a soil auger and the examining the degree of mottling). Figure 8 shows the different wetness and soil characteristics in a typical wetland.

Four specific wetland indicators were used in the detailed field delineation of wetlands, which include:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur.
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.

- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation.
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

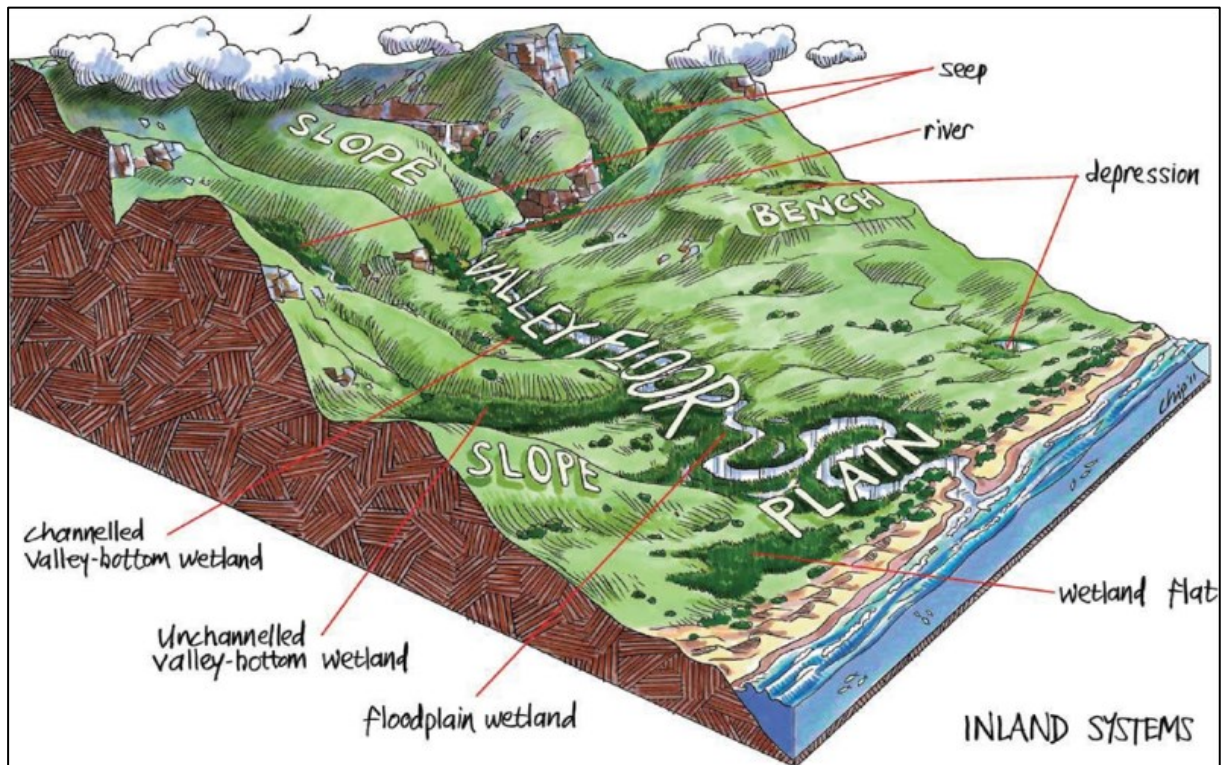


**Figure 2: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change as one moves along a gradient of decreasing wetness, from the middle to the edge of the wetland. Source: Donovan Kotze, University of KwaZulu-Natal.**

According to the wetland definition used in the National Water Act, vegetation is the primary indicator, which must be present under normal circumstances. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role. The reason is that vegetation responds relatively quickly to changes in soil moisture regime or management and may be transformed; whereas the morphological indicators in the soil are far more permanent and will hold the signs of frequent saturation long after a wetland has been drained (perhaps for several centuries).

### 7.3 Wetland functional assessment

In order to identify the wetland types, using Kotze *et al.* (2009) and Ollis *et al.* (2013), a characterisation of hydrogeomorphic (HGM) types was conducted. These have been defined based on the geomorphic setting of the wetland in the landscape (e.g. hillslope or valley bottom, whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated), how water flows through the wetland (diffusely or channelled) and how water exits the wetland (Figure 9).



**Figure 8: Illustration of wetland types and their typical landscape setting (From Ollie *et al.* 2013)**

The classification system of Ollis *et al.* (2013) uses hydrological and geomorphological traits to distinguish the primary wetland units, i.e. direct factors that influence wetland function. Other wetland assessment techniques, such as the DWAF (2005) delineation method, only infer wetland function based on abiotic and biotic descriptors (size, soils & vegetation) stemming from the Cowardin approach (Ollis *et al.*, 2013). The classification system is summarised below:

There is a six-tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 10 and 11). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular system has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale. This is opposed to specific attributes such as soils and vegetation.

**Level 2** has adopted the following systems:

- Inshore bioregions (marine)
- Biogeographic zones (estuaries)
- Ecoregions (Inland)

**Level 3** of the NWCS assess the topographical position of inland wetlands as this factor broadly defines certain hydrological characteristics of the inland systems. Four landscape units based on topographical position are used in distinguishing between Inland systems at this level. No subsystems are recognised for Marine systems, but estuaries are grouped according to their periodicity of connection with the marine environment, as this would affect the biotic characteristics of the estuary.

**Level 4** classifies the hydrogeomorphic (HGM) units discussed earlier. The HGM units are defined as follows:

- Landform – shape and localised setting of wetland
- Hydrological characteristics – nature of water movement into, through and out of the wetland
- Hydrodynamics – the direction and strength of flow through the wetland

These factors characterise the geomorphological processes within the wetland, such as erosion and deposition, as well as the biogeochemical processes.

**Level 5** of the assessment pertains to the classification of the tidal regime within the marine and estuarine environments, while the hydrological and inundation depth classes are determined for inland wetlands. Classes are based on frequency and depth of inundation, which are used to determine the functional unit of the wetlands and are considered secondary discriminators within the NWCS.

**Level 6** uses six descriptors to characterise the wetland types based on biophysical features. As with Level 5, these are non-hierarchical in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

- Geology;
- Natural vs. Artificial;
- Vegetation cover type;
- Substratum;
- Salinity; and
- Acidity or Alkalinity.

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, and these are thus nested in relation to each other. The HGM unit (Level 4) is the focal point of the system, with the upper levels (11– Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

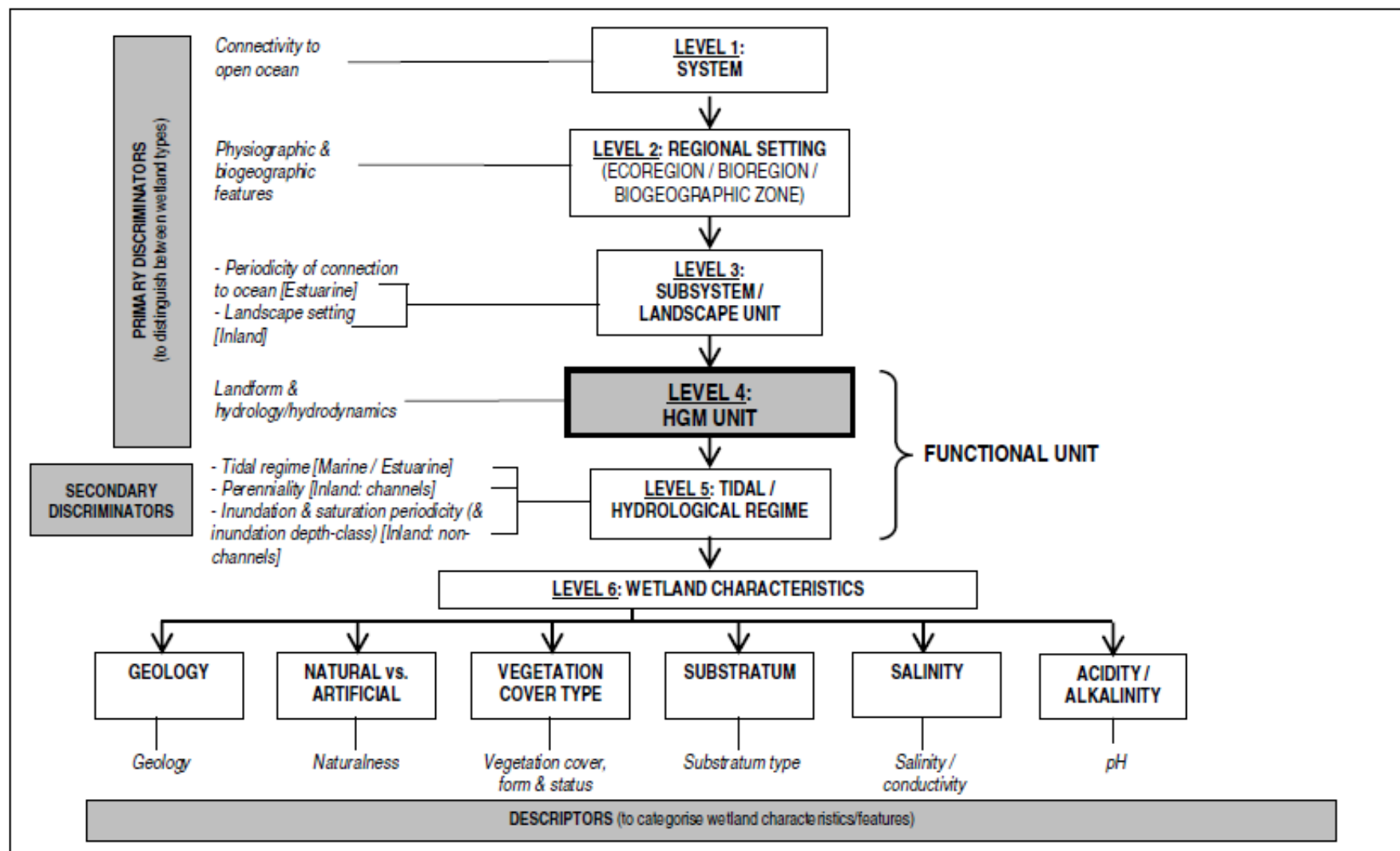


Figure 9: Basic structure of the NWCS, showing how ‘primary discriminators’ are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with ‘secondary discriminators’ applied at Level 5 to classify the tidal/hydrological regime, and ‘descriptors’ applied

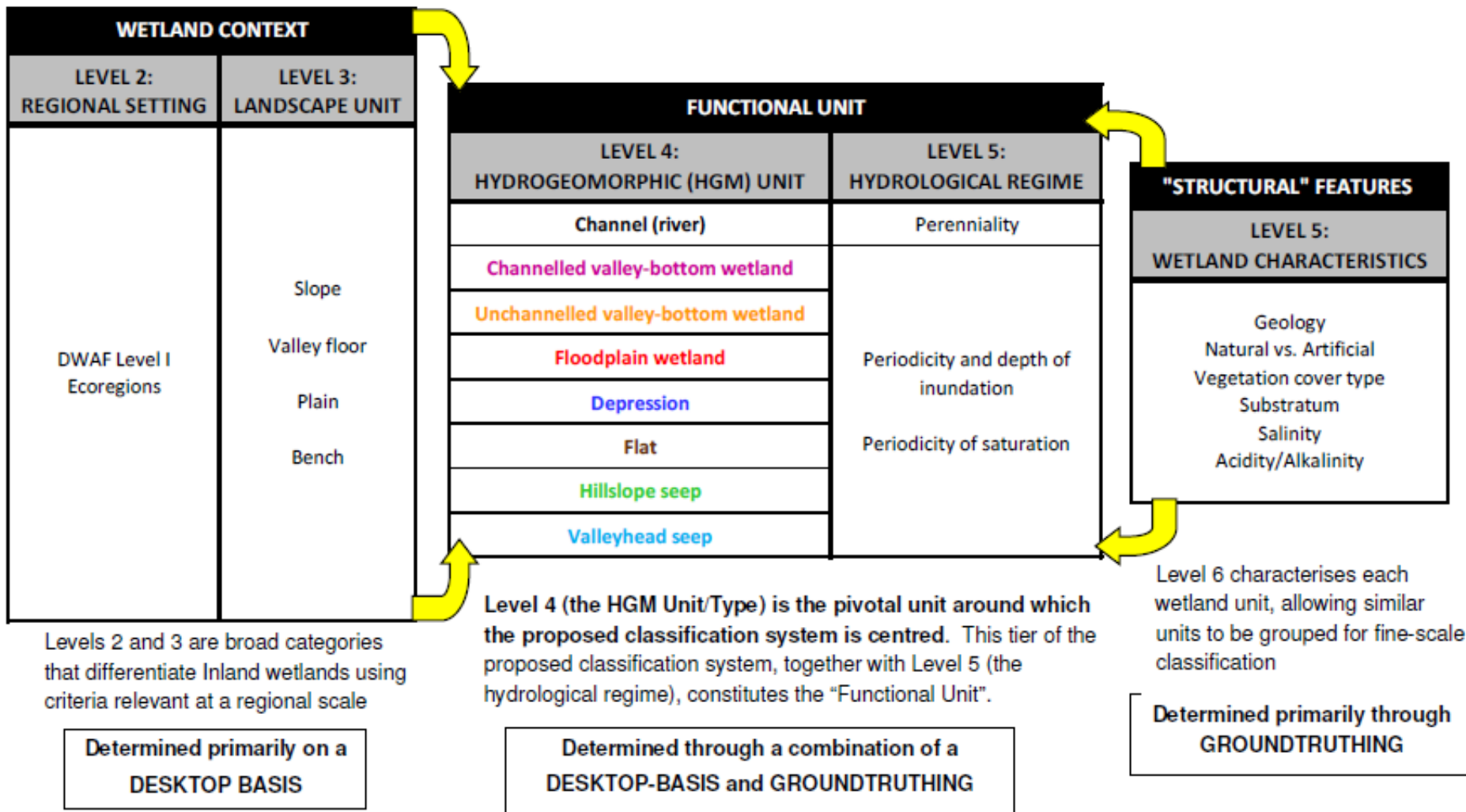


Figure 10: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis et al., 2013)

## 7.4 Determining the ecological integrity of wetlands

The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table 2)

**Table 2: Description of A – F ecological categories based on Kleynhans et al., (2005)**

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
<b>A</b>	Unmodified, natural.	Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
<b>B</b>	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	Some human-related disturbance, but mostly of low impact potential
<b>C</b>	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation
<b>D</b>	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
<b>E</b>	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality
<b>F</b>	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	

The WETLAND-IHI model is composed of four modules. The “Hydrology”, “Geomorphology” and “Water Quality” modules all assess the contemporary driving processes behind wetland formation and maintenance. The last module, “Vegetation Alteration”, provides an indication of the intensity of human land use activities on the wetland surface itself and how these may have modified the condition of the wetland. The integration of the scores from these 4 modules provides an overall PES score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a site visit.

Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment.

## 7.5 Determining the Present Ecological State of wetlands

WET-Health assists in assessing the health of wetlands using indicators based on geomorphology, hydrology and vegetation. WET-Health is a tool designed to assess the health or integrity of a wetland. Wetland health is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. This technique attempts to assess hydrological, geomorphological and vegetation health in three separate modules.

- **Hydrology** is defined in this context as the distribution and movement of water through a wetland and its soils. This module focuses on changes in water inputs as a result of changes in catchment activities and characteristics that affect water supply and its timing, as well as on modifications within the wetland that alter the water distribution and retention patterns within the wetland.
- **Geomorphology** is defined in this context as the distribution and retention patterns of sediment within the wetland. This module focuses on evaluating current geomorphic health through the presence of indicators of excessive sediment inputs and/or losses for clastic (minerogenic) and organic sediment (peat).
- **Vegetation** is defined in this context as the vegetation structural and compositional state. This module evaluates changes in vegetation composition and structure as a consequence of current and historic onsite transformation and/or disturbance.

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. The tool attempts to standardise the way that impacts are calculated and presented across each of the modules. This takes the form of assessing the spatial extent of impact of individual activities and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact.

Impact scores obtained for each of the modules reflect the degree of change from natural reference conditions. Resultant health scores fall into one of six health categories (A-F) on a gradient from "unmodified/natural" (Category A) to "severe/complete deviation from natural" (Category F) as depicted in Table 3, below. This classification is consistent with DWAF categories used to evaluate the present ecological state of aquatic systems.

An overall wetland health score was calculated by weighting the scores obtained for each module and combining them to give an overall combined score using the following formula:

$$\text{Overall health rating} = \frac{[(\text{Hydrology} * 3) + (\text{Geomorphology} * 2) + (\text{Vegetation} * 2)]}{7}$$

This overall score assists in providing an overall indication of wetland health/functionality which can in turn be used for recommending appropriate management measures.

**Table 3: Health categories used by WET-Health for describing the integrity of wetlands (after Macfarlane et al., 2008).**

IMPACT CATEGORY	DESCRIPTION	RANGE	PES
<b>None</b>	Unmodified, natural.	0 – 0.9	<b>A</b>
<b>Small</b>	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1 – 1.9	<b>B</b>
<b>Moderate</b>	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2 – 3.9	<b>C</b>
<b>Large</b>	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4 – 5.9	<b>D</b>
<b>Serious</b>	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9	<b>E</b>
<b>Critical</b>	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 – 10	<b>F</b>

## 7.6 Determining the Ecological Importance and Sensitivity of wetlands

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. Wetland conservation is now driven by the South African National Biodiversity Institute, a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).

Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However, wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel et al., 2004).

The most common attributes or goods and services provided by wetlands include:

- Improve water quality;
- Impede flow and reduce the occurrence of floods;
- Reeds and sedges used in construction and traditional crafts;
- Bulbs and tubers, a source of food and natural medicine;
- Store water and maintain base flow of rivers;
- Trap sediments; and
- Reduce the number of water-borne diseases.

In terms of this study, the wetlands provide ecological (environmental) value to the area acting as refugia for various wetland associated plants, butterflies and birds. In the past wetland conservation has focused on biodiversity as a means of substantiating the protection of wetland habitat. However not all wetlands provide such motivation for their protection, thus wetland managers and conservationists began assessing the importance of wetland function within an ecosystem.

WET-EcoServices is used to assess the goods and services that individual wetlands provide, thereby aiding informed planning and decision making. It is designed for a class of wetlands known as

palustrine wetlands (i.e. marshes, floodplains, vleis or seeps). The tool provides guidelines for scoring the importance of a wetland in delivering each of 15 different ecosystem services (including flood attenuation, sediment trapping and provision of livestock grazing). The first step is to characterise wetlands according to their hydro-geomorphic setting (e.g. floodplain). Ecosystem service delivery is then assessed either at Level 1, based on existing knowledge or at Level 2, based on a field assessment of key descriptors (e.g. flow pattern through the wetland).

The overall goal of WET-EcoServices is to assist decision makers, government officials, planners, consultants and educators in undertaking quick assessments of wetlands, specifically in order to reveal the ecosystem services that they supply. This allows for more informed planning and decision making.

Table 4, below summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al.*, 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

**Table 4: Summary of direct and indirect ecoservices provided by wetlands from Kotze et al., 2008**

<b>Ecosystem services supplied by wetlands</b>	<b>Indirect benefits</b>	<b>Hydro-geochemical benefits</b>	Flood attenuation		
			Stream flow regulation		
			<b>Water quality enhancement benefits</b>	Sediment trapping	
				Phosphate assimilation	
				Nitrate assimilation	
				Toxicant assimilation	
				Erosion control	
	Carbon storage				
	<b>Direct benefits</b>	Biodiversity maintenance			
		<i>Provision of water for human use</i>			
		<i>Provision of harvestable resources<sup>2</sup></i>			
		<i>Provision of cultivated foods</i>			
		<i>Cultural significance</i>			
		<i>Tourism and recreation</i>			
	<i>Education and research</i>				

Conservation importance of the individual wetlands was based on the following criteria:

Habitat uniqueness;

Species of conservation concern;

Habitat fragmentation or rather, continuity or intactness with regards to ecological corridors; and

Ecosystem service (social and ecological).

## 7.7 Ecological classification and description

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of Conservation Concern (SCC) was observed, in which case it would receive a HIGH rating. Any system that was highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied. Natural wetlands or Wetlands that resemble some form of the past landscape but receive a LOW conservation importance rating could be included into stormwater management features and should not be developed to retain the function of any ecological corridors.

## 8 Results

### 8.1 Aquatic delineation

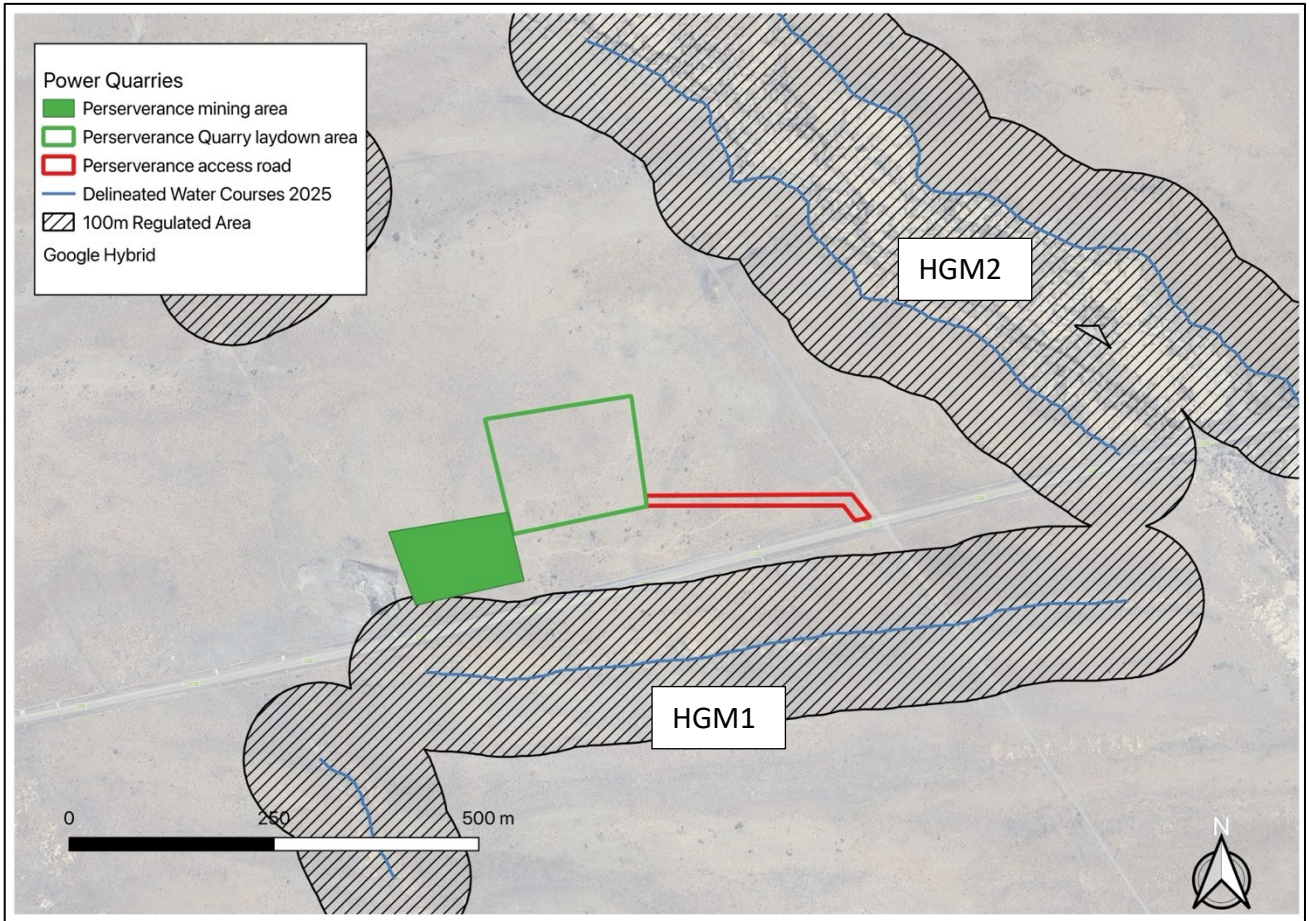
Following the contextualisation of the study area with the available desktop data, and the site visit conducted), to groundtruth the findings and delineate the aquatic habitat and map the associated 100m Regulated Area. Subsequent screening provided an indication of which of these systems may potentially be impacted upon by the project. There are a number of factors which influence the level of impact, such as type of system, position of the system in relation to the project and position where the system is located in the landscape.

### 8.2 Aquatic unit identification

In order to identify the wetland/river types, using Kotze *et al.* (2009) and Ollis *et al.* (2013), a characterisation of hydrogeomorphic (HGM) types was conducted. For reference purposes, the HGM units was named HGM1 & HGM2, both classified as riverine watercourses and not considered to be wetlands.

Water inputs are naturally dominated by surface sheet flow from the upstream catchment, which flows downstream, with small areas remaining inundated for very short periods.

Plate 1 & 2 is a photograph showing the identified rivers (small drainage feature and riparian dominated Kraai River). Figure 11 shows the site in relation to the observed systems and the 100m regulated area.



**Figure 11: The aquatic features present within the study area**



**Plate 1: Downstream view of HGM1 - minor watercourse below the proposed site after rains**



**Plate 2: Upstream view of the Kraai River, dominated by *Vachellia karroo* riparian areas, and alluvial fan deposits**

### 8.3 Aquatic unit setting

The units were screened according to their proximity to the disturbance and their landscape setting. During screening assessment, it was determined that the watercourses near the sites, namely HGM1, was the only feature located within 1500m of the proposed mining areas (Figure 11), but the proposed activities due to the presence of the R61 road, had no direct connection with this systems.

Refer to Table 5 for screening assessment results.

**Table 5: Summary of screening assessment**

Unit	Type	Impacted by the project and/or requires further assessment?	Reason
HGM1	Riverine	Yes – 100m regulated area	Quarry is however isolated from catchment of system
HGM2	Riverine	No	No activities are located within this system or its regulated area

### 8.4 Wetland soils

None were taken due to the lack of wetlands

## **8.5 Description of aquatic types**

All of the identified watercourses can be classified as ephemeral systems. Water inputs are naturally dominated by surface sheet flow from the upstream catchment, but with no obligate instream, emergent of facultative aquatic plants and species observed.

## **8.6 General functional description of aquatic types**

The hydrology of the area appears to include surface sheet-flow (likely linked to rainfall and interflow contributions) in a southerly direction, collecting in areas where ponding occurs. Disturbances, such as roads, dams and soil cultivation have altered/ blocked the sheet-flow in areas.

The watercourses are normally expected to contribute to:

- some surface flow attenuation early in the season until the soils are saturated, after which their contribution to flood attenuation is likely to be limited.
- several water quality enhancement benefits, for example, removing excess nutrients and inorganic pollutants produced by agriculture is limited.

## **8.7 Aquatic ecological functional assessment**

No endemic or conservation worthy species (Listed or Protected) were observed or have been recorded within the site.

## **8.8 The ecological health assessment of the project area**

The PES of a river, watercourse or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The updated PES system also incorporates Ecological Importance (EI) and Ecological Sensitivity (ES) separately as opposed to Ecological Importance and Sensitivity (EIS) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the parameters are assessed or the overall PES is rated between a C or D.

## 8.9 The PES assessment

Using the VEGRAI, the vegetation component scored the natural habitat, noting the impact of the R61 road has had on the system, hence the overall PES would have been D (Largely modified) for the but still retained some form of natural function (Table 6). Noting this was rated similarly by DWS (2014) – PES = D for the entire Kraai Subcatchment.

**Table 6: VEGRAI Level 3 rating results**

LEVEL 3 ASSESSMENT					
METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	% WEIGHT
MARGINAL	63,3	37,3	2,0	1,0	100,0
NON MARGINAL	46,7	19,2	2,0	2,0	70,0
	2,0				170,0
LEVEL 3 VEGRAI (%)				56,5	
<b>VEGRAI EC</b>				<b>D</b>	
AVERAGE CONFIDENCE				2,0	

## 8.10 The EIS assessment

The DWS (2014) rated the system as having a Moderate /Medium EIS which was supported by infield observations – due to the lack of any obligate aquatic species and or habitats.

## 9 Impact assessment discussions

During this assessment, it became evident that several watercourses, mostly ephemeral alluvial channels some with riparian vegetation were well away from the proposed activities, only the aquatic 100m regulated area of one minor drainage line being affected. Therefore, it is anticipated with suitable mitigation, such as suitable stormwater management as a minimum, no direct impacts on these systems would occur. The only potential impact was related to hydrological changes

### 9.1 Loss of aquatic units, and or habitats

None.

### 9.2 Changes to the surface water hydrology

The significance of an impact to the environment or ecosystem can only be assessed in terms of the change to ecosystem services, resources and biodiversity value associated with that system or component being assessed. The impact significance upon aquatic biodiversity for the project was determined as Low after mitigation, due to the fact that these will be completely avoided and no direct physical impacts are anticipated.

However there is the potential for changes to surface alterations that could indirectly affect the interflow of water that may affect the hydrological conditions of these systems. The cumulative impact in this regard then also needs to be addressed, due to all the present and future activities that will take place related to future farming practices and the construction of wind farms.

Refer to Tables 7 and 8 for the results of impact assessment

**Table 7: Hydrological changes due to mining activities**

Impact Phase: Operation					
<b>Nature of the impact:</b> – Disturbance/ loss of aquatic habitats due to diversion of surface water flow and or groundwater impendence (accumulation of groundwater seepage in the open void, especially after mining has been completed).					
<b>Description of Impact:</b> – The changes in the quantity, timing and distribution of water inputs and flows within the systems can result in possible deterioration in freshwater ecosystem integrity, reduction/loss of habitat for aquatic dependent flora and fauna, and a reduction in the supply of ecosystem goods & services. Although due to the scale of mining operations and the types of affected systems this is unlikely.					
Impact Status: Negative					
	E	D	R	M	P
Without Mitigation	Regional	Permanent	Recoverable	Moderate	Probable
Score	3	5	3	3	3
With Mitigation	Site	Permanent	Reversible	Low	Low Probability
Score	1	5	1	2	2

Significance Calculation	Without Mitigation	With Mitigation
$S=(E+D+R+M)*P$	Medium Impact (42)	Low Impact (18)
Mitigation measures: <ul style="list-style-type: none"> <li>It is recommended that any surface and or groundwater inflow into the voids be discharged safely via a stormwater pond / swales to allow for the continuation of hydrological connectivity within the surrounding environment. The discharge must be monitored for high silt and hydrocarbon loads, and the ponds/swales must allow for some form of passive treatment</li> </ul>		
Residual impact	No residual impact - with adoption of mitigation measures and monitoring	

**Table 8: Cumulative impact upon aquatic biodiversity**

<b>Cumulative Impact:</b> Cumulative impacts on the aquatic resources of the area					
<b>Description of Cumulative Impact:</b> Increased impedance and or diversion of surface / groundwater flows will cumulatively impact aquatic habitat. This, and the expansion of cultivated lands, may potentially accelerate the rate of wetland degradation and loss in the area.					
<b>Impact Status:</b> Negative					
	E	D	R	M	P
<b>Without Enhancement</b>	Regional	Permanent	Recoverable	High	Probable
<b>Score</b>	3	5	3	4	3
<b>With Enhancement</b>	Local	Long Term	Reversible	Low	Low Probability
<b>Score</b>	2	4	1	2	2
Significance Calculation	Without Enhancement		With Enhancement		
$S=(E+D+R+M)*P$	Medium Impact (45)		Low Impact (18)		
Mitigation measures to reduce residual risk or enhance opportunities: <ul style="list-style-type: none"> <li>It is recommended that any surface and or groundwater inflow into the voids be discharged safely via a stormwater pond / swales to allow for the continuation of hydrological connectivity within the surrounding environment. The discharge must be monitored for high silt and hydrocarbon loads, and the ponds/swales must allow for some form of passive treatment</li> </ul>					
Residual impact	Low				

### 9.3 Aquatic buffer zone

An aquatic impact buffer zone is defined as a zone of vegetated land designed and managed so that sediment and pollutant transport carried from source areas via diffuse surface runoff is reduced to acceptable levels (Macfarlane and Bredin 2016). Aquatic buffer zones are designed to act as barriers between human activities and sensitive water resources in order to protect them from adverse negative impacts. Buffer zones associated with water resources have been shown to perform a wide

range of functions and have therefore been adopted as a standard measure to protect water resources and associated biodiversity.

Currently there are no formalised riverine or wetland buffer distances provided by the provincial authorities and as such the buffer model as described Macfarlane & Bredin (2017) for wetlands, rivers and estuaries was used. These buffer models are based on the condition of the waterbody, the state of the remainder of the site, coupled to the type of activity, as well as the proposed alteration of hydrological flows.

Based then on the information known for the site, the buffer model recommends a 95m buffer zone between the site and watercourses but this is less than the 100m regulated area (Figure 11).

## 10 Conclusions and Recommendations

During this assessment, it became evident that several watercourses, mostly ephemeral alluvial channels with riparian vegetation were in close proximity to proposed activities, with most of the proposed areas (access and mining) well outside the aquatic features but within the 100m regulated area.

It is anticipated with suitable mitigation, such as suitable stormwater management as a minimum, a GA could be followed and the author has no objection to the authorisation of this project.

## 11 References

- Agricultural Resources Act, 1983 (Act No. 43 of 1983).
- Davies, B. and Day J., (1998). *Vanishing Waters*. University of Cape Town Press.
- Department of Water Affairs and Forestry - DWAF (2005). *A practical field procedure for identification and delineation of wetland and riparian areas Edition 1*. Department of Water Affairs and Forestry, Pretoria.
- Department of Water Affairs and Forestry - DWAF (2008). *Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types* by M. Rountree (ed); C.P. Todd, C. J. Kleynhans, A. L. Batchelor, M. D. Louw, D. Kotze, D. Walters, S. Schroeder, P. Illgner, M. Uys. and G.C. Marneweck. Report no. N/0000/00/WEI/0407. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.
- Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012. *National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems*. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.
- Ewart-Smith J.L., Ollis D.J., Day J.A. and Malan H.L. (2006). *National Wetland Inventory: Development of a Wetland Classification System for South Africa*. WRC Report No. KV 174/06. Water Research Commission, Pretoria.
- GEOSS (2021). *Extended Aquifer test at Zwartbos Farm, Humansdorp, Eastern Cape*. Report No: 2021/08-01.
- Kleynhans C.J., Thirion C. and Moolman J. (2005). *A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland*. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria.
- Kotze D.C., Marneweck G.C., Batchelor A.L., Lindley D.S. and Collins N. (2008). *WET-EcoServices A technique for rapidly assessing ecosystem services supplied by wetlands*. WRC Report No: TT 339/08.
- Kotze D, Macfarlane D, Edwards R, Mander M, Collins N, Texeira-Leite A, Lagesse J, Pringle C, Marneweck G, Batchelor A And Lindley D (2020) *WET-EcoServices Version 2.0: A technique for rapidly assessing ecosystem services supplied by wetlands and riparian areas*. WRC Report No. TT 833/20. Water Research Commission, Pretoria, South Africa.
- Le Maitre, D.C., Seyler, H., Holland, M., Smith-Adao, L., Nel, J.L., Maherry, A. And Witthüser, K. (2018) *Identification, Delineation and Importance of the Strategic Water Source Areas of South Africa, Lesotho and Swaziland for Surface Water and Groundwater*. Report No. TT 743/1/18, Water Research Commission, Pretoria.
- Macfarlane, D.M. & Bredin, I.P. 2017. *Buffer Zone Guidelines for Rivers, Wetlands and Estuaries*. WRC Report No TT 715/1/17 Water Research Commission, Pretoria.
- Macfarlane, D.M., Ollis, D.J., Kotze, D.C. 2020. *WET-Health (Version 2) Technical Guide*. Report to the Water Research Commission. WRC Project No. K5/2549).
- Mitsch, J.G. and Gosselink, G. (2000). *Wetlands 3<sup>rd</sup> Ed*, Wiley, NewYork, 2000, 920 pg.
- Mucina, L., & Rutherford, M.C., 2006. *The Vegetation of South Africa, Lesotho and Swaziland*, Strelitzia 19, South Africa.
- National Water Act, 1998 (Act No. 36 of 1998), as amended
- Nel, J., Maree, G., Roux, D., Moolman, J., Kleynhans, N., Silberbauer, M. and Driver, A. 2004. *South African National Spatial Biodiversity Assessment 2004: Technical Report*. Volume 2: River

Component. CSIR Report Number ENV-S-I-2004-063. Council for Scientific and Industrial Research, Stellenbosch.

- Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.
- Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.
- Parsons R. (2004). Surface Water – Groundwater Interaction in a Southern African Context. WRC Report TT 218/03, Pretoria.
- Ramsar Convention, (1971) including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000).
- van Deventer H., Smith-Adao, L. Petersen C., Mbona N., Skowno A., Nel, J.L. (2018) Review of available data for a South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Water SA 44 (2) 184-199.

## 12 Appendix 1 CV

### CURRICULUM VITAE

**Dr Brian Michael Colloty**

**7212215031083**

1 Rossini Rd

Pari Park

Gqeberha, 6070

brianc@envirosci.co.za

083 498 3299

Profession: Ecologist & Environmental Assessment Practitioner (Pr. Sci. Nat. 400268/07)

Member of the South African Wetland Society

Specialisation: Ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries

Years experience: 30 years

### SKILLS BASE AND CORE COMPETENCIES

- 30 years experience in environmental sensitivity and conservation assessment of aquatic and terrestrial systems inclusive of Index of Habitat Integrity (IHI), WET Tools, Riparian Vegetation Response Assessment Index (VEGRAI) for Reserve Determinations, estuarine and wetland delineation throughout Africa. Experience also includes biodiversity and ecological assessments with regard sensitive fauna and flora, within the marine, coastal and inland environments. Countries include Mozambique, Kenya, Namibia, Central African Republic, Zambia, Eritrea, Mauritius, Madagascar, Angola, Ghana, Guinea-Bissau and Sierra Leone. Current projects also span all nine provinces in South Africa.
- 15 years experience in the coordination and management of multi-disciplinary teams, such as specialist teams for small to large scale EIAs and environmental monitoring programmes, throughout Africa and inclusive of marine, coastal and inland systems. This includes project and budget management, specialist team management, client and stakeholder engagement and project reporting.
- GIS mapping and sensitivity analysis

### TERTIARY EDUCATION

- 1994: B Sc Degree (Botany & Zoology) - NMU
- 1995: B Sc Hon (Zoology) - NMU
- 1996: M Sc (Botany - Rivers) - NMU
- 2000: Ph D (Botany – Estuaries & Mangroves) – NMU

### EMPLOYMENT HISTORY

- 1996 – 2000 Researcher at Nelson Mandela University – SAB institute for Coastal Research & Management. Funded by the WRC to develop estuarine importance rating methods for South African Estuaries
- 2001 – January 2003 Training development officer AVK SA (reason for leaving – sought work back in the environmental field rather than engineering sector)
- February 2003- June 2005 Project manager & Ecologist for Strategic Environmental Focus (Pretoria) – (reason for leaving – sought work related more to experience in the coastal environment)

- July 2005 – June 2009 Principal Environmental Consultant Coastal & Environmental Services (reason for leaving – company restructuring)
- June 2009 – August 2018 Owner / Ecologist of Scherman Colloty & Associates cc
- August 2018 Owner / Ecologist - EnviroSci (Pty) Ltd

## **SELECTED RELEVANT PROJECT EXPERIENCE**

### **World Bank IFC Standards**

- Botswana South Africa 400kv transmission line (400km) biodiversity assessment on behalf of Aurecon - current
- Farim phosphate mine and port development, Guinea Bissau – biodiversity and estuarine assessment on behalf of Knight Piesold Canada – 2016.
- Tema LNG offshore pipeline EIA – marine and estuarine assessment for Quantum Power (2015).
- Colluli Potash South Boulder, Eritrea, SEIA marine baseline and hydrodynamic surveys co-ordinator and coastal vegetation specialist (coastal lagoon and marine) (on-going).
- Wetland, estuarine and riverine assessment for Addax Biofuels Sierra Leone, Makeni for Coastal & Environmental Services: 2009
- ESHIA Project manager and long-term marine monitoring phase coordinator with regards the dredge works required in Luanda bay, Angola. Monitoring included water quality and biological changes in the bay and at the offshore disposal outfall site, 2005-2011

### **South Africa**

- Plant and animal search and rescue for the Dassiesridge Wind Farm on behalf of EDF Current
- Plant and animal search and rescue for the Karusa and Soetwater Wind Farms on behalf of Enel Green Power, 2021
- Plant and animal search and rescue for the Nxuba, Oyster Bay and Garob Wind Farms on behalf of Enel Green Power, 2018 - 2019
- Plant and Animal Search and Rescue for the Port of Ngqura, Transnet Landside infrastructure Project, with development and management of on site nursery, Current
- Plant and Animal Search and Rescue for the Port of Ngqura, OTGC Tank Farm Project (2019)
- Plant search and rescue, for NMBM (Driftsands sewer, Glen Hurd Drive), Department of Social Development (Military veterans housing, Despatch) and Nxuba Wind Farm, - current
- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.
- CDC IDZ Alien eradication plans for three renewable projects Coega Wind Farm, Sonop Wind Farm and Coega PV, on behalf of JG Afrika (2016 – 2017).
- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Rangers Biomass Gasification Project (Uitenhage), biodiversity and wetland assessment and wetland rehabilitation / monitoring plans for CEM IEM Unit – 2017
- Gibson Bay Wind Farm implementation of the wetland management plan during the construction and operation of the wind farm (includes surface / groundwater as well wetland rehabilitation & monitoring plan) on behalf of Enel Green Power - 2018
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.
- Tsitsikamma Community Wind Farm implementation of the wetland management plan during

the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.

- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Mogalakwena 33kv transmission line in the Limpopo Province, on behalf of Aurecon, 2016
- Cape St Francis WWTW expansion wetland and passive treatment system for the Kouga Municipality, 2015
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan 2015
- Eskom Prieska to Copperton 132kv transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Pola park bulk sewer line upgrade aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay
- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the PE to George, George to Graaf Reinet, PE to Colesburg, and East London to Bloemfontein on behalf of SRK (2013-2015).