

# **Khoe Wind Farm**

## **AQUATIC IMPACT ASSESSMENT REPORT**

**FOR**

**Fe Hugo & Khoe (Pty) Ltd**

**BY**



**EnviroSci (Pty) Ltd**

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**DATE**

5 December 2023

**REVISION 1**

## EXECUTIVE SUMMARY

Fe Hugo & Khoe (Pty) Ltd appointed EnviroSci (Pty) Ltd to conduct an aquatic assessment report for the proposed Khoe Wind Energy Facility project, located ca. 25-km southeast of De Doorns, and 30-km north-west of Montagu in the Cape Fold mountains of the Western Cape. This included an assessment of the site during a visit conducted, early summer on the 26-27 November 2023. Based then on the sensitivity mapping provided to the client, a layout will be developed and thus a preliminary impact assessment is included in this report.

It is proposed to develop a wind energy generation facility, of up to 290 MW in capacity, and associated infrastructure located on Farms Eendragt38 RE/1, Eendragt38 2, Eendragt38 11, Eendragt38 0/193 and Eendragt38 RE.

The regulatory requirements are also discussed with regard the National Water Act and NEMA in Section 4 of this report. While the PROTOCOL FOR SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR THE ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY (Government Gazette 43110, 20 March 2020), superseding the Appendix 6 NEMA requirements, was also adhered to. This report thus meets the criteria to fulfil a Specialist Verification Assessment Report as the proposed site is located within an area rated as **Very High** sensitivity by the DFFE Screening Tool due to the presence of See Screening Verification Statement – Appendix 2):

- Critical Biodiversity Areas (CBA) 1: Aquatic
- Ecological Support areas (ESA) 1: Aquatic

The site is situated within the North Langeberg Sandstone Fynbos (FFs15), South Langeberg Sandstone Fynbos (FFs16) and Matjiesfontein Shale Renosterveld (FRs6) vegetation units, all forming part of the Die Brak river catchment (H40A). These vegetation units are not listed as a Threatened Ecosystem, by NEMA due to it being considered Endangered. A small southern portion of the site is located in the Koo River catchment (H40B) however only one drainage feature associated with this catchment is located within the study area farm portions.

The area was characterised by low lying drainage areas with riverine and drainage line systems, valley bottom wetland areas, seepage wetlands associated with several of the larger dams and one small depression. Further the area has seen a high degree of transformation in the form of cultivation areas, grazing, as well as the creation of several farm dams, roads and tracks. Of significance is the fact that most of the watercourses have either been converted into herring bone drain features or bermed to increase flows into downstream dams. This has then led to riverbed incision and the formation of the alluvial fans observed, i.e. sedimentation of low lying downstream areas due to this and loss of vegetative cover.

The findings of this report were substantiated by the current waterbody inventories (van Deventer *et al.*, 2020), 1: 50 000 topocadastral surveys mapping. These inventories include wetland spatial data based on landcover 2007 data, previous assessments and wetland information retained by the Provincial authorities, combined into one database that formed part of the updated National Biodiversity Assessment, 2018. These also indicated that the only wetland hydrogeomorphic unit or type observed in the greater region included small pans or depressions (endorheic), and seeps associated with dams, which then correspond to those observed in this site. All of the above information was then integrated into a baseline map and refined using the 2023 survey data, digitised at a scale of 1:10 000.

Coupled to the aquatic delineations, information was collected on potential species that could occur within the watercourses, especially any conservation worthy species (Listed or Protected) but noting these were mostly terrestrial in nature and associated with the high level of disturbance.

Using the baseline description, aquatic features were identified, then categorised into one of number pre-determined sensitivity categories to provide protection and/or guide the layout planning processes. The sensitivity ratings of High (No-Go) to Low were determined through an assessment of the habitat sensitivity and related constraints. However, these No-Go areas (with buffers) relate in general terms to the project and there are areas where encroachment on these areas would occur (i.e. existing road crossings within systems) and this is considered acceptable since these areas are already disturbed.

These proposed constraints / buffers do not include bird buffers / constraints as their buffers along aquatic features are at times far larger around aquatic features, than those required for the known aquatic species within this region.

Development Component	Waterbody type	Sensitivity rating of the respective waterbody type against the development type and the required buffer	Sensitivity rating override if an impact such as a road already occurs within the proposed footprint
<b>Wind turbine generators (WTGs), hardstands and crane pads</b>	All delineated wetland systems	High & Very High = No-go with respective buffer (60m)	
	All watercourses / drainage lines	Moderate Sensitivity (50m) = No Go	
	Artificial dams	Not Applicable = If these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required	
<b>Buildings / Substations &amp; BESS</b>	All delineated wetland systems	High & Very High = No-go with respective buffer (60m)	
	All watercourses / drainage lines	Moderate Sensitivity (50m) = No Go	
	Artificial dams	Not Applicable = as these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required	
<b>Roads</b>	All delineated wetland systems	LOW if an existing crossing / road or impact is already present, that must then be included in the potential road network	
	All watercourses / drainage lines		
	Artificial dams	Not Applicable = as these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required	
<b>Overhead Lines</b>	All delineated wetland systems	Assumption is that the overhead lines could span these areas, but the towers/pylons should adhere to the buffer distances as indicated where possible as some of the alluvial system are very broad	
	Artificial dams		

**In summary, any structures such as WTGs, buildings, substations, and BESS, must be placed outside of the observed aquatic systems, while roads (only if existing impact occurs at that site) and transmission could cross or span these areas (Figure 9). Further it must be noted that once the final designs have been produced, any conflicts will be assessed by this specialist, and specific mitigations will be provided in these areas where needed.**

In conclusion, most of the anticipated impacts would include disturbance during the construction phase, while changes to form and function of the site due to increased runoff roads or hard surfaces that would occur in the operational and maintenance (O&M) phase. Based then on this assumption the following impacts were assessed.

- Impact 1: Loss of habitat containing protected species or Species of Special Concern
- Impact 2: Loss of any critical corridors, important catchment areas and connected habitats that are linked to any future conservation plans or protected areas expansion associated within any riverine or wetland systems
- Impact 3: The potential spread of alien vegetation
- Impact 4: Loss of riparian and or wetland habitat
- Impact 5: Changes to the hydrological regime and increased potential for erosion
- Impact 6: Changes to water quality
- Impact 7: Cumulative Impacts

In summary, the impacts upon aquatic biodiversity associated with the project are of Low significance, after mitigation. The loss of irreplaceable aquatic habitat and/or important biota is highly unlikely, i.e. Very High sensitivity or No-Go areas. This also includes the spanning of a functioning drainage line, which would not be seen as problematic, if suitable stormwater management and drainage from the area of the site is provided.

The specialist has no objection to the authorisation of the proposed activities assuming that all mitigations and buffer zones are implemented.

The significant impacts are associated with the access road crossings river systems. These systems are generally in a modified state (existing road), but still provide some habitat and important ecological functions.

Mitigation should focus on these areas and include measures to halt erosion and rehabilitate habitat in the sections affected by the construction. Without the implementation of mitigation measures, the project has potential to cause a Moderate cumulative impact upon aquatic biodiversity. However, with the adoption of mitigation, the proposed project will have a Low impact upon aquatic biodiversity.

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## ACRONYMS

CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DWS	Department of Water and Sanitation formerly the Department of Water Affairs
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
GA	General Authorisation (WUA type)
GIS	Geographic Information System
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, <i>et al.</i> 2011).
OHL	Overhead Line – transmission line cable that is not buried
ORC	Off road cable – underground or overhead transmission cable not within a road reserve
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SQ	Subquaternary catchment
WUA	Water Use Authorisation
WUL	Water Use License
WULA	Water Use License Application

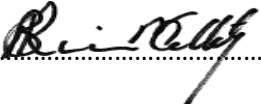
## SPECIALIST REPORT DETAILS

This report has been prepared as per the requirements of the Environmental Impact Assessment Regulations and the National Environmental Management Act (Act 107 of 1998), any subsequent amendments and any relevant National and / or Provincial Policies related to biodiversity assessments. This also includes the minimum requirements as stipulated in the National Water Act (Act 36 of 1998), as amended in Water Use Licence Application and Appeals Regulations, 2017 Government Notice R267 in Government Gazette 40713 dated 24 March 2017, which includes the minimum requirements for a Wetland Delineation/ Aquatic Report.

**Report prepared by:** Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Member SAEIES and Wetland Society of South Africa.

**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 DFFE and or Department of Water and Sanitation

Signed:.....  ..... Date:....5 December 2023.....

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# 1 Introduction

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The regulatory requirements are also discussed with regard the National Water Act and NEMA in Section 4 of this report. While the PROTOCOL FOR SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR THE ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY (Government Gazette 43110, 20 March 2020), superseding the Appendix 6 NEMA requirements, was also adhered to. This report thus meets the criteria to fulfil a Specialist Verification Assessment Report as the proposed site is located within an area rated as **Very High** sensitivity by the DFFE Screening Tool due to the presence of See Screening Verification Statement – Appendix 2):

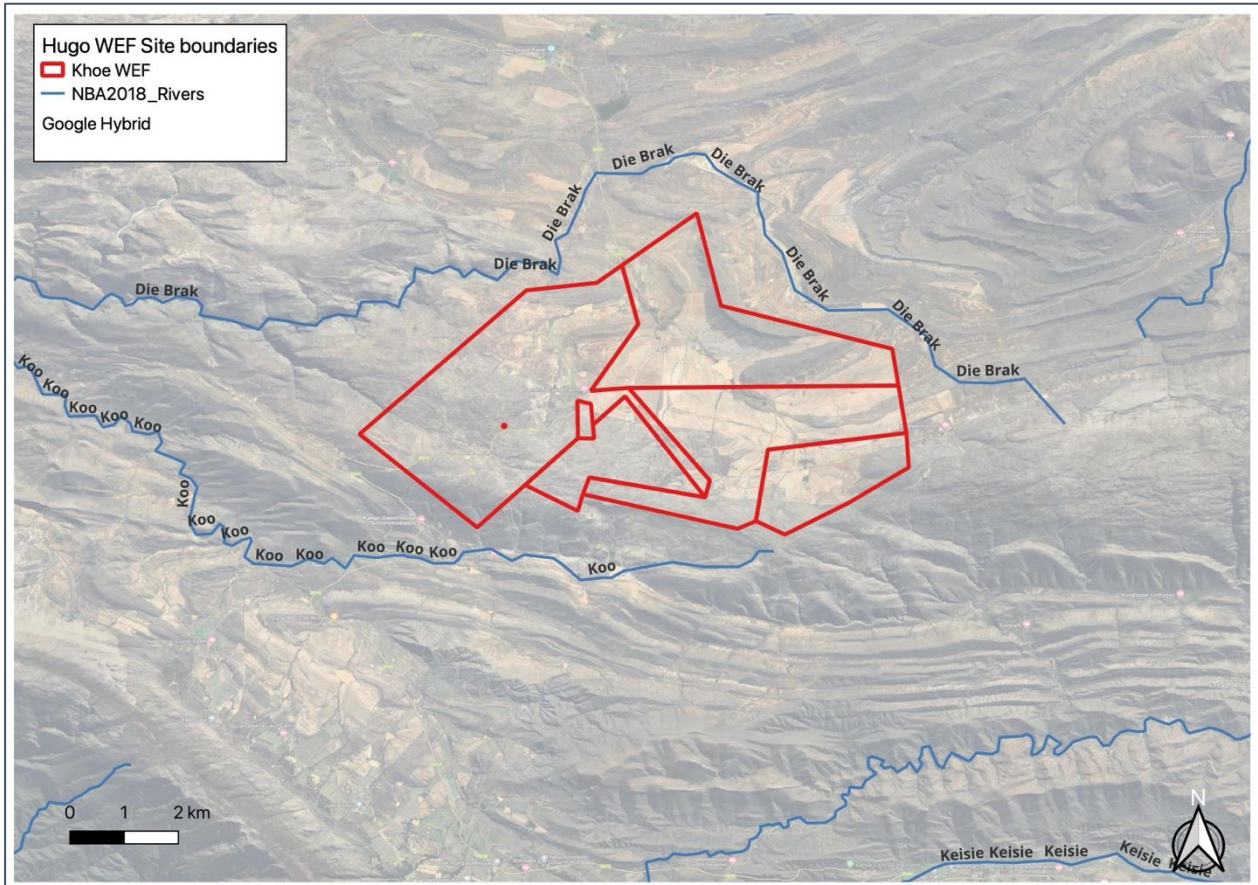
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The area was characterised by low lying drainage areas with riverine and drainage line systems, valley bottom wetland areas, seepage wetlands associated with several of the larger dams and one small depression. Further the area has seen a high degree of transformation in the form of cultivation areas, grazing, as well as the creation of several farm dams, roads and tracks. Of significance is the fact that most of the watercourses have either been converted into herring bone drain features or bermed to increase flows into downstream dams. This has then led to riverbed incision and the formation of the alluvial fans observed, i.e. sedimentation of low lying downstream areas due to this and loss of vegetative cover.

The findings of this report were supported by baseline data collected during a site visited in 26-27 November 2023. This assessment adheres to criteria contained in the DWAF 2005 / 2008 delineation manuals and the Wetland / Riverine Classification System.

Several important national and provincial scale conservation plans were also considered, with the results of those studies where relevant being included in this report. Most conservation plans are produced at a high level, so it is important to verify or ground truth the actual status of the study area. Groundtruthing of aquatic resources in the project area was also important as the information was critical for the identification and mapping of important habitat where protected or endangered species are known to occur within the region.



**Figure 1: The site boundary in relation to the surrounding mainstem rivers**

### **1.1 Aims and objectives**

The aim of this report is to firstly provide a summary of the aquatic baseline and identify any No-Go areas. The report also makes recommendations with regard to further management and mitigation, to further reduce, avoid or mitigate the potential impacts and ultimately ensure the responsible and sustainable use of South Africa’s aquatic resources. The proposed layout was then assessed with regard the potential impacts and mitigations later in this report.

Certain aspects of the development could trigger the need for Section 21, Water Use License Applications (WULAs) (or general authorisation [GA] applications) such as river crossings or any activities within 500m of a wetland. Once the final layout receives Environmental Authorisation, these applications must then be submitted to the Department of Water and Sanitation (DWS).

Information regarding the state and function of the observed water bodies, including suitable no-go buffers areas is thus also provided.

### **1.2 Assumptions and Limitations**

To obtain a comprehensive understanding of the dynamics of both the flora and fauna of 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 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 sample and assess as much of the potential site, as well as make use of any supporting literature, species distribution data and aerial photography.

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.

## 2 Terms of Reference

The proposed methods used in this assessment have been developed with the renewable industry in mind, coupled to the minimum requirements stipulated by DFFE and the Department of Water and Sanitation. These have been successful in assessing the direct, indirect and cumulative impacts of ca 180 renewable energy projects (2010 – 2023), of which 23 have been constructed:

- Desktop analysis
- Site investigation
- Compilation of one draft and one final site screening / sensitivity report for the project which adheres to the following (this list is not exhaustive):
  - The Initial Site Sensitivity Verification reporting requirements for environmental themes set out in Government Gazette No. 43110 which was promulgated on 20 March 2020 in terms of section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).
  - Identification and mapping of any discrepancies with the environmental sensitivity as identified on the national web based environmental screening tool.
  - Identification of sensitive areas to be avoided (including corresponding spatial data) and the determination of the respective buffers (if applicable) for each site.
  - Initial recommendations for the layout and allowable development footprint from a surface water and aquatic biodiversity perspective (including corresponding spatial data).
  - Recommendations regarding the areas to be utilised for solar technologies within the project site from a surface water and aquatic biodiversity perspective (including corresponding spatial data)
- Assess the potential impacts, based on a supplied methodology, including cumulative impacts and for pre-construction, construction, operations and decommissioning phases.
- Provide mitigations regarding project related impacts, including engineering services that could negatively affect demarcated wetland areas.
- Supply the client with geo-referenced GIS shape files of the wetland / riverine areas.
- Provide one draft report for comment, with a maximum of two rounds of comments addressed per project phase (max of 2).

### 3 Project Description

The project is located ca. 22-km southeast of De Doorns, and 29-km north-west of Montagu in the Cape Fold mountains of the Western Cape. The project is located within the Langeberg Local Municipality and the greater Cape Winelands District Municipality. The project site comprises a several affected properties, located on Farms Eendragt38 RE/1, Eendragt38 2, Eendragt38 11, Eendragt38 0/193 and Eendragt38 RE

The project is known as the Khoe WEF. The project is planned as part of a cluster of renewable energy projects, which includes a second wind energy facility, Hugo WEF, located approximately 13 km north of the FE Khoe WEF

Access to the site will be via an access road off of the nearby R318. The FE Khoe WEF project site is proposed to accommodate the following infrastructure:

- Up to 38 wind turbines, turbine foundations and turbine hardstands.
- An on-site substation hub incorporating:
  - A132 kV on-site facility substation (OSS);
  - Switchyard with collector infrastructure;
  - Battery Energy Storage System (BESS); and
  - Operation and Maintenance buildings.
- A balance of plant area incorporating:
  - Temporary laydown areas; and
  - A construction camp laydown and temporary concrete batching plant.
- Power lines internal to the wind farm, trenched and located adjacent to internal access roads, where feasible. The intention is for internal project cabling to follow the internal roads.
- Access roads (gravel) to the site and between project components with a width up to 8 m for primary access routes.

technically viable development footprint was proposed by the developer and assessed as part of the studies.

The details of the project is as follows:

<b>Project Name</b>	<b>FE Hugo Wind Energy Facility</b>
<b>Location</b>	22-km southeast of De Doorns, and 29-km north-west of Montagu
<b>Applicant</b>	FE Hugo & Khoe (Pty) Ltd
<b>Contracted capacity</b>	Up to 290 MW (turbines up to 7.5 MW in capacity)
<b>Number of turbines</b>	Up to 38 turbines
<b>Turbine hub height</b>	Up to 164 m
<b>Turbine top tip height</b>	Up to 250m
<b>Rotor swept area</b>	up to 21 000m <sup>2</sup>
<b>Capacity of on-site substation</b>	132 kV
<b>Area occupied by the on-site substation</b>	~ 2.5 ha in extent
<b>Underground cabling</b>	Underground cabling, with a capacity of 33 kV, will be installed to connect the turbines to the on-site facility substation.
<b>Battery Energy Storage System (BESS)</b>	Solid state battery technology (e.g. Lithium-ion technology) as a preferred technology. BESS will be housed in containers approximately 20 m long, 3 m wide, and 5m high with an approximate footprint of up to 5 ha.
<b>Operation and maintenance (O&amp;M) buildings</b>	~ 1 ha in extent

<b>Balance of plant area</b>	Temporary laydown areas with an extent up to 9 ha. Temporary warehouse of 1 ha Temporary site camp establishment and concrete batching plants of 1 ha.
<b>Access and internal roads – Main road</b>	Main access road to the site and between project components with a width up to 8 m and a servitude of 13.5 m.
<b>Access and internal roads – internal network</b>	Road network between project components with a width up to 8 m
<b>Turbine hardstand footprint</b>	For each turbine the following will be relevant: ~up to 7500 m <sup>2</sup> for the turbine hardstand area
<b>Turbine foundation footprint</b>	~ 1000 m <sup>2</sup> per turbine

The project is intended to provide electricity to the national grid through the Department of Mineral Resource and Energy's (DMRE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme or other public or private off-taker programmes.

The proposed project will require clearing of natural vegetation for the construction of the WEF, and the associated infrastructure which includes access roads, turbines and grid connections (substation, BESS and cabling), as well as any construction areas and laydown areas. These project aspects could potentially have negative impacts to the freshwater ecosystems and associated biota.

## 4 Relevant legislation, policy and permit requirements

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);
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- National Forest Act (No. 84 of 1998); and
- National Heritage Resources Act (No. 25 of 1999) – could apply if cultural use or heritage is linked to any aquatic resources

NEMA and the CARA identify and categorise invasive plants together with associated obligations on the landowner. Several Category 1 & 2 invasive plants were observed in several areas of the site under investigation.

Based on an assessment of the proposed activities (Table 1) and past engagement with DWS, the following Water Use Authorisations may be required based on the following thresholds as listed in the following Government Notices, however ultimately the Department of Water and Sanitation (DWS) must determine if a General Authorisation (GA) or full WULA will be required during the pre-application process as it relates to the following, bearing in mind that this will only be conducted once a final project scope is known:

- **DWS Notice 538 of 2016, 2 September in GG 40243**– Section 21a water uses relating to the Abstraction of water.
- **Government Notice 509 in GG 40229 of 26 August 2016** – Section 21c & 21i water uses relating to the Impeding or diverting the flow of water in a watercourse and or altering the bed, banks, course or characteristics of a watercourse.
- **Government Notice 665, 6 September 2013 in GG 36820** - Section 21g relating to disposing of waste in a manner that may detrimentally impact on a water source which includes temporary storage of domestic wastewater i.e. conservancy tanks under Section 37 of the notice.

**Table 1: Water Use Activities**

	<b>Water Use Activity</b>	<b>Applicable to this development proposal</b>
S21(a)	Taking water from a water resource	Yes, if water is abstracted from new and or existing (change of use from agricultural to industrial) boreholes.
S21(b)	Storing water	Only if water is stored within a instream dam. The use of tanks and or reservoirs is thus advised as these don't require a license if filled with an authorised resource.
S21(c)	Impeding or diverting the flow of water in a watercourse	If any works (permanent or temporary) are located within a watercourse or wetland regulated zone then a GA process can potentially be followed if the DWS Risk Assessment Matrix indicates that all impacts with mitigation are LOW.
S21(d)	Engaging in a stream flow reduction activity	Not applicable
S21(e)	Engaging in a controlled activity	Not applicable
S21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit	Not applicable
S21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource	Typically, the conservancy tanks at construction camps and then O/M buildings require a license (GA if volumes are below 10 000 m <sup>3</sup> ).
S21(h)	Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process	Not applicable

	Water Use Activity	Applicable to this development proposal
S21(i)	Altering the bed, banks, course or characteristics of a watercourse	If any works (permanent or temporary) are located within a watercourse or wetland regulated zone then a GA process can potentially be followed if the DWS Risk Assessment Matrix indicates that all impacts with mitigation are LOW.
S21(j)	Removing, discharging or disposing of water found underground for the continuation of an activity or for the safety of persons	Not applicable
S21(k)	Using water for recreational purposes	Not applicable

DWS WILL DETERMINE IF A GA OR WULA APPLICATION WILL BE REQUIRED DURING THE PREAPPLICATION PHASE AND TYPICALLY IF ONE OF THE ABOVE WATER USES REQUIRES A WULA THEN ALL APPLICATIONS WILL BE TREATED AS A WULA AND NOT GA.

#### 4.1 Wetland and riverine buffer policy

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. This system of defining ecological buffers provides a means to protect the functional aquatic habitat as well as the transitional ecotone that exists around any aquatic body. This is opposed to the 32m NEMA regulated area, which is not an ecological buffer, with no consideration of the form or function of a system that may be impacted.

These buffer models are based on the condition of the waterbody, the state of the remainder of the site, coupled to the type of development, as well as the proposed alteration of hydrological flows. Based then on the information known for the site the buffer model provided the following:

##### Watercourses – Moderate sensitivity

- Construction period: 50m
- Operation period: 42 m
- Final: 50 m

##### Delineated wetlands– High & Very High = No-Go for Buildings, Turbines & new roads

- Construction period: 60m
- Operation period: 54 m
- Final: 60 m

Artificial dams were not buffered.

## 5 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.

Current water resource classification systems make use of the Hydrogeomorphic (HGM) approach, and for this reason, the National Wetland Classification System (NWCS) approach will be used in this study. It is also important to understand the legal definition of a wetland, the means of assessing wetland conservation and importance and the relevant legislation aimed at protecting wetlands. These aspects will be discussed in greater depth in this section of the report, as they form the basis of the study approach to assessing wetland impacts.

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

### 5.1 Waterbody classification systems

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al.*, 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects. **Coupled to this was the inclusion of other**



**criteria within the classification systems to differentiate between river, riparian and wetland systems, as well as natural versus artificial waterbodies.**

The South African National Biodiversity Institute (SANBI) in collaboration with several specialists and stakeholders developed the newly revised and now accepted National Wetland Classification Systems (NWCS) (Ollis *et al.*, 2013). This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, with including structural features at the finer or lower levels of classification (Ollis *et al.*, 2013).

Wetlands develop in a response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determines the form and function of the respective wetlands. Water is thus the common driving force, in the formation of wetlands (DWAF, 2005). It is significant that the HGM approach has now been included in the wetland classifications as the HGM approach has been adopted throughout the water resources management realm with regards to the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Water and Sanitation (DWS). The Ecological Reserve of a wetland or river is used by DWS to assess the water resource allocations when assessing WULAs

The NWCS process is provided in more detail in the methods section of the report, but some of the terms and definitions used in this document are present below:

#### **Definition Box**

**Present Ecological State** is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.

**EcoStatus** is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology, and water quality).

**Reserve:** The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

**Reserve requirements:** The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).

**Ecological Reserve determination study:** The study undertaken to determine Ecological Reserve requirements.

**Licensing applications:** Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment or any other activity that qualifies as a water use.

**Ecological Water Requirements:** This is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the **Reserve Template**

**Water allocation process (compulsory licensing):** This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.

**Ecoregions** are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the Department of Water Affairs & Forestry (DWAFF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

## 5.2 Wetland definition

Although the National Wetland Classification System (NWCS) (Ollis *et al.*, 2013) is used to classify wetland types it is still necessary to understand the definition of a wetland. 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.

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised as the seaward boundary of the shallow photic zone (Lombard *et al.*, 2005). An additional minor adaptation of the definition is the removal of the term 'fen' as fens are considered a type of peatland. 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. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the latter as a

watercourse (Ollis *et al.*, 2013). Table 1 below provides a comparison of the various wetlands included within the main sources of wetland definitions used in South Africa.

Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. “wetlands”, as defined by the NWA, together with open waterbodies), it is understood that subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (Ollis *et al.*, 2013).

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).

*It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines and rivers.*

**Table 2: Comparison of ecosystems considered to be ‘wetlands’ as defined by the proposed NWCS, the NWA and ecosystems included in DWAF’s (2005) delineation manual.**

Ecosystem	NWCS “wetland”	National Water Act wetland	DWAF (2005) delineation manual
Marine	YES	NO	NO
Estuarine	YES	NO	NO
Waterbodies deeper than 2 m (i.e. limnetic habitats often described as lakes or dams)	YES	NO	NO
Rivers, channels and canals	YES	NO <sup>1</sup>	NO
Inland aquatic ecosystems that are not river channels and are less than 2 m deep	YES	YES	YES
Riparian <sup>2</sup> areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface	YES	YES	YES <sup>3</sup>
Riparian <sup>3</sup> areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface	NO	NO	YES <sup>3</sup>

<sup>1</sup> Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a ‘watercourse’ in terms of the Act

<sup>2</sup> According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods and would be considered riparian wetlands, as opposed to non-wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.

<sup>3</sup> The delineation of 'riparian areas' (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF's (2005) delineation manual.

### 5.3 National Wetland Classification System method

Due to the nature of the wetlands and watercourses observed, it was determined that the newly accepted NWCS should be adopted. This classification approach has integrated aspects of the HGM approach used in the WET-Health system as well as the widely accepted eco-classification approach used for rivers.

The NWCS (Ollis *et al.*, 2013) as stated previously, 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 used in this study is thus based on Ollis *et al.* (2013) and is summarised below:

The NWCS has a six-tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 2). 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 NWCS, with the upper levels (Figure 3 Figure – 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.

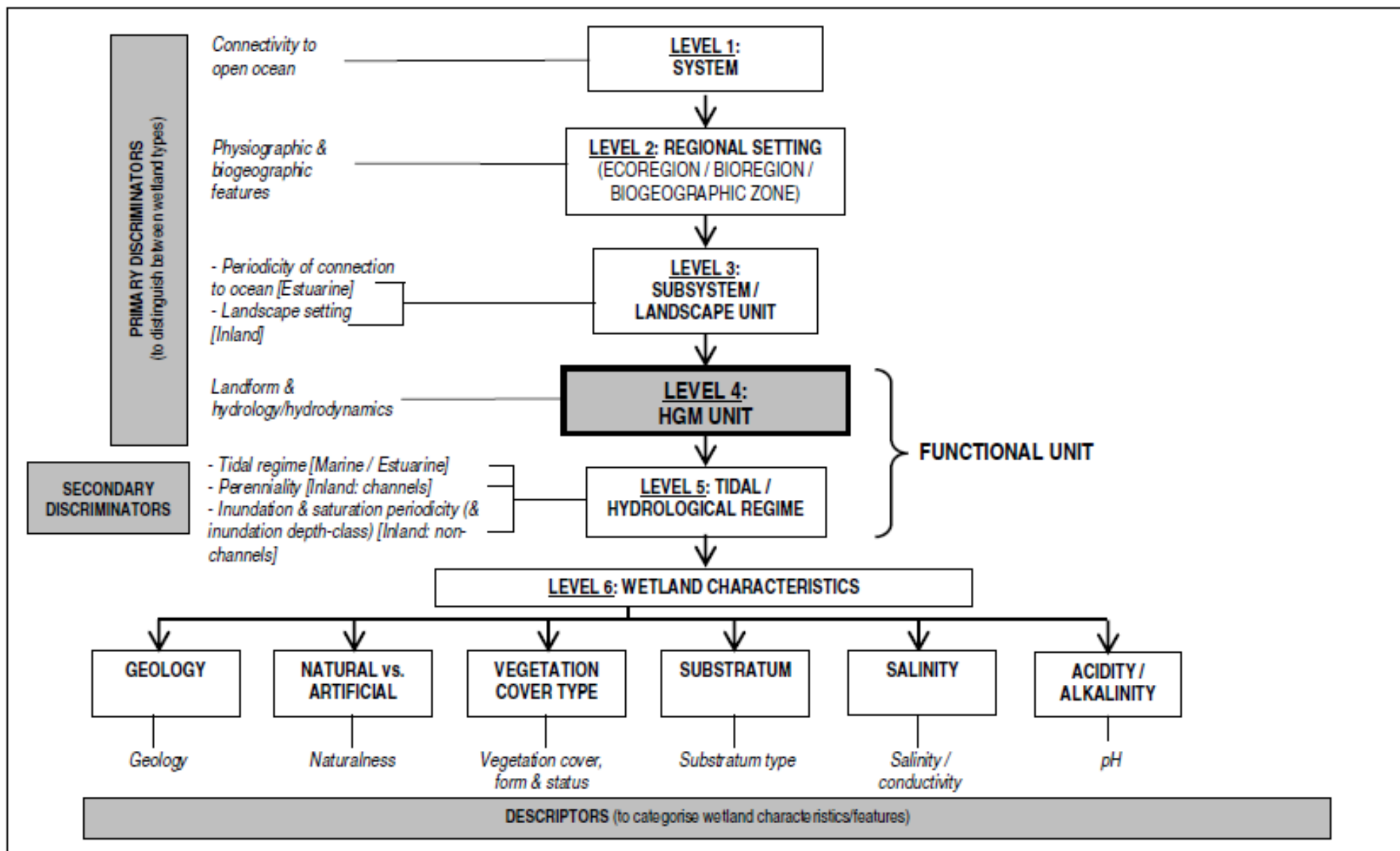


Figure 2: Basic structure of the NWCS, showing how ‘primary discriminators’ are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with ‘secondary discriminators’ applied at Level 5 to classify the tidal/hydrological regime, and ‘descriptors’ applied

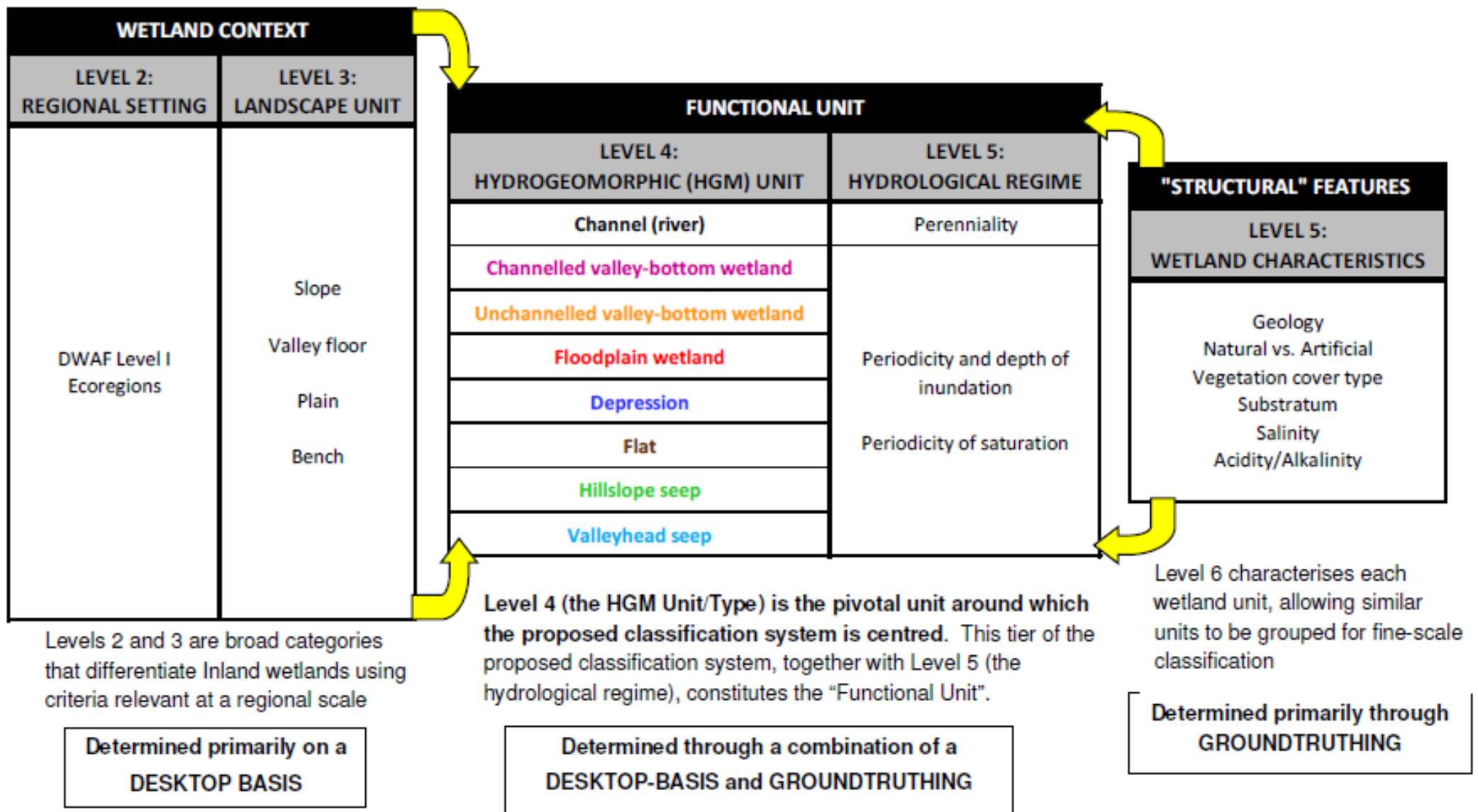


Figure 3: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al.*, 2013)

## 5.4 Waterbody condition

To assess the PES or condition of the observed wetlands, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. 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 ) and provide a score of the PES of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model-based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind and is not always suitable for impact assessments. This coupled with the degraded state of the wetlands in the study area, indicated that a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

**Table 3: Description of A – F ecological categories based on Kleynhans *et al.*, (2005)**

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
A	Unmodified, natural.	Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
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
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	<b>Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation</b>
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	<b>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	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. The interface of the WETLAND-IHI has been developed in a format which is similar to DWA's River EcoStatus models which are currently used for the assessment of PES in riverine environments.

## 5.5 Aquatic ecosystem importance and function

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.

Table 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>	<i>Indirect benefits</i>	Hydro-geochemical benefits	Flood attenuation		
			Stream flow regulation		
			Water quality enhancement benefits	Sediment trapping	
				Phosphate assimilation	
				Nitrate assimilation	
				Toxicant assimilation	
		Erosion control			
	Carbon storage				
	Biodiversity maintenance				
	<i>Direct benefits</i>	<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).

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.

## 6 Description of the affected environment

The site was assessed over a two day period summer (26 – 27 November 2023) after significant winter rainfall, and towards the end of the growth period for most of the species known to occur within the region.

The site is situated within the North Langeberg Sandstone Fynbos (FFs15), South Langeberg Sandstone Fynbos (FFs16) and Matjiesfontein Shale Renosterveld (FRs6) vegetation units, all forming part of the Die Brak river catchment (H40A). These vegetation units are not listed as a Threatened Ecosystem, by NEMA due to it being considered Endangered. A small southern portion of the site is located in the Koo River catchment (H40B) however only one drainage feature associated with this catchment is located within the study area farm portions.

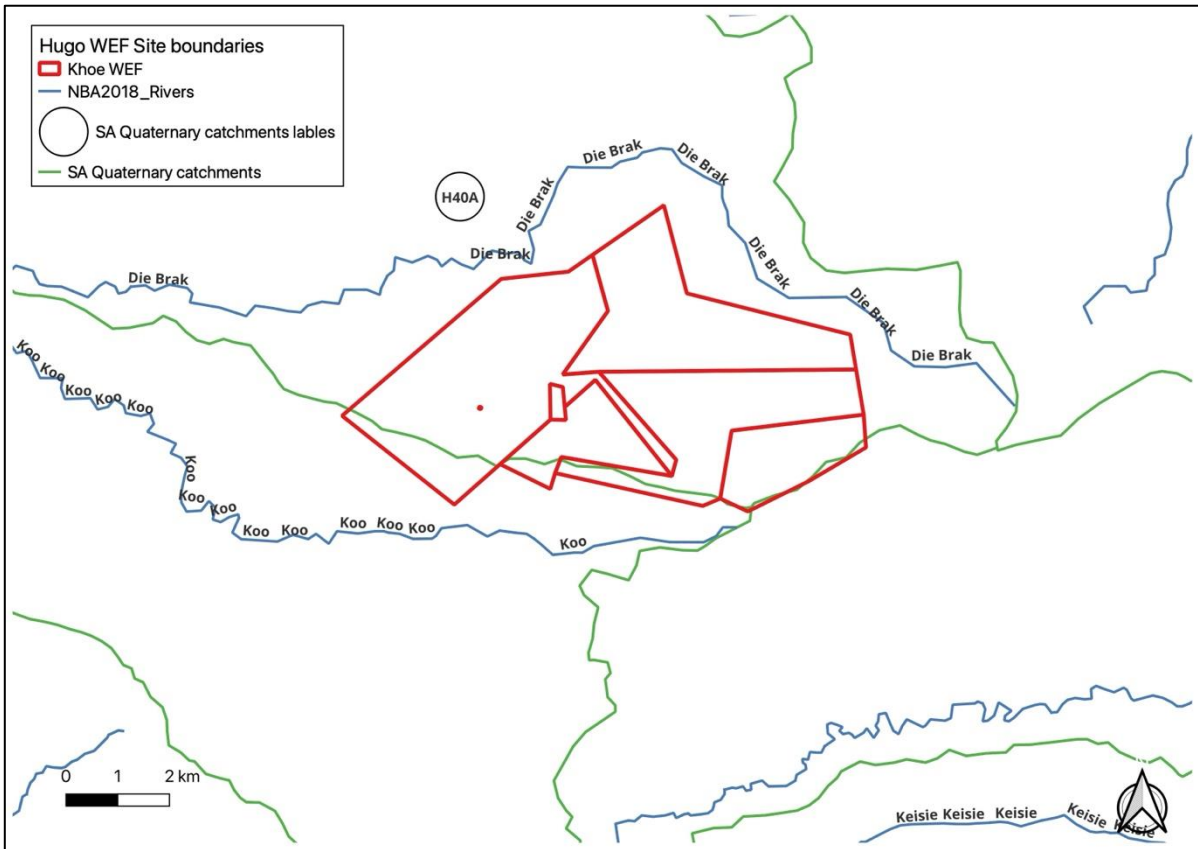
The study area is dominated by low lying drainage areas with riverine and drainage line systems (Plate 1), valley bottom wetland areas (Plate 2), seepage wetlands associated with several of the larger dams and one small depression. Dams and weirs / berms with no wetland or aquatic features were also common within the study area.

Further the area has seen a high degree of transformation in the form of cultivation areas (Plate 3), grazing, as well as the creation of several farm dams, roads and tracks. Of significance is the fact that most of the watercourses have either been converted into herring bone drain features or bermed to increase flows into downstream dams. This has then led to riverbed incision and the formation of the alluvial fans observed, i.e. sedimentation of low lying downstream areas due to this and loss of vegetative cover.

The study area is located within the Southern Folded Mountain Bioregion, hence the diversity of high lying mountain catchments (mostly rocky) and the low lying alluvial systems, but all located within the Breede-Olifants Catchment Management Agency and is the lead agent for water resources management within the Breede-Gouritz Water Management Area (BGWMA).

The Department of Forestry, Fisheries and Environment (DFFE) identified the aquatic environment for the study area as having a Very High Sensitivity, to the presence of (See Screening Verification Statement – Appendix 2):

- Critical Biodiversity Areas (CBA) 1: Aquatic
- Ecological Support areas (ESA) 1: Aquatic



**Figure 4: Project locality map indicating the various quaternary catchments and mainstem rivers (Source DWS and NGI) within the project boundary**



**Plate 1: A view of one of the significant seep areas within the site**



**Plate 2: Aerial view of an degraded valley bottom wetland systems, with several cut off drains and road crossings, with a transformed catchment**



**Plate 3: An alluvial systems (red arrows) transformed by the creation of agricultural production areas**

These groundtruthed delineations were then compared to current waterbody inventories (Figure 5) (van Deventer *et al.*, 2020), 1: 50 000 topocadastral surveys mapping and the site. These inventories include wetland spatial data based on landcover 2007 data, previous assessments and wetland information retained by the Provincial authorities, combined into one database that formed part of the updated National Spatial Biodiversity Assessment, 2018. However little was known or assessed previously for this site.

A baseline map was then developed and refined using the 2023 survey data, noting that due to the topography and geology, the features were digitised at a scale of 1:5 000 (Figure 6).

Coupled to the aquatic delineations, information was collected on potential species that could occur within the watercourses, especially any conservation worthy species (Listed or Protected, however none were observed (aquatic), that will be impacted upon within the proposed footprint.

None of the dominant riparian / wetland associated plant species observed are listed or protected under any form of legislation. Plant species included the following:

- *Ficinia nodosa*
- *Juncus effusus*
- *Carex* spp
- *Centella asiatica*
- *Erianthus capensis*
- *Sporobolus fimbriatus*
- *Cynodon incompletus*
- *Erharta calcynia*
- *Merxmuellera disticha*
- *Phragmites australis*
- *Cynodon dactylon*

This was confirmed by accessing data housed by the Freshwater Biodiversity Information System (FBIS), where sites (1) on the Die Brak River, an ephemeral system, contained approximately 6 floral species, previously observed, however all are listed as Least Concern. These included:

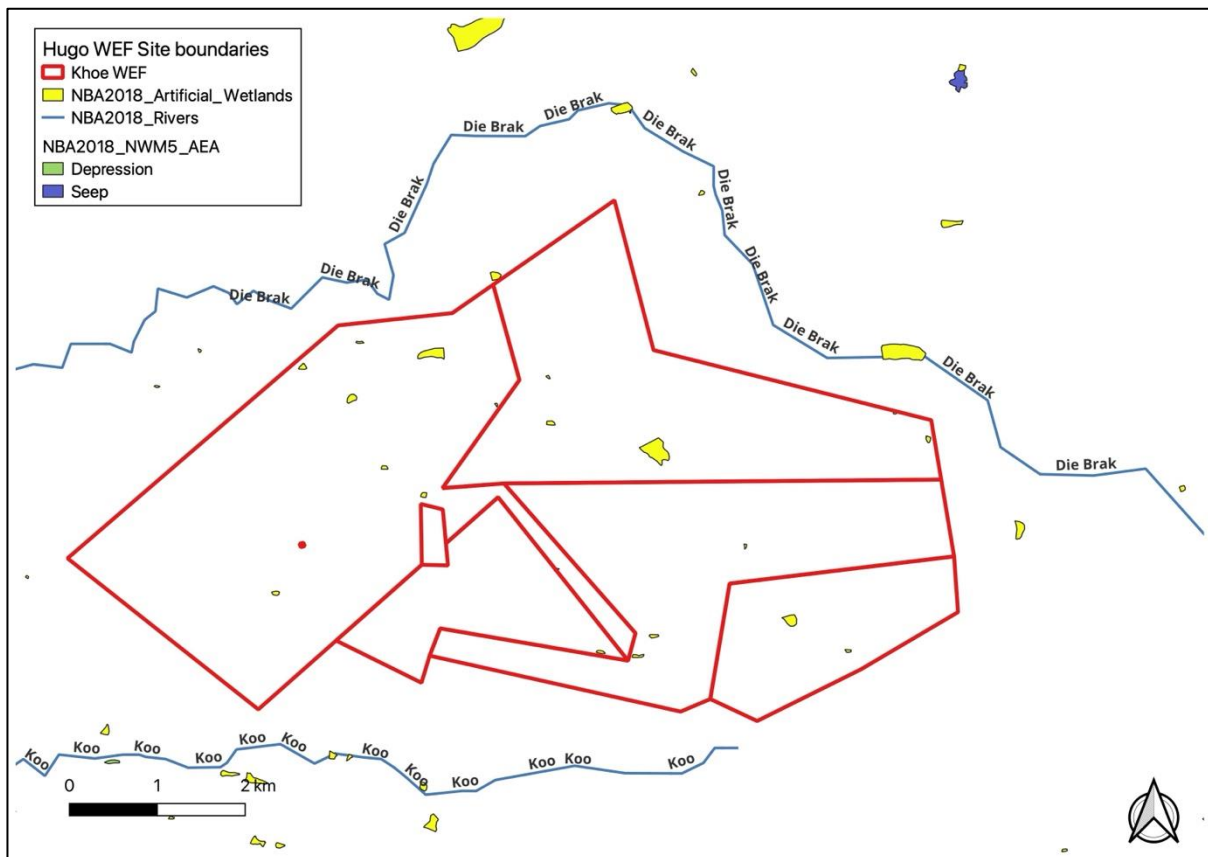
- *Arctotis arctotooides* (L.fil.) O.Hoffm.
- *Brachylaena neriifolia* (L.) R.Br.
- *Brunia africana* (Burm.fil.) Class.-Bockh. & E.G.H.Oliv.
- *Brunia noduliflora* Goldblatt & J.C.Manning
- *Marsilea macrocarpa* C.Presl
- *Spiloxene capensis* (L.) Garside

Similarly, amphibian species are known to occur within the region based on collection data for the region, but little is known of the actual distribution of frogs within the study area. Therefore, based on mapping data contained in Minter *et al.* (2004) and the FrogMAP spatial database, Table 5 indicates the potential frogs known to occur in the area and their preferred habitat, with one frog species being observed during this assessment.

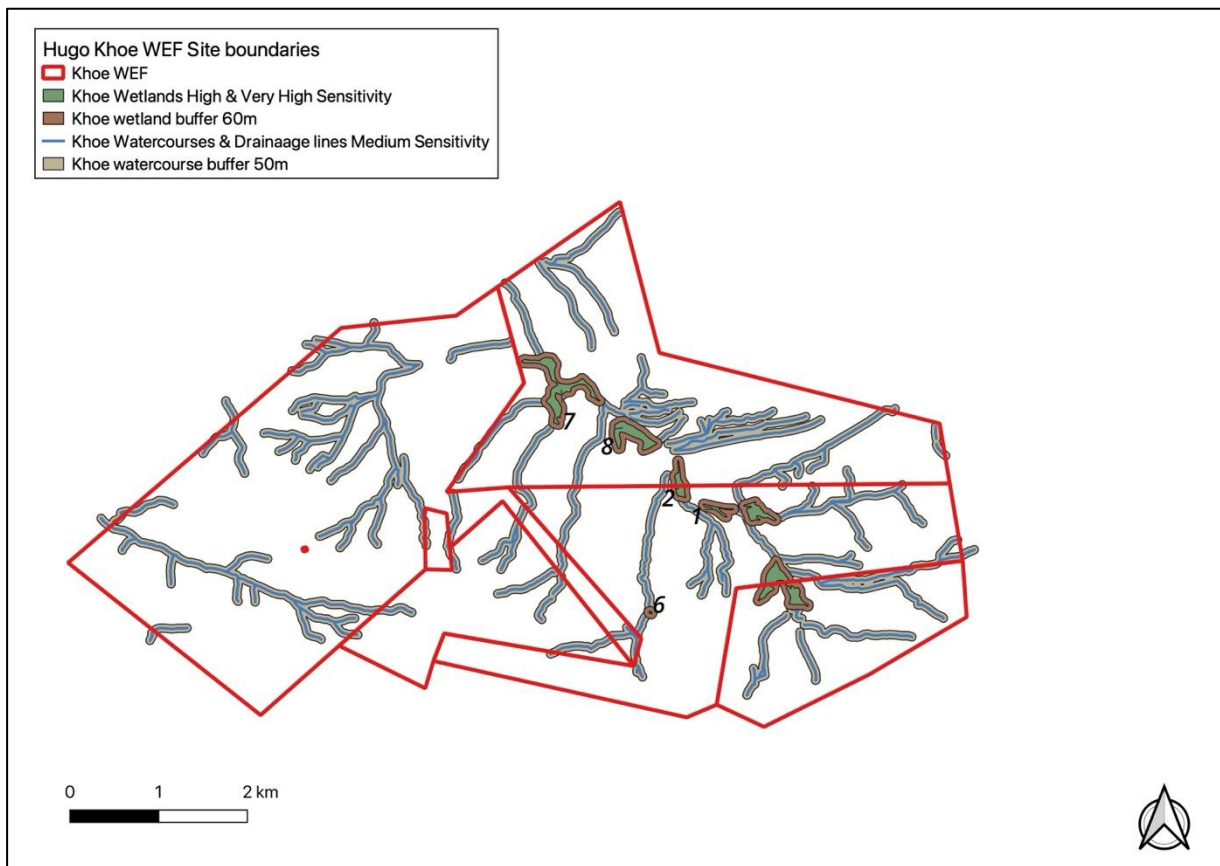
**Table 5: Potential and observed amphibians within the study area**

FrogMAP. 2019. Animal Demography Unit. Accessed from <http://frogmap.adu.org.za/?sp=400>; on 2022.10.015.

Amphibian Taxa	Common Name	Conservation Status (IUCN)	Likelihood of Occurring Based on Previous Records and or Availability of Habitat
<i>Vandijkophrynus gariepensis gariepensis</i>	Karoo toad	Least Concern	Likely
<i>Cacosternum boettgeri</i>	Common caco	Least Concern	Likely
<i>Cacosternum karoocicum</i>	Karoo dainty frog	Least Concern	Unlikely
<i>Strongylopus grayii</i>	Clicking stream frog	Least Concern	Unlikely
<i>Amietia fuscigula</i>	Cape river frog	Least Concern	Observed
<i>Xenopus laevis</i>	African clawed toad	Least Concern	Unlikely
<i>Tomopterna delanandii</i>	Cape sand frog	Least Concern	Unlikely



**Figure 5: National Wetland Inventory wetlands and waterbodies (van Deventer *et al.*, 2020)**



**Figure 6: Waterbodies delineated in this assessment based on groundtruthing information collected**

## 7 Present Ecological State and conservation importance

The Present Ecological State (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 new PES system 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 above-mentioned parameters are assessed or the overall PES is rated between a C or D.

All of the systems assessed by DWS (2014) on a Subquaternary level within the study area were rated as PES = D or Largely Modified. While these were also rated as High in terms of Ecological Sensitivity and Very High in terms of Ecological Importance respectively, for SQ8809.

Based on the information collected during the field investigations, these ratings are verified and upheld for the riverine systems (Table 6), i.e. systems were rated high (PES = D). The High Ecological Sensitivity rating for the natural water sources (Table 6), is further substantiated by the fact that the affected catchments contain



wetlands, included as Critical Biodiversity Areas, Ecological Support Areas, wetlands and rivers (Figure 6 and 7). Further, the sites are shown as National Freshwater Ecosystem Priority Area – NFEPA (Figure 8).

**Table 6: Results summary, that will be expanded during the EIA phase of the project for the wetland systems**

Aquatic Feature	Central Coordinate S,E WGS 84	HGM Unit Level 4 B-D	Inundation periodicity (Level 5)	Dominant hydrodynamics	Condition (Present Ecological State Score)	Ecological importance & Sensitivity
1	-33.43328,19.88667	Channelled Valley Bottom	Intermittent	Vertical & bidirectional	D	High
2	-33.43501,19.86530	Channelled Valley Bottom	Intermittent	Vertical & bidirectional	D	High
3	-33.45564,19.86616	Channelled Valley Bottom	Intermittent	Vertical & bidirectional	D	High
4	-33.477201,19.868125	Channelled Valley Bottom	Intermittent	Vertical & bidirectional	D	High
5	-33.483434,19.873687	Channelled Valley Bottom	Intermittent	Vertical & bidirectional	D	High
6	-33.486072,19.868380	Depression	Intermittent	Vertical & bidirectional	D	High
7	-33.469272,19.823820	Seep	Intermittent	Vertical & bidirectional	D	High
8	-33.496704,19.867090	Seep	Intermittent	Vertical & bidirectional	D	High

Overall, these catchment areas and subsequent rivers / watercourses are largely in a transformed state with localised impacts in some areas, which include the following:

- Erosion and sedimentation associated with road crossings;
- Grazing and farming
- Alien invasive trees / plants
- Impeded water flow due to several in channel farm dams; and

Lastly based on the observation made in the field, and the runoff generated by the site, the importance of these areas in terms of surface and ground water resources is thus valid, however should the wind farm footprint avoid any of the delineated areas, and place suitable stormwater management features in place, then little to no changes to the hydrological environment is anticipated. This was then translated into criteria used in the sensitivity rating of the respective systems in Section 8 below.

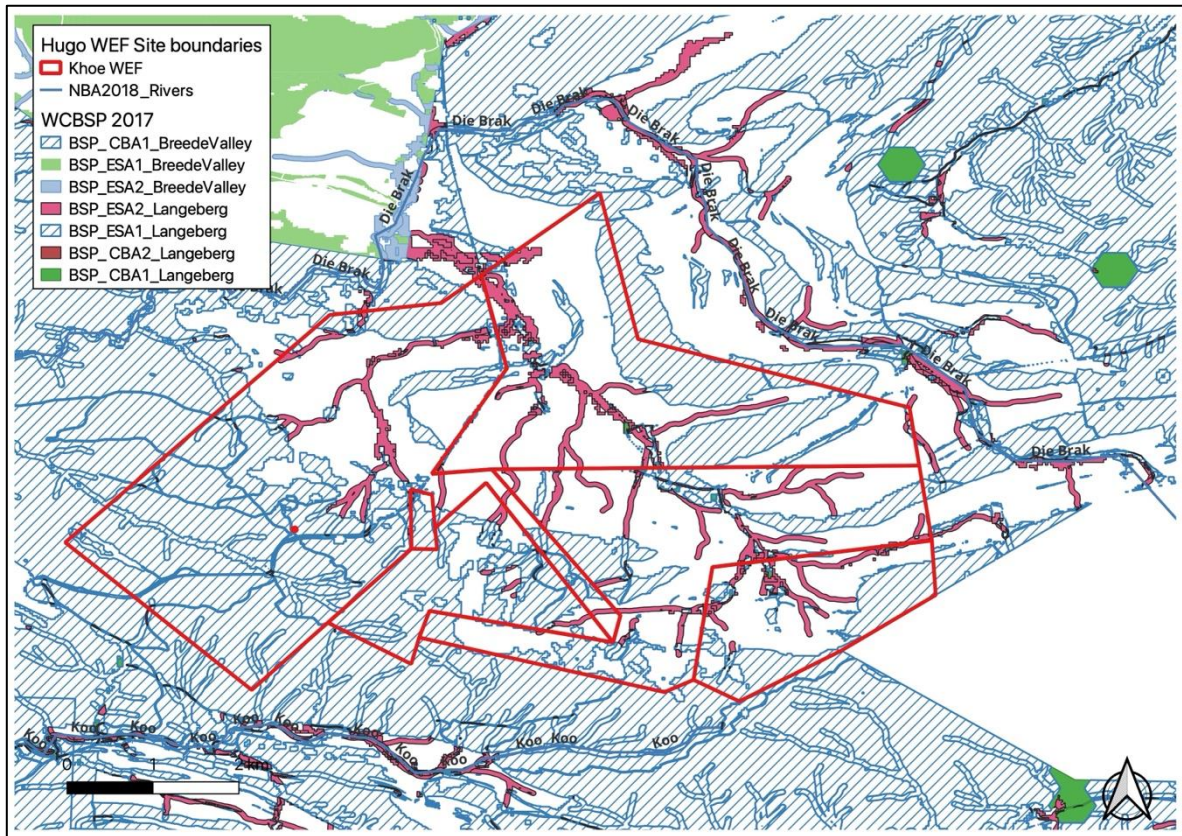


Figure 7: The Critical Biodiversity Areas as per the North West Biodiversity Spatial Plan – NW BSP 2015

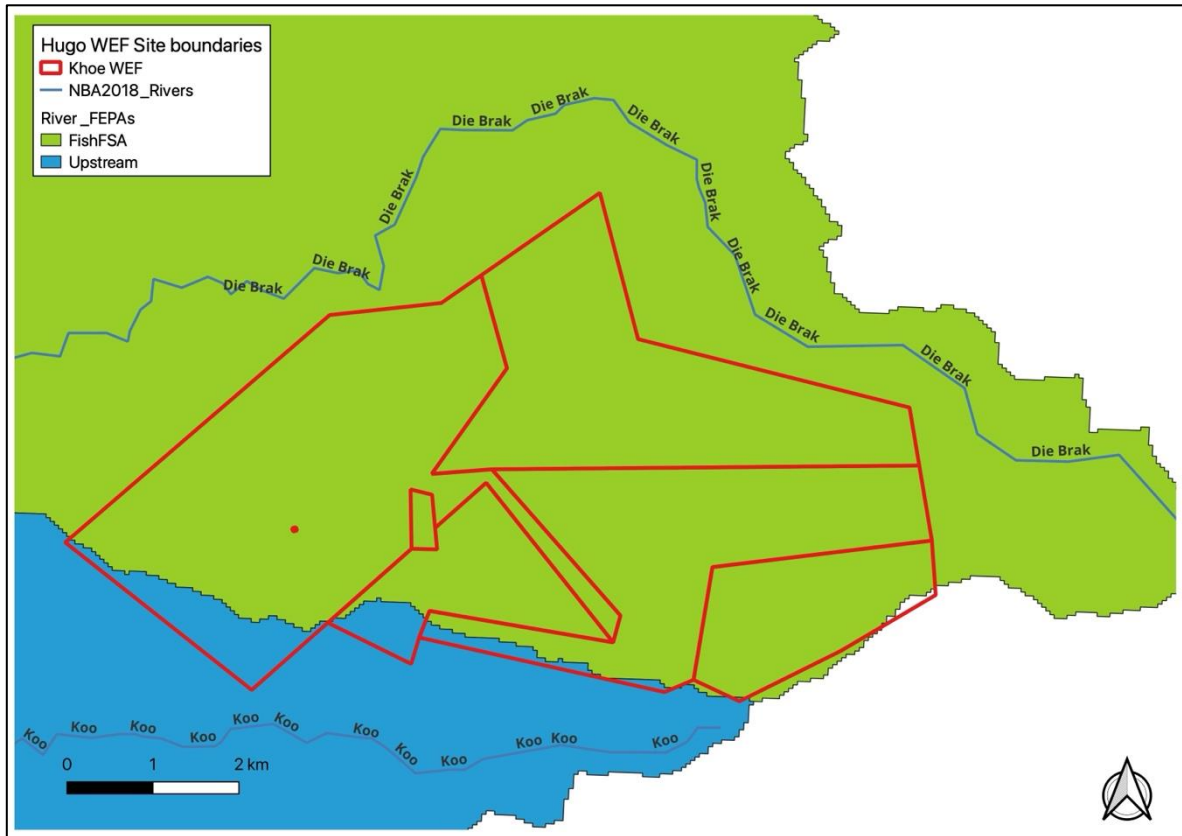


Figure 8: The Freshwater Ecosystem Priority Areas for the study site (Nel *et al*, 2011)

## 8 Site Sensitivity

Using the baseline description and field data while considering the current disturbances and site characteristics, the following features were identified, then categorised into one of number pre-determined sensitivity categories to provide protect and/or guide the layout planning and possibly the design processes of the corridor and a suitable alignment for the grid within:

High = No Go	“No go” areas or setbacks and areas or features that are considered of such significance that impacting them may be regarded as fatal flaw or strongly influence the project impact significance profile Therefore areas or features that are considered to have a high sensitivity or where project infrastructure would be highly constrained and should be avoided as far as possible. Infrastructure located in these areas are likely to drive up impact significance ratings and mitigations
Medium	Buffer areas and or areas that are deemed to be of medium sensitivity but should still be avoid as this would minimise impacts and or the need for additional Water Use Authorisation
Low	Areas of low sensitivity or constraints, such as artificial systems with little to no biological value or would not result in any future licensing requirements e.g. dry earth wall farm dams
Neutral	Unconstrained areas (left blank in mapping)

Table 7 below provides an overview of the sensitivity of various aquatic features (with buffers distances included) as it relates to the main project component types for the project. The features are shown spatially in Figure 9 below. The sensitivity ratings of High No-go and Low were determined through an assessment of the aquatic habitat sensitivity and related constraints. However, these No-Go areas (with buffers) relate in general terms to the project and there are areas where encroachment on these areas would occur (i.e. existing road crossings within systems, but this is considered acceptable since these areas have already been impacted.

These proposed constraints / buffers do not include bird and or bat specialist buffers / constraints as theirs buffers along aquatic features are at times far larger around aquatic features, than those required for the known aquatic species within this region.

**Table 7: Results of the sensitivity rating / constraints assessment**

Development Component	Waterbody type	Sensitivity rating of the respective waterbody type against the development type and the required buffer	Sensitivity rating override if an impact such as a road already occurs within the proposed footprint
Wind turbine generators (WTGs), hardstands and crane pads	All delineated wetland systems	High & Very High = No-go with respective buffer (60m)	
	All watercourses / drainage lines	Medium Sensitivity (50m) = No Go	
	Artificial dams	Not Applicable = If these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required	
Buildings / Substations & BESS	All delineated wetland systems	High & Very High = No-go with respective buffer (60m)	
	All watercourses / drainage lines	Medium Sensitivity (50m) = No Go	
	Artificial dams	Not Applicable = as these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required	
Roads	All delineated wetland systems	LOW if an existing crossing / road or impact is already present, that must then be included in the potential road network	
	All watercourses / drainage lines		
	Artificial dams	Not Applicable = as these systems have no biological value, structures could be placed within the dams, or dams could be demolished if required	
Overhead Lines	All delineated wetland systems	Assumption is that the overhead lines could span these areas, but the towers/pylons should adhere to the buffer distances as indicated where possible as some of the alluvial system are very broad	
	Artificial dams		

In summary, any structures such as WTGs, buildings, substations, and BESS, must be placed outside of the observed aquatic systems, while roads (only if existing impact occurs at that site) and transmission could cross or span these areas (Figure 9). Further it must be noted that once the final designs have been produced, any conflicts will be assessed by this specialist and specific mitigations will be provided in these areas where needed.

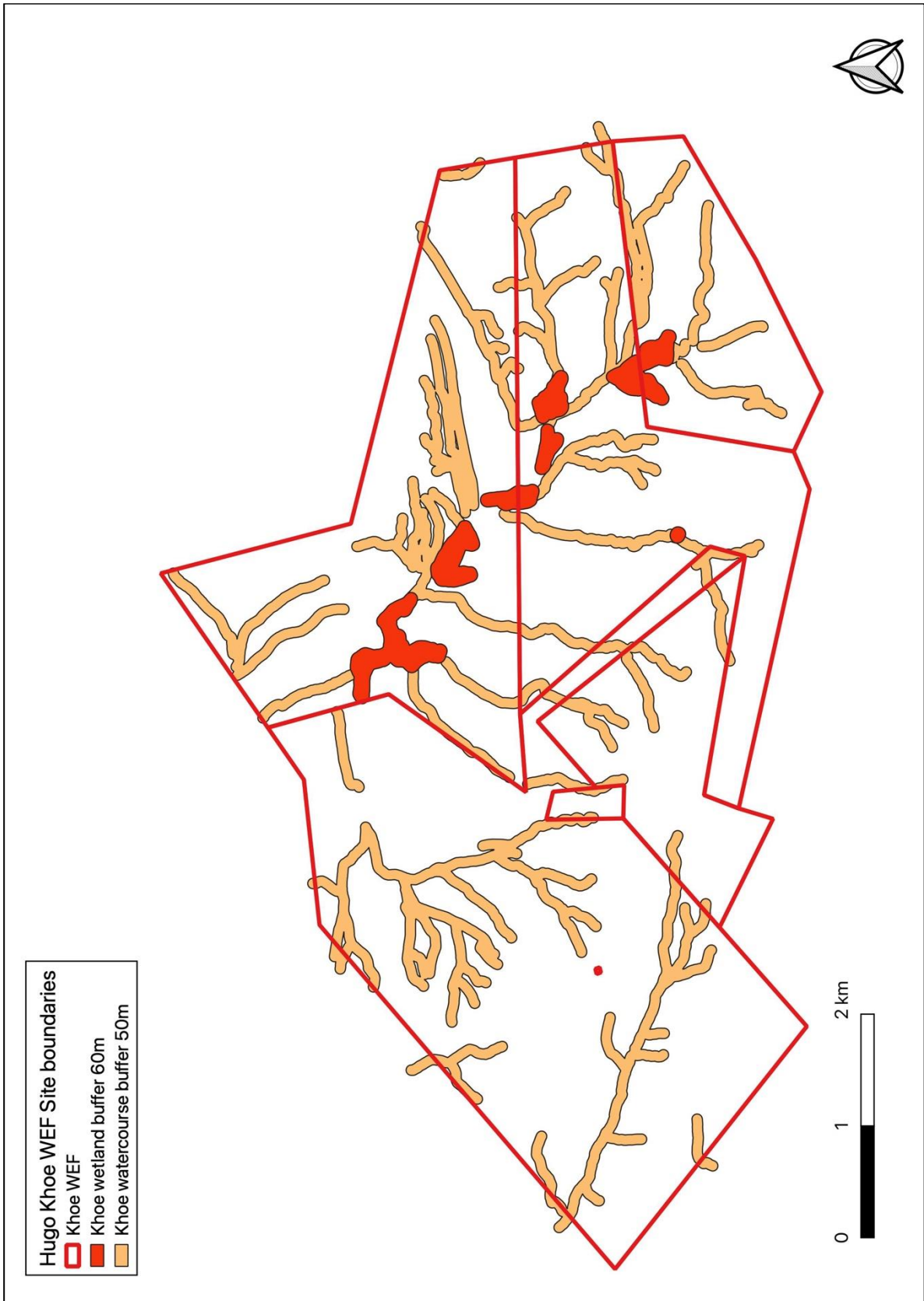


Figure 9: The delineated systems inclusive of the respective buffers together the applied sensitivity rating applied to WTGs, buildings and substations

## **9 Assessment of Impacts and Identification of Management Actions**

During this phase of the investigation it was found that the greatest number of impacts could occur within the construction phase, however the High sensitivity / No-Go areas can be avoided, thus the impacts would be limited on the aquatic environment.

With regard to the decommissioning phase, these impacts would be the same as those in the construction phase, but again limited as all sensitive aquatic habitats were avoided.

### **9.1 Alternatives Assessment**

The 2014 EIA Regulations require that any feasible and reasonable activity, location and technology alternatives considered must be described and comparatively assessed. However as all of the proposed alternatives have avoided any sensitivity aquatic areas, the impacts assessed below would thus be the same for any of the proposed footprints (Substations and Access roads).

### **9.2 No-Go Option**

With regard the No-Go option it is assumed that the site would continue to degrade due to the prevalence of grazing and or erosion within the water courses. This would continue into the long-term with a Low intensity that would impact on the regional scale due to loss of important habitat. Little in the way of mitigation could be proposed due to the social needs of the surrounding residents, grazing areas, coupled to the need for access.

### **9.3 Potential aquatic ecosystems impacts**

- Impact 1: Loss of habitat containing protected species or Species of Special Concern
- Impact 2: Loss of any critical corridors, important catchment areas and connected habitats that are linked to any future conservation plans or protected areas expansion associated within any riverine or wetland systems
- Impact 3: The potential spread of alien vegetation
- Impact 4: Loss of riparian and or wetland habitat
- Impact 5: Changes to the hydrological regime and increased potential for erosion
- Impact 6: Changes to water quality
- Impact 7: Cumulative Impacts

The Tables 8 – 14 below assesses the impact significance for each impact. It was determined that the impacts upon aquatic biodiversity associated with the project are of Low significance, after mitigation. This assumes that the mitigations listed below are considered coupled to the fact that the overall layouts have avoided any of the High / No-Go areas, unless making use of areas with impacts such as existing farm roads.

The loss of irreplaceable aquatic habitat and/or important aquatic obligate biota is therefore highly unlikely. The impacts are easily mitigated (provided the mitigation measures and monitoring plan within the EMP and this report are implemented and adhered to during all phases of the project).

**Table 8: Impact assessment summary for Impact 1 – Loss of habitat containing protected species or Species of Special Concern**

<b>Impact Phase:</b> Construction and Decommissioning							
<b>Nature of the impact:</b> Loss of vegetation and in particular species / habitats that could contain listed as Critically Endangered and or Vulnerable species (direct)							
<b>Description of Impact:</b> Activities resulting in physical disturbance of aquatic systems which provide ecosystem services, especially where new crossings are made, or large hard engineered surfaces are placed within the buffer zones. Loss can also include a functional loss, through change in vegetation type via alien encroachment, reducing aquatic biodiversity. However no aquatic vegetation or fauna with conservation concern were observed during this assessment, coupled to the fact that any sensitive areas will be avoided.							
<b>Impact Status:</b> Negative							
	<b>E</b>	<b>P</b>	<b>R</b>	<b>I</b>	<b>D</b>	<b>C</b>	<b>M</b>
<b>Without Mitigation</b>	Local	Probable	Irreversible	No Loss	Long Term	Low	Medium
<b>Score</b>	2	3	4	1	3	2	2
<b>With Mitigation</b>	Site	Possible	Partly reversible	No Loss	Short Term	Negligible	Low
<b>Score</b>	1	2	3	1	1	1	1
<b>Significance Calculation</b>	<b>Without Mitigation</b>			<b>With Mitigation</b>			
<b>S=(E+P+R+I+D+C)*M</b>	Moderate Negative Impact (30)			Low Negative Impact (9)			
Was public comment received? Not yet							
Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods							
Mitigation measures to reduce residual risk or enhance opportunities: <ul style="list-style-type: none"> <li>• The development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout.</li> <li>• Where large cut and fill areas are required, these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation.</li> <li>• Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc).</li> </ul>							
To minimise the impact of the access roads:							

- Use existing roads or upgrade existing tracks rather than constructing entirely new roads wherever possible.
- Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly before any construction commences.
- Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils.
- Where required, all pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that headcut erosion does not develop because of the gradient change from the natural ground level to the invert level of the culvert.
- The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown.
- Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities.
- Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted.
- All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated.

It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.



**Table 9: Impact assessment summary for Impact 2 – Loss of CBAs or potential areas with conservation potential or linked to any important catchments and strategic water resource areas**

Impact Phase: Construction and Decommissioning							
<b>Nature of the impact:</b> Loss of any critical corridors and connect habitats that are linked to any future conservation plans or protected areas expansion (direct) is not expected as these have been avoided, coupled to the fact that hydrological connections will be retained through avoidance or the inclusion of ecological buffers.							
<b>Description of Impact:</b> Activities resulting in physical disturbance of aquatic systems which provide ecosystem services, especially where new crossings are made, or large hard engineered surfaces are placed within the buffer zones and have been included in any Critical Biodiversity Areas.							
<b>Impact Status:</b> Negative							
	E	P	R	I	D	C	M
Without Mitigation	Local	Probable	Irreversible	No Loss	Long Term	Low	Medium
Score	2	3	4	1	3	2	2
With Mitigation	Site	Possible	Partly reversible	No Loss	Short Term	Negligible	Low
Score	1	2	3	1	1	1	1
Significance Calculation	Without Mitigation			With Mitigation			
$S=(E+P+R+I+D+C)*M$	Moderate Negative Impact (30)			Low Negative Impact (9)			
Was public comment received? Not yet							
Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods							
Mitigation measures to reduce residual risk or enhance opportunities: <ul style="list-style-type: none"> <li>The aquatic systems have been mapped to a finer scale and have taken cognizance of any potential CBAs. As High / No-Go have been avoided by the major infrastructure such as turbines and buildings, the aquatic zones associated within the CBA / ESAs have also been avoided. Roads will need to traverse these areas, thus it is important to try and select existing areas with impacts / crossings where possible</li> <li>The development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout prior to construction.</li> <li>Where large cut and fill areas are required, these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation.</li> <li>Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc).</li> </ul>							

To minimise the impact of the access roads:

- Use existing roads or upgrade existing tracks to cross wetlands rather than constructing entirely new roads wherever possible.
- Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences.
- Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils.
- Where required, all pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that head cut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert.
- The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown.
- Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities.
- Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted.
- All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated.

It is the contractor’s responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.

Residual impact	Very low and acceptable with adoption of mitigation measures
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**Table 10: Impact assessment summary for Impact 3 – Potential spread of alien vegetation**

<b>Impact Phase:</b> Construction and Operation							
<b>Nature of the impact:</b> Any physical disturbance could result in the spread of alien vegetation (direct)							
<b>Description of Impact:</b> During construction, complete clearing of the PV panel areas, as well any ancillary structures (offices and substations) will be required. This disturbance then allows for the alien species to colonise the soils, if left unmanaged.							
<b>Impact Status:</b> Negative							
	<b>E</b>	<b>P</b>	<b>R</b>	<b>I</b>	<b>D</b>	<b>C</b>	<b>M</b>
<b>Without Mitigation</b>	Local	Probable	Irreversible	No Loss	Long Term	Low	Medium
<b>Score</b>	2	3	4	1	3	2	2

<b>With Mitigation</b>	Site	Possible	Partly reversible	No Loss	Short Term	Negligible	Low
<b>Score</b>	1	2	3	1	1	1	1
<b>Significance Calculation</b>	<b>Without Mitigation</b>		<b>With Mitigation</b>				
<b>S=(E+P+R+I+D+C)*M</b>	Moderate Negative Impact (30)		Low Negative Impact (9)				
Was public comment received? Not yet							
Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods							
Mitigation measures to reduce residual risk or enhance opportunities: <ul style="list-style-type: none"> <li>• Alien vegetation management must be initiated at the beginning of the construction period and must extend into any remaining areas into the operation phase on the facility</li> <li>• The revegetation of any temporary sites as well as any previously degraded areas must begin from the onset of the project, with the involvement of a botanist to assist with the revegetation specifications</li> </ul> Regeneration of alien vegetation must be monitored once all areas have been cleared, forming part of a long-term alien vegetation management plan							
Residual impact	Very low and acceptable, with adoption of mitigation measures and monitoring						

**Table 11: Impact assessment summary for Impact 4 – Loss of riparian and or wetland habitat**

<b>Impact Phase:</b> Construction and Decommissioning							
<b>Nature of the impact:</b> It was recommended that all wetlands / riverine systems as well as the inclusive of buffers, be avoided. This was then taken forward in the design process.							
Description of Impact: During construction, complete clearing of the PV panel areas, as well any ancillary structures (offices and substations) will be required, which may impact the aquatic function or any corridors or connections between aquatic systems. However, all Very High Sensitivity / No-Go areas have been avoided by the proposed layout by also making use of existing road crossings or considering any of the proposed buffers.							
<b>Impact Status:</b> Negative							
	<b>E</b>	<b>P</b>	<b>R</b>	<b>I</b>	<b>D</b>	<b>C</b>	<b>M</b>
<b>Without Mitigation</b>	Local	Probable	Irreversible	No Loss	Long Term	Low	Medium
<b>Score</b>	2	3	4	1	3	2	2
<b>With Mitigation</b>	Site	Possible	Partly reversible	No Loss	Short Term	Negligible	Low
<b>Score</b>	1	2	3	1	1	1	1
<b>Significance Calculation</b>	<b>Without Mitigation</b>		<b>With Mitigation</b>				

S=(E+P+R+I+D+C)*M	Moderate Negative Impact (30)	Low Negative Impact (9)
Was public comment received? Not yet		
Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods		
<p>Mitigation measures to reduce residual risk or enhance opportunities:</p> <ul style="list-style-type: none"> <li>• The development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout prior to construction.</li> <li>• Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation.</li> <li>• Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc).</li> </ul> <p>To minimise the impact of the access roads:</p> <ul style="list-style-type: none"> <li>• Use existing roads or upgrade existing tracks to cross wetlands rather than constructing entirely new roads wherever possible.</li> <li>• Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences.</li> <li>• Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils.</li> <li>• Where required, all pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be constructed with an appropriate drop inlet structure on the upstream side to ensure that head cut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert.</li> <li>• The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown.</li> <li>• Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities.</li> <li>• Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted.</li> <li>• All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated.</li> </ul> <p>It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.</p>		
Residual impact	Very low and acceptable with adoption of mitigation measures	

**Table 12: Impact assessment summary for Impact 5 – Changes to the hydrological regime and increase potential for erosion**

<b>Impact Phase:</b> Construction and Decommissioning							
<b>Nature of the impact:</b> Increased hard surfaces can result in increases in runoff generated by the site, thereby resulting in changes to localised hydrological regimes.							
<b>Description of Impact:</b> During construction, complete clearing of the PV panel areas, as well any ancillary structures (offices and substations) will be required, which may impact the aquatic function or any corridors or connections between aquatic systems. However, these areas have all been avoided by the proposed layout by also making use of existing road crossings or by considering any of the proposed buffers.							
<b>Impact Status:</b> Negative							
	<b>E</b>	<b>P</b>	<b>R</b>	<b>I</b>	<b>D</b>	<b>C</b>	<b>M</b>
<b>Without Mitigation</b>	Local	Probable	Irreversible	No Loss	Long Term	Low	Medium
<b>Score</b>	2	3	4	1	3	2	2
<b>With Mitigation</b>	Site	Possible	Partly reversible	No Loss	Short Term	Negligible	Low
<b>Score</b>	1	2	3	1	1	1	1
<b>Significance Calculation</b>	<b>Without Mitigation</b>		<b>With Mitigation</b>				
<b>S=(E+P+R+I+D+C)*M</b>	Moderate Negative Impact (30)		Low Negative Impact (9)				
Was public comment received? Not yet							
Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods							
<p>Mitigation measures to reduce residual risk or enhance opportunities:</p> <ul style="list-style-type: none"> <li>No stormwater discharged may be directed to delineated aquatic zones or the associated buffers.</li> <li>A stormwater management plan finalised prior to construction, detailing the structures and actions that must be installed to prevent the increase of surface water flows directly into any natural systems.</li> <li>Effective stormwater management must include measures to slow, spread and deplete the energy of concentrated flows thorough effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed areas</li> </ul> <p>To minimise the impact of the access roads:</p> <ul style="list-style-type: none"> <li>Use existing roads or upgrade existing tracks to cross wetlands rather than constructing entirely new roads wherever possible.</li> <li>Use the smallest possible working corridor. Outside the working corridor, all watercourses are to be considered no go areas.. Where intrusion is required, the working corridor must be kept to a minimum and demarcated clearly, before any construction commences.</li> <li>Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils.</li> <li>Where required, all pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. Crossings that are installed below the natural ground level are to be</li> </ul>							

<p>constructed with an appropriate drop inlet structure on the upstream side to ensure that head cut erosion does not develop as a result of the gradient change from the natural ground level to the invert level of the culvert.</p> <ul style="list-style-type: none"> <li>• The channel profile, regardless of the current state of the river / water course, will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown.</li> <li>• Water diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions shall be removed to restore natural flow patterns. Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities.</li> <li>• Any fauna (frogs, snakes, etc.) that are found within the construction area must be moved to the closest point of similar habitat type outside of the areas to be impacted.</li> <li>• All disturbed areas beyond the construction site that are intentionally or accidentally disturbed during the construction phase must be rehabilitated.</li> </ul> <p>It is the contractor’s responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which prevents any damage to the remaining indigenous species and inhibits the re-infestation of the cleaned areas.</p>	
Residual impact	Very low and acceptable with adoption of mitigation measures

**Table 13: Impact assessment summary for Impact 6 –Changes to surface water quality characteristics**

<b>Impact Phase:</b> Construction and Decommissioning							
<b>Nature of the impact:</b> Potential impact on localised surface water quality (indirect)							
<b>Description of Impact:</b> During construction or decommissioning, earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. This can result in possible deterioration in aquatic ecosystem integrity and species diversity.							
<b>Impact Status:</b> Negative							
	E	P	R	I	D	C	M
<b>Without Mitigation</b>	Local	Probable	Irreversible	No Loss	Long Term	Low	Medium
<b>Score</b>	2	3	4	1	3	2	2
<b>With Mitigation</b>	Site	Possible	Partly reversible	No Loss	Short Term	Negligible	Low
<b>Score</b>	1	2	3	1	1	1	1

Significance Calculation	Without Mitigation	With Mitigation
$S=(E+P+R+I+D+C)*M$	Moderate Negative Impact (30)	Low Negative Impact (9)
Was public comment received? Not yet		
Has public comment been included in mitigation measures? Note still in the draft phase and that comment will be obtained during the NEMA comment periods		
Mitigation measures to reduce residual risk or enhance opportunities:		
<ul style="list-style-type: none"> <li>All liquid chemicals including fuels and oil, including for the BESS, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely.</li> <li>Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment).</li> <li>Mechanical plant and bowsers must not be refueled or serviced within 100m of a river channel or wetland.</li> <li>All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be beyond any demarcated water courses and their respective buffers.</li> <li>Littering and contamination associated with construction activity must be avoided through effective construction camp management.</li> <li>No stockpiling should take place within or near a water course.</li> <li>All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable.</li> </ul> <p>ESO monitors the site on a daily basis to ensure plant is in working order (minimise leaks), spills are prevented and if they do occur, are quickly rectified.</p>		
Residual impact	Low risk and acceptable, with adoption of mitigation measures and monitoring	

**Table 14: Impact assessment summary for Impact 7 - Cumulative impact assessment for aquatic biodiversity**

<b>Cumulative Impact:</b> Cumulative impacts on the aquatic resources of the area							
<b>Description of Cumulative Impact:</b> The cumulative impact assessment considers the combined impact of the remaining and other renewable projects within a 30km radius, that are also in the development phase and the associated grid lines on the aquatic resources. The rating below is based on the premise that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.							
<b>Impact Status:</b> Negative							
	E	P	R	I	D	C	M
<b>Without Mitigation</b>	Local	Probable	Irreversible	No Loss	Long Term	Low	Medium
<b>Score</b>	2	3	4	1	3	2	2
<b>With Mitigation</b>	Site	Possible	Partly reversible	No Loss	Short Term	Negligible	Low

<b>Score</b>	1	2	3	1	1	1	1
<b>Significance Calculation</b>	<b>Without Mitigation</b>			<b>With Mitigation</b>			
<b>S=(E+P+R+I+D+C)*M</b>	Moderate Impact (30)	Negative	Low Negative Impact (9)				
Can Impacts be Enhanced?	No						
Enhancement:	<p>The project should share roads and infrastructure where possible to reduce the overall footprint and reduce stormwater and erosion and sedimentation related impacts</p> <p>The projects should collaborate with provincial roads authority to upgrade the main access routes and improve the crossings and stormwater controls</p>						
Residual impact	Low						

#### 9.4 Draft Specialists Recommendations for the inclusion in the EA

The DFFE Screening Tool identified two sensitivity ratings within the development footprint, namely, Low and Very High. There is overlap with the findings on site and the Screening Tool’s outcome, thus the development footprint must be developed with cognisance of these sensitivities.

Therefore, environmental sensitivity input received from the aquatic ecology specialist will be taken forward and considered within the EIA process and the impact to these areas assessed. Appropriate layout and development restrictions will be implemented within the development footprint to ensure that the impact to aquatic ecology is deemed acceptable by the aquatic ecologist.

The specialist has no objection to the authorisation of the proposed activities assuming that all mitigations and buffer zones are implemented.

Mitigation should focus on these areas and include measures to halt erosion and rehabilitate habitat in the sections affected by the construction. Without the implementation of mitigation measures, the project has potential to cause a Low cumulative impact upon aquatic biodiversity. However, with the adoption of mitigation, the proposed project will have a Very Low impact upon aquatic biodiversity.

## 10 Monitoring and Management Actions

The following are key recommendations, which are also critical to the proposed mitigations:

- Any of the activities, should also be monitored by the appointed Environmental Officer /Environmental Control Officer (EO/ECO) on a daily basis, especially during periods of river flow during construction.
- Any points of erosion should be stabilised immediately (sand bags in the short term) using gabions and reno mattress as required. No activities should take place outside of the demarcated servitude, to prevent additional cumulative impacts on these systems.
- The EMP, must include a Construction Specific Monitoring and Rehabilitation Plan related to the water course and wetland crossings, and specifically to the prevention of erosion and sedimentation



as these systems are prone to scour, with rehabilitation options being limited due to the sparse nature of the vegetation.

- Monitoring should occur on a monthly basis for 6 months post construction and where any unstable soils occur, these must be protected with temporary stabilisation dependent on the scale of the impact i.e. sand bags - hay bales) until areas become revegetated. If any areas require permanent erosion protection (e.g. gabions or stone pitching) then the WULA/GA must be amended to include these areas.

## **11 Conclusion and Recommendations**

During this assessment, several sensitive aquatic habitats were observed and are shown in the maps provided in this report. Noteworthy areas, were then avoided by the required infrastructure, and include the main riverine and wetland systems, while the access roads could will make use of existing roads thus previously disturbed areas.

In summary, the impacts upon aquatic biodiversity associated with the project are of Low significance, after mitigation. The loss of irreplaceable aquatic habitat and/or important biota is highly unlikely, i.e. Very High sensitivity or No-Go areas. This also includes the spanning of a functioning drainage line, which would not be seen as problematic, if suitable stormwater management and drainage from the area of the site is provided.

The specialist has no objection to the authorisation of the proposed activities assuming that all mitigations and buffer zones are implemented.

The significant impacts are associated with the access road crossings river systems. These systems are generally in a modified state, but still provide some habitat and important ecological functions.

Mitigation should focus on these areas and include measures to halt erosion and rehabilitate habitat in the sections affected by the construction. Without the implementation of mitigation measures, the project has potential to cause a Moderate cumulative impact upon aquatic biodiversity. However, with the adoption of mitigation, the proposed project will have a Low impact upon aquatic biodiversity.

## 12 References

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## 13 Appendix 1 – Copy of Specialist CV

### **CURRICULUM VITAE Dr Brian Michael Colloty 7212215031083**

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Pari Park  
Port Elizabeth, 6070  
b.colloty@gmail.com  
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: 25 years

#### **SKILLS BASE AND CORE COMPETENCIES**

- 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. 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**

- Kenmare Mining Piliwilli, Mozambique - wetland (mangroves, peatlands and estuarine) assessment and biodiversity offset analysis - current
- 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 Biofeuls 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 African

- Plant and animal search and rescue for the Karusa and Soetwater Wind Farms on behalf of Enel Green Power, Current
- 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 Exxaro 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.
- Biodiversity and aquatic assessments for 118 renewable projects in the past 9 years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, Red Cap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. Particular aquatic sensitivity assessment and Water Use License Applications on behalf of Mainstream Renewable Energy (8 wind farms and 3 PV facilities.), Cennergi / Exxaro (2 Wind farms), WKN Wind current (2 wind farms & 2 PV facilities), ACED (6 wind farms) and Windlab (3 Wind farms) were also conducted. Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- 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).

## 14 Appendix 2: Site verification report, as per the DFFE Screening Tool guideline

### Site verification report – Aquatic Ecology

Government Notice No. 645, dated 10 May 2019, includes the requirement that an Initial Site Sensitivity Verification Report must be produced for a development footprint. As per Part 1, Section 2.3, the outcome of the Initial Site Verification must be recorded in the form of a report that-

- (a) Confirms or disputes the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool;
- (b) Contains a motivation and evidence of either the verified or different use of the land and environmental sensitivity;
- (c) Is submitted together with the relevant reports prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

This report has been produced specifically to consider the aquatic ecology theme and addresses the content requirements of (a) and (b) above. The report will be appended to the respective specialist study included in the Scoping and EIA Reports produced for the projects.

### Site sensitivity based on the aquatic biodiversity theme included in the Screening Tool and specialist assessment

Based on the DFFE Screening Tool, the site contains areas of very high sensitivity due to the presence of (Figure 1):

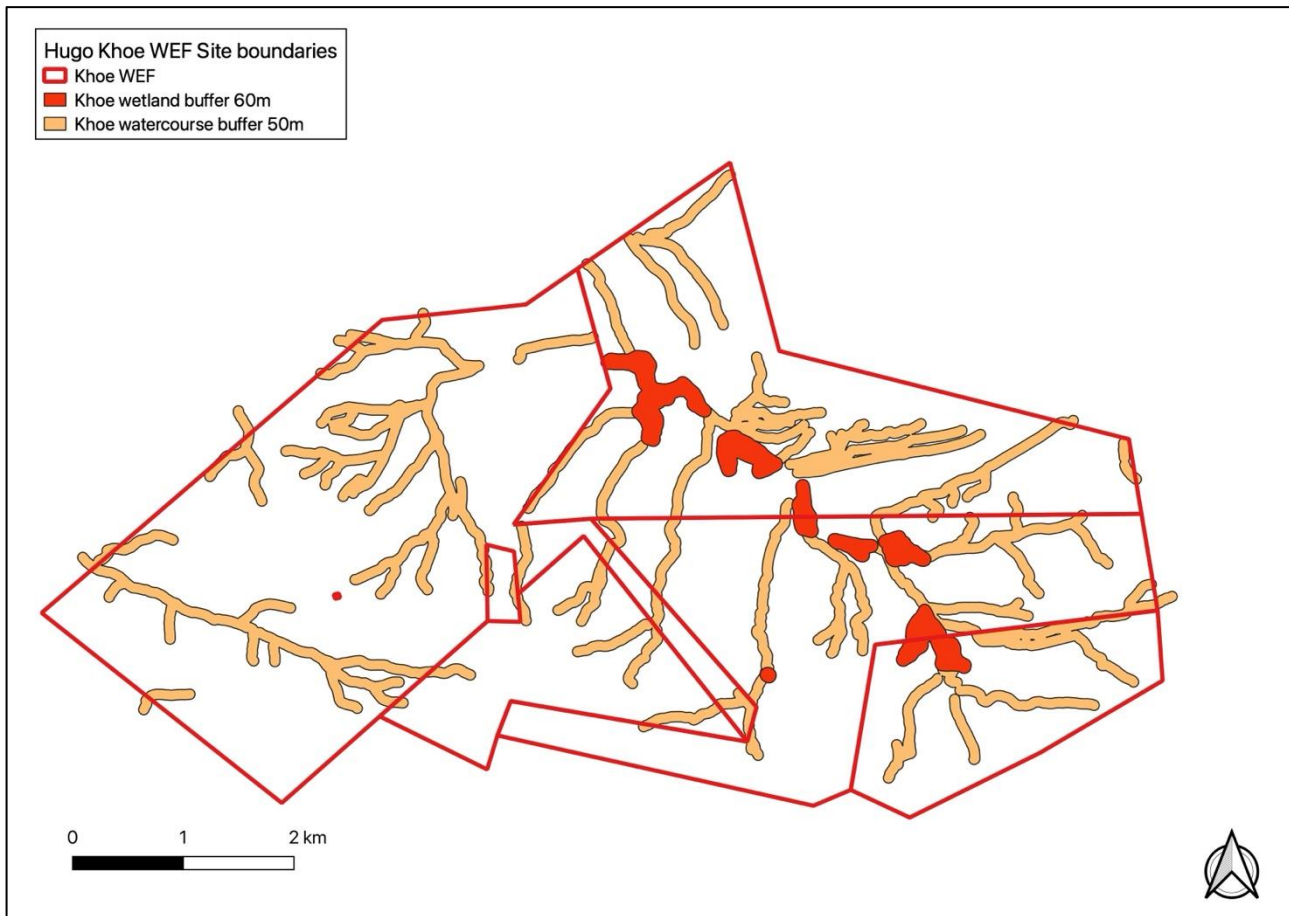
- Critical Biodiversity Areas (CBA) 1: Aquatic
- Ecological Support areas (ESA) 1: Aquatic



**Figure 1. DFFE Screening Tool outcome for the aquatic biodiversity theme**

Based on the above outcomes, the specialist **agrees with** the environmental sensitivities identified on site. The findings have been informed by a site visit undertaken by Dr Brian Colloty in 1-3 September 2023. Some of the systems observed are sensitive and thus shown in this assessment as No-Go i.e. Very High sensitivity.

Figure 2 below shows the sensitivity map produced following the desktop assessment as well as a groundtruthing exercises, with mapping of the observed features at a finer scale.



**Figure 2. Environmental sensitivity map produced by the aquatic specialist (High)**

Motivation of the outcomes of the sensitivity map and key conclusions

In conclusion, the DFFE Screening Tool identified two sensitivity ratings within the development footprint, namely, Low and Very High. There is overlap with the findings on site and the Screening Tool's outcome, thus the development footprint must be developed with cognisance of these sensitivities.

Therefore, environmental sensitivity input received from the aquatic ecology specialist will be taken forward and considered within the EIA process and the impact to these areas assessed. Appropriate layout and development restrictions will be implemented within the development footprint to ensure that the impact to aquatic ecology is deemed acceptable by the aquatic ecologist.

## 15 Appendix 3: Compliance with the Aquatic Biodiversity Protocol (GN 320, 20 March 2020)

<b>Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity</b>	<b>Section where this has been addressed in the Specialist Report</b>
<p>2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:</p> <p>2.3.1. a description of the aquatic biodiversity and ecosystems on the site, including;</p> <p>a) aquatic ecosystem types; and</p> <p>b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution, and movement patterns;</p>	Section 6 Pg 20
<p>2.3.2. the threat status of the ecosystem and species as identified by the screening tool;</p>	Section 6 Pg 20
<p>2.3.3. an indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e., if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free -flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and</p>	Section 6 Pg 20
<p>2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including:</p> <p>a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g., movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and</p> <p>b) the historic ecological condition (reference) as well as present ecological state of rivers (in- stream, riparian, and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).</p>	Section 6 Pg 20
<p>2.4. The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.</p>	Section 8 Page 25
<p>2.5. Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions:</p> <p>2.5.1. Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?</p> <p>2.5.2. Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?</p> <p>2.5.3. How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include:</p>	Section 9



<b>Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity</b>	<b>Section where this has been addressed in the Specialist Report</b>
<ul style="list-style-type: none"> <li>a) <i>impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g., suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes);</i></li> <li>b) <i>will the proposed development change the sediment regime of the aquatic ecosystem and its sub -catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);</i></li> <li>c) <i>what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g., at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and</i></li> <li>d) <i>to what extent will the risks associated with water uses and related activities change;</i></li> </ul>	
<p>2.5.4. <i>how will the proposed development impact on the functioning of the aquatic feature? This must include:</i></p> <ul style="list-style-type: none"> <li>a) <i>base flows (e.g., too little or too much water in terms of characteristics and requirements of the system);</i></li> <li>b) <i>quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g., seasonal to temporary or permanent; impact of over - abstraction or instream or off stream impoundment of a wetland or river);</i></li> <li>c) <i>change in the hydrogeomorphic typing of the aquatic ecosystem (e.g., change from an unchannelled valley-bottom wetland to a channelled valley -bottom wetland);</i></li> <li>d) <i>quality of water (e.g., due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication);</i></li> <li>e) <i>fragmentation (e.g., road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and</i></li> <li>f) <i>the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g., waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);</i></li> </ul>	Section 9
<p>2.5.5. <i>how will the proposed development impact on key ecosystems regulating and supporting services especially:</i></p> <ul style="list-style-type: none"> <li>a) <i>flood attenuation;</i></li> <li>b) <i>streamflow regulation;</i></li> <li>c) <i>sediment trapping;</i></li> <li>d) <i>phosphate assimilation;</i></li> <li>e) <i>nitrate assimilation;</i></li> <li>f) <i>toxicant assimilation;</i></li> <li>g) <i>erosion control; and</i></li> <li>h) <i>carbon storage?</i></li> </ul>	Section 9
<p>2.5.6. <i>how will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?</i></p>	Section 9

<b>Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity</b>	<b>Section where this has been addressed in the Specialist Report</b>
2.6. In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: a) size of the estuary; b) availability of sediment; c) wave action in the mouth; d) protection of the mouth; e) beach slope; f) volume of mean annual runoff; and g) extent of saline intrusion (especially relevant to permanently open systems).	N/A
2.7. The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	This report
2.7.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix 1
2.7.2. a signed statement of independence by the specialist;	Attached to BAR
2.7.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 6
2.7.4. the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	Section 5
2.7.5. a description of the assumptions made any uncertainties or gaps in knowledge or data;	Section 1
2.7.6. the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	Section 8
2.7.7. additional environmental impacts expected from the proposed development;	Section 9
2.7.8. any direct, indirect, and cumulative impacts of the proposed development on site;	Section 9
2.7.9. the degree to which impacts, and risks can be mitigated;	Section 9
2.7.10. the degree to which the impacts and risks can be reversed;	Section 9
2.7.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	Section 9
2.7.12. a suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies;	Section 4
2.7.13. proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	Section 9
2.7.14. a motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate;	Section 9
2.7.15. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	Section 10
2.7.16. any conditions to which this statement is subjected.	Section 10
2.8. The findings of the Aquatic Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the	Yes

<b>Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity</b>	<b>Section where this has been addressed in the Specialist Report</b>
<i>mitigation and monitoring measures as identified, that are to be included in the EMPr.</i>	
2.9. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	Yes