

**ENVIRONMENTAL IMPACT ASSESSMENT (BAR) FOR THE PROPOSED FRONTEER  
WIND FARM, IN THE EASTERN CAPE PROVINCE**

**AQUATIC IMPACT ASSESSMENT**

**FOR**

**SAVANNAH ENVIRONMENTAL (PTY) LTD**

**BY**



**EnviroSci (Pty) Ltd**

**Dr Brian Colloty**

1 Rossini Rd  
Pari Park  
Port Elizabeth  
6070

**DATE**

17 February 2021

**REVISION 1**

## Executive Summary

Savannah Environment (Pty) Ltd appointed EnviroSci (Pty) Ltd to conduct an assessment of the potential impact of the proposed wind farm and supporting infrastructure on the aquatic environment. This based on a detailed site visits conducted for the project in 2020. The study area includes the affected farm portions as listed in the project description section, a potential development area of 2689 ha area and this will contain the 49.4 ha development footprint. The footprint is defined as any area that will require disturbance when establishing the project should it proceed. At times reference is made to the study region, which refers to the greater Subquaternary catchments in which the study area/development area falls when relevant as context.

This assessment included the delineation of any natural waterbodies within the development area in question, as well as assessing the potential consequences of the proposed layout on the surrounding watercourses and wetlands. This was based on information collected during the site specific visits (January / February and May / June 2020) and was compared to assessment data collected in the same area from 2012 onwards for other wind farm projects, thus spanning various seasons within the region. This allowed for the collection of important detail on the extent of these largely ephemeral systems, with the exception of the Great Fish River, which receives managed flows via the Gariep / Orange River Transfer Scheme.

The surveys adhered to the assessment criteria contained in the DWAF 2005/2008 delineation manuals, the National Wetland Classification System and the requisite habitat integrity methods to determine the Present Ecological State (PES) and the Ecological Importance and Sensitivity (EIS) of the observed aquatic systems. Note the PES rating scale is also used to show the Ecological Category of the system being assessed.

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.

It should be noted that the aquatic sensitivity spatial data was provided to the applicant prior to the lodging of the application for environmental authorisation, in order to develop an optimal layout. This approach would then allow for the avoidance of any critical habitats and where not possible provide mitigation to reduce the significance of the potential aquatic impacts, such as any required road crossings.

This process also then negated the need to assess any alternative sites and or layouts within this development area. Consolidation of access roads, transmission lines and substations, further limiting the overall or cumulative impacts within the greater region would also be achieved.

The proposed development occurs within the following Subquaternary (Quinary) catchments with the respective mainstem rivers all within the Southern Folded Mountains Ecoregion:

- Q91C Brak River
- P10A New Year's River

The development area contains short tributaries that link to these systems, consisting mostly of non-perennial rivers, within incised valleys that contain narrow riparian systems, more typical of the Drought Corridor Ecoregion, 9km north of the area.

Overall, these watercourses are largely in a natural state, when compared to other mainstem systems within the greater region (e.g. Great Fish River), which is considered Largely Modified. Current or existing impacts occur in localised areas within the development area and these include existing roads

/tracks, evidence of grazing (livestock), bush encroachment (*Vachellia karroo*) and various farm dams (surface water impoundments).

The National Wetland Inventory v5.2 spatial data (NWI), only indicated natural riverine systems and depressions/pans within the study area, as well as the high number of artificial farm dams. The presence of the pans, Critical Biodiversity Areas and National Freshwater Ecosystems Priority Areas (NFEPA), resulted in portions of the study area, receiving a Very High Aquatic sensitivity rating in the DEFF Screening Tool. Based on this, an Aquatic Biodiversity Assessment (this report) is required as part of the Basic Assessment process being undertaken for the project.

The only natural wetlands observed within or in close proximity to the development area, included seven depressions. These, inclusive of the proposed buffers (57m), will be avoided by the development footprint (including the access road) based on the information supplied in this report. Any activities within 500m of these pan boundaries will however require a Water Use License, which has been initiated by the Applicant.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all the riverine (riparian not wetland) systems within the development area have been assigned a condition score of AB (Nel *et al.* 2011), indicating that they are largely intact and perform an ecological function. However, the development area systems are ephemeral and only carried water for short periods, thus the observed systems do not support any wide riparian zones and the vegetation associated with these watercourses were between 0.25 m and 20 m wide and contain mostly terrestrial species.

The only dense riparian vegetation was found along reaches of the Fish and Brak Rivers, dominated by sedges and grasses (*Cynodon dactylon*, *Cyperus textilis*, *Phragmites australis*) on the river edge, while tall trees on the steep banks (*Searsia lancea*, *Combretum caffrum*), and thicket trees and shrubs on the upper slope of the banks included *Azima tetraantha*, *Buddleja saligna*, *Ehretia rigida*, *Gymnosporia heterophylla*, *Lycium* spp., *Olea europea* subsp. *africana*, *Vachellia karroo* and *Ziziphus mucronate*.

Climbers, including *Asparagus* spp. and *Cynanchum* spp., dwarf shrubs (*Felicia* spp.), and grasses (*Panicum deustum*, *P. maximum*) and succulents (*Drosanthemum hispidum*, *Malephora lutea*) occur in the open patches and disturbed margins of the riparian zones.

#### **No aquatic species of special concern were observed within the development area.**

The National Freshwater Ecosystems Priority Areas (NFEPA) (Nel *et al.*, 2011), also earmarked sub-quaternaries, based either on the presence of important biota (e.g. rare or endemic fish species) or conversely the degree of riverine degradation, i.e. the greater the catchment degradation the lower the priority to conserve the catchment. The important catchment areas are then classified as Freshwater Ecosystems Priority Areas (FEPAs).

The development area falls within an Upstream Support Area, which is earmarked as a support catchment for FSAs (Fish Support Areas) and a Phase 2 FEPA, while portions of the development area are located within an Ecological Support Area Type 1 as per the Eastern Cape Biodiversity Conservation Plan (ECBCP, 2019).

The Present Ecological State (PES) and the Ecological Importance and Sensitivity Scores (EIS) were based on the current state and function of the natural systems observed, or where systems contributed to the ecological character of the development footprint. These ratings were then translated in the respective sensitivity ratings of the various aquatic systems (High to Low), and used to prepare a sensitivity map, used in guiding the preparation of the layout.

The following summary is present of the PES/EIS score of the natural wetlands found within or adjacent to the development footprint of this project.

Feature number	Hydrogeomorphic Type	Present Ecological State	Ecological Importance and Sensitivity	Overall Sensitivity	Buffer as per Macfarlane & Bredin (2017) Model
1	Pan/Depression	B/C	High	High	57
2	Pan/Depression	B	High	High	57
3	Pan/Depression	B	High	High	57
4	Pan/Depression	D/E	Low	Low	57
5	Pan/Depression	D/E	Low	Low	57
6	Pan/Depression	B	High	High	57
7	Pan/Depression	B/C	High	High	57

With regard to the watercourses, none of the complex riparian zones as described above are located within the development footprint, with only small drainage lines and watercourses being affected by the proposed access roads connecting the wind turbines. In this assessment the PES / EIS of these systems was rated a C or Moderately Modified, mostly due to grazing activities and a LOW EIS, due to the features being ephemeral with little to no aquatic features. Therefore, these were rated as having a LOW sensitivity, but must still be avoided by the larger infrastructure (turbines, hardstands and buildings/substations). Therefore, all road crossings of these small drainage features are considered to be acceptable from an aquatic perspective.

Thus, the layout for the most part, will be developed further to avoid the pans (Pan 1 and 3), inclusive of the associated buffers indicated in this report, as these areas corresponded to the Very High Sensitivity systems considered in the DEFF Screening Tool spatial data. Similarly the BoP will also be adjusted to avoid the minor water course and the proposed buffer.

While the watercourses will be only be impacted upon by a limited number of water course crossings that will be mitigated by appropriate measures which include erosion protection etc.

Therefore, the following direct impacts were then assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and assessed against the layout:

Biodiversity Assessment Protocol Impacts found applicable to this project	Impacts assessed in this report below
Fragmentation (physical loss of ecological connectivity and or CBA corridors)	Impact 1 & 2
Changes in numbers and density of species	Impact 1 & 2
Faunal and vegetation communities inhabiting the site	Impact 1 & 2
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 3
Streamflow regulation	Impact 3
Erosion control	Impact 4
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication)	Impact 5
Cumulative Impacts	Impact 6

- Impact 1: Loss of High Sensitivity systems, namely the pans through physical disturbance the proposed layout will need to be altered to avoid these systems inclusive of the associated buffers (Figure 8).
- Impact 2: Impact on water courses (Low Sensitivity), through physical disturbance
- Impact 3: Impact on all watercourse and wetland systems through the possible increase in surface water runoff on riparian form and function through hydrological changes
- Impact 4: Increase in sedimentation and erosion
- Impact 5: Risks on the aquatic environment due to water quality impacts
- Impact 6: Cumulative impacts

In summary, the proposed layout for the facility would not have a direct impact on the following:

- Any Very High sensitivity areas identified by the DEFF Screening Tool for the development footprint
- Mainstem riparian systems (outside of the development footprint) and Pans that do contain functioning aquatic environments that received a High sensitivity rating will also be avoided as the development layout is amended

Therefore, based on the results of this report, the significance of the remaining impacts assessed for the aquatic systems after mitigation would be LOW. This includes the internal roads proposed that would need to cross some of these systems. Thus, based on the findings of this study no objection to the authorisation of any of the proposed activities is made at this point based on the current layout as provided by the developer. This is subject to the final layout being updated to include the recommendations, i.e. avoidance of the pans 1 and 3, and move the BoP area away from a drainage line.

This report also indicates the watercourses and pans within 500m of the development area. Any activities within these areas, the buffers or 500m from the wetland boundary, will require a Water Use license under Section 21 c and i of the National Water Act (Act 36 of 1998).

As the proposed activities have the potential to create erosion, the following recommendations are proposed:

- Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment, and suitable dust and erosion control mitigation measures should be included in the EMP to mitigate the impact.
- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid the spread of any contamination / leaks outside of any delineated waterbodies and their buffers. Washing and cleaning of equipment should also be done in berms or bunds to trap any cement / hazardous substances and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any watercourse

- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO must be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas along aquatic features, using selected species detailed in this report.
- All alien plant re-growth must be monitored and should these alien plants reoccur these plants must be re-eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.
- It is further recommended that a comprehensive rehabilitation plan be implemented from the project onset within watercourse areas (including buffers) to ensure a net benefit to the aquatic environment. This should form part of the suggested walk down as part of the final EMP preparation during the pre-construction phase.

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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	Ecological Importance and Sensitivity
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
GIS	Geographic Information System
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, <i>et al.</i> 2011).
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SQ	Subquaternary catchment
WUL	Water Use License
WULA	Water Use License Application



**COMPLIANCE WITH THE PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT  
CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON AQUATIC BIODIVERSITY ISSUED 20  
MARCH 2020, REPLACING REQUIREMENTS OF APPENDIX 6 – GN R326 EIA REGULATIONS OF 7 APRIL  
2017**

DEA Screening Tool Summary			
Requirement	Completed / Assessed	Date	Comments
Desktop and satellite imagery analysis	Yes	5 March 2020	
Preliminary On-site inspection	No	January / February and May / June 2020	Several summer / winter, as well low and high rainfall periods have been observed within the region over the years
Additional information			Results
1:50 000 topocadastral maps	Yes	October 2020	Cadastre and indicated features unchanged
Google Earth	Yes	October 2020	Used as the basis of GIS mapping and layout verification
National Wetland Inventory Spatial Data	Yes	October 2020	Natural and artificial systems present
National Vegetation Spatial Data	Yes	October 2020	Saltire Karroid Thicket, Albany Valley Thicket & Grahamstown Grassland Thicket
Threatened Ecosystems Spatial Data	Yes	October 2020	None
Conservation Plans (WCBSP, ECBCP, NCBSP etc)	Yes	October 2020	ECBCP ESA 1
National Freshwater Ecosystem Priority AREA (NFEPA)	Yes	October 2020	Phase 2 FEPA & Upstream FEPA
Strategic Water Resource Area	Yes	October 2020	None
Free flowing Rivers	Yes	October 2020	None
Wetland Clusters	No	October 2020	None
Critical Biodiversity Area (CBA)	Yes	October 2020	No
Ecological Support Area (ESA)	Yes	October 2020	Yes
Ecological Importance and Sensitivity of Site (EIS)	Yes	October 2020	High to LOW
Description of ecosystem processes (movement of surface water, recharge/discharge & sediment transport etc)	Yes	October 2020	Ephemeral systems with little to no riparian zones and small pans

Historic Reference Condition and Present Ecological State (PES) of rivers (instream, riparian, floodplain), wetlands or estuaries and possible changes to channel and flow regime (surface & groundwater)	Yes	October 2020	PES = B to D/E Reference Condition B	
<b>Review of Screening Tool results</b>	<b>Present</b>	<b>Confirmed / Disputed (if disputed photographic evidence must be included into assessment)</b>	<b>Aquatic Biodiversity Specialist Assessment Protocol Required (Y/N or N/A)</b>	<b>Aquatic Biodiversity Compliance Statement Protocol required (Y / N or N/A)</b>
Very High Aquatic Habitat	Yes	Confirmed, but will be avoided by the proposed layout	N/A	N/A
Low Aquatic Habitat	Yes	Confirmed	YES – reasons stated in this report	N/A
<b>ASSESSMENT AND REPORTING OF IMPACTS ON AQUATIC BIODIVERSITY PROTOCOL REQUIREMENTS</b>				
<b>Aquatic Biodiversity Specialist Assessment Protocol</b>	<b>YES</b>	<b>Aquatic Biodiversity Compliance Statement Protocol</b>		<b>NO</b>
<i>Reason</i>	VERY HIGH aquatic habitats – within proximity of the development	<i>Reason</i>		
Proposed Site (Site Sensitivity)	Low only within the footprint	Proposed Site (Site Sensitivity)		
Preferred Site (Site Sensitivity)	Not assessed as site specific sensitive no-go areas were provided at the onset of the design process in order to avoid the systems that were rated as No-Go, where feasible	Preferred Site (Site Sensitivity)		
<b>ANTICIPATED IMPACT AND IF REQUIRING ASSESSMENT IN THE SPECIALIST ASSESSMENT</b>	<b>(Y/N)</b>	<b>AQUATIC BIODIVERSITY COMPLIANCE STATEMENT REQUIREMENTS</b>		<b>(Y/N)</b>
<b>Aquatic features</b>		<b>Aquatic features</b>		
Alteration in baseflow (increase or Reduction of overall flows)	No	Preferred site and proposed development footprint assessed		Yes
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Yes	LOW site sensitivity confirmed		Yes with additional No-Go areas provided by the aquatic specialist including buffers

Change in hydrogeomorphic typing (Unchannelled valley bottom wetland to Channelled Valley Bottom Wetland)		Confirm whether or not the proposed development will have an impact on the aquatic features	Impacts will still occur
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication)	No		
Fragmentation (physical loss of ecological connectivity and or CBA corridors)	Yes		
Loss or degradation of unique characters or features (waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, pans/ depressions)	Yes		
<b>Ecosystem regulating and supporting services</b>			
Flood attenuation	No		
Streamflow regulation	Yes		
Sediment trapping	No		
Phosphate assimilation	No		
Nitrate assimilation	No		
Toxicant assimilation	No		
Erosion control	Yes		
Carbon storage	No		
<b>Ecosystem Community Composition</b>			
Changes in numbers and density of species	Yes		
Integrity (condition, viability, predator prey ratios, dispersal rates)	Yes		
Faunal and vegetation communities inhabiting the site	Yes		
<b>Estuary function (where applicable)</b>			
Size of estuary	N/A		
Availability of sediment	N/A		
Wave action in mouth	N/A		
Protection of mouth	N/A		

Beach slope	N/A		
volume of Mean Annual Runoff	N/A		
Extent of saline intrusion (especially where relevant to Permanently Open Systems	N/A		
<b>REPORTING REQUIRMENTS ADDRESSED OR INCLUDED IN THE ASSESSMENT / COMPLIANCE STATEMENT (REPLACING SECTION 6 OF NEMA REGUALTIONS (REPORTING REQUIREMENTS</b>			
Details of SACNASP author included (Registration number, field of expertise and CV	YES	Details of SACNASP author included (Registration number, field of expertise and CV attached in appendix 1.	
Signed statement of independence	YES	Signed statement of independence	
Statement of duration, date and season of site inspection, methods and models use, as well as equipment	YES	A baseline profile description of biodiversity and ecosystems of the site	
Description of assumptions and limitations (uncertainties & knowledge gaps)	YES	The methodology used to verify the sensitivities of the aquatic biodiversity features on the site including the equipment and modelling used where relevant.	
Location of No-Go areas for construction and operation	YES	In the vase of linear activity, confirmation from the aquatic biodiversity specialist that in their opinion, based on the mitigation and remedial measures proposed the land cane be returned to the current state within two years of completion of the construction phase.	
Additional environmental impacts	YES	Proposed impact management actions and impact management outcomes or any monitoring requirements for inclusion in the EMPr.	
Direct, indirect and cumulative impacts assessed	YES	Description of assumptions and limitations (uncertainties & knowledge gaps).	
Degree to which impacts and risks can be mitigated	YES	Any conditions to which approval is subject	
Degree to which impact or risks can be reversed	YES	Signed copy of assessment must be appended to the BAR or EIA	
Degree to which impact or risks can cause the loss of irreplaceable resources	YES		
Inclusion of a suitable construction and operational buffer using accepted methodologies	YES		

Proposed impact management actions and impact management outcomes for inclusion in the EMPr	YES	
Motivation for using High Sensitive Areas versus available Low Biodiversity Sensitive Areas	YES	
Substantiated statement based on the findings of the specialist assessment, regarding the acceptability or no of the proposed development and if the proposed development should receive approval or not	YES	
Any conditions to which approval is subject	YES	
Signed copy of assessment must be appended to the BAR or EIA	YES	

Note: The above screening and protocol summary table remains intellectual property of EnviroSci (Pty) Ltd may not be distributed unless part of this this document.

# SPECIALIST DECLARATION



## environmental affairs

Department:  
Environmental Affairs  
REPUBLIC OF SOUTH AFRICA

### DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

(For official use only)

File Reference Number:

NEAS Reference Number:

Date Received:

DEA/EIA/

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

### PROJECT TITLE

Fronteer Wind Farm, Eastern Cape.

### Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at <https://www.environment.gov.za/documents/forms>.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

### Departmental Details

#### Postal address:

Department of Environmental Affairs

Attention: Chief Director: Integrated Environmental Authorisations

Private Bag X447

Pretoria

0001

**Physical address:**

Department of Environmental Affairs

Attention: Chief Director: Integrated Environmental Authorisations

Environment House

473 Steve Biko Road

Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:

Email: EIAAdmin@environment.gov.za

**1. SPECIALIST INFORMATION**


Specialist Company Name:	EnviroSci (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Dr Brian Colloty			
Specialist Qualifications:	Ph.D			
Professional affiliation/registration:	SACNASP Pr Sci Nat 400268/07 Ecological			
Physical address:	1 Rossini Rd Pari Park Port Elizabeth 6070			
Postal address:	1 Rossini Rd Pari Park Port Elizabeth 6070			
Postal code:	6070	Cell:	0834983299	
Telephone:	0413662077	Fax:	-	
E-mail:	b.colloty@gmail.com			

**2. DECLARATION BY THE SPECIALIST**

I, \_\_\_\_\_ Brian Colloty \_\_\_\_\_, declare that –

- I act as the independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.

- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



---

Signature of the Specialist

EnviroSci (Pty) Ltd

---

Name of Company:

17 February 2021

---

Date



## SPECIALIST REPORT DETAILS

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

**Expertise / Field of Study:** BSc (Hons) Zoology, MSc Botany (Rivers), Ph.D Botany Conservation Importance rating (Estuaries) and interior wetland / riverine assessment consultant from 1996 to present.

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



Signed: ..... Date:....17 February 2021.....

Appendix 1 of this report contains a detailed CV.

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# 1. Introduction

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This assessment included the delineation of any natural waterbodies within the development area in question, as well as assessing the potential consequences of the proposed layout on the surrounding watercourses and wetlands. This was based on information collected during the site specific visits (January / February and May / June 2020) and was compared to assessment data collected in the same area from 2012 onwards for other wind farm projects, thus spanning various seasons within the region. This allowed for the collection of important detail on the extent of these largely ephemeral systems, with the exception of the Great Fish River, which receives managed flows via the Gariep / Orange River Transfer Scheme.

The surveys adhered to the assessment criteria contained in the DWA 2005/2008 delineation manuals, the National Wetland Classification System and the requisite habitat integrity methods to determine the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the observed aquatic systems. Note the PES rating scale is also used to show the Ecological Category of the system being assessed.

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This process also then negated the need to assess any alternative sites and or layouts within this development area. Consolidation of access roads, transmission lines and substations, further limiting the overall or cumulative impacts within the greater region would also be achieved.

Several important national, provincial and municipal scale conservation plans were also reviewed, with the results of those studies being included in this report. Most conservation plans are produced at a high level, so it is therefore important to verify the actual status of the study area.

## 1.2 Aims and objectives

The aim of this report is to provide the applicant with the requisite delineation of any natural waterbodies, while providing the competent authority with the relevant information to make an informed decision.

Certain aspects of the development may also trigger the need for a Section 21 c & i, Water Use License Applications (WULAs) (or General Authorisation [GA] applications) such as river or water course crossings or any activities within 500m of a wetland boundary. These applications must be submitted to the Department of Water and Sanitation (DWS) and information contained in this report must be used in the supporting documentation.

Information with regard to the state and function of the observed water bodies, suitable no-go buffers and assessment of the potential impacts are also provided.

### 1.3 Assumptions and Limitation

To obtain a comprehensive understanding of the dynamics of both the flora and fauna of the aquatic communities, 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. No baseline long-term monitoring was undertaken as part of this assessment. However, a concerted effort was made to assess as much of the potential development area and the study area, as well as make use of any available literature, species distribution data and aerial photography. Furthermore, based on the previous assessments undertaken between 2012 and 2020 in the area, this was not foreseen as a huge limiting factor. The level of investigation undertaken is sufficient to inform this assessment.

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.

For the purposes of this report, it is assumed that any existing roads and tracks within the development area will be upgraded, while the new roads can avoid or span (Figure 1) the observed watercourses and wetlands as far as possible. A further assumption is that water will be sourced from a licensed resource and not illegally abstracted from any surrounding watercourses and or boreholes, particularly if dust suppression is required.

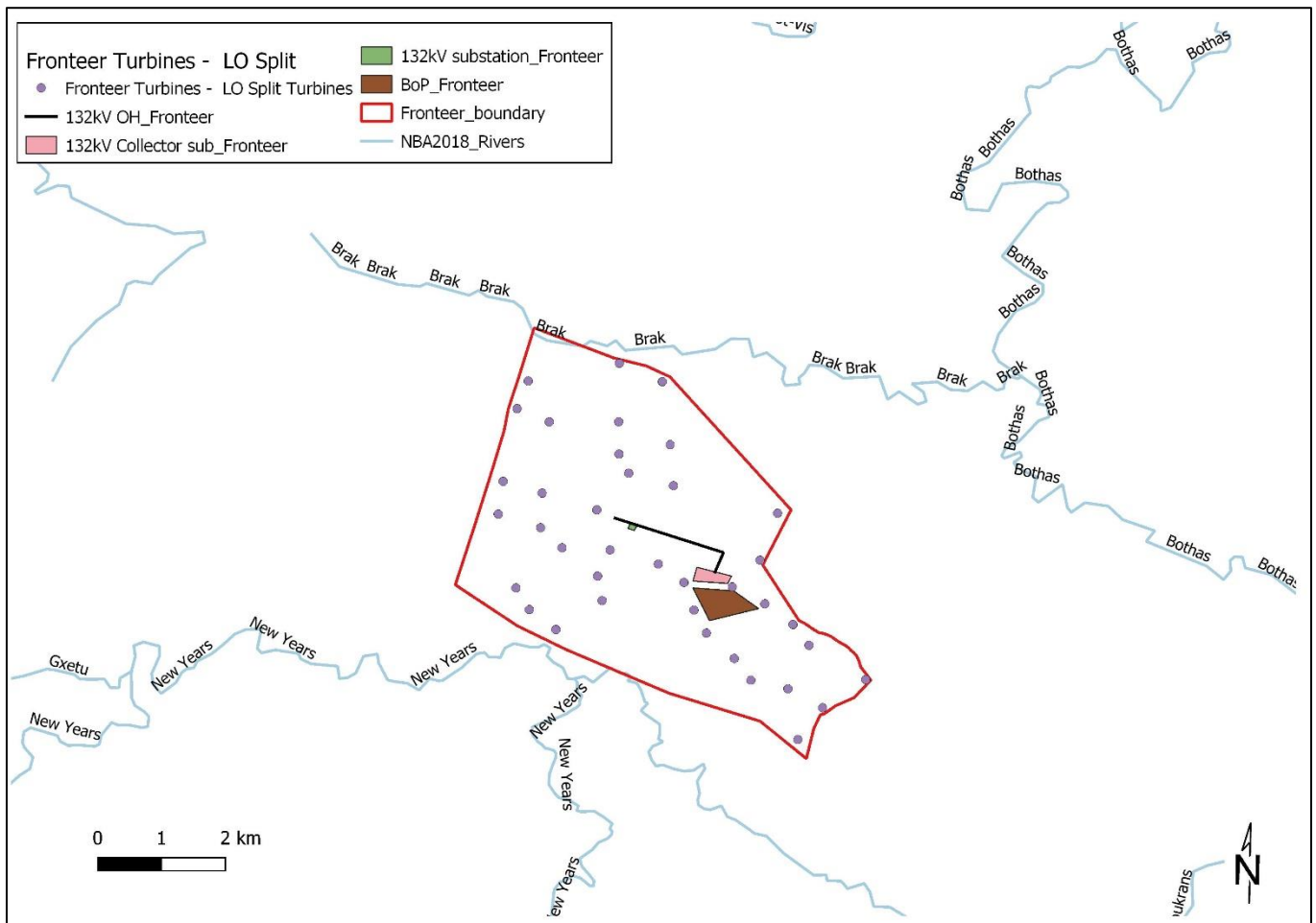


Figure 1: The study area in relation to the mainstem rivers

## 2. Terms of Reference

The following scope of work was used as the basis of this study to fulfil the above requirements as provided by the EAP:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with the Specialist Assessment Protocol 20 March 2020.
- Adherence to all appropriate best practice guidelines, relevant legislation and authority requirements;
- Provide a thorough overview of all applicable legislation and guidelines;
- Cumulative impact identification and assessment as a result of other developments in the area (including; a cumulative environmental impact table(s) and statement, review of the specialist reports undertaken for other Renewable Energy developments and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered);
- Identification of sensitive areas to be avoided (including providing shapefiles/kmls);
- Assessment of the significance of the proposed development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of direct, indirect and cumulative impacts:
  - Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
  - Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
  - Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.
- Comparative assessment of alternatives (infrastructure alternatives have been provided);
- Recommend mitigation measures in order to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (e.g. permits, licenses etc) and specialist comment if the proposed development should be authorised.

## 3. Project Description

The following information was provided by the client:

Fronteer (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 12km north-west of Grahamstown (measured from the centre of the site) within the Makana Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province.

A preferred project site with an extent of ~2689ha has been identified by Fronteer (Pty) Ltd as a technically suitable area for the development of the Fronteer Wind Farm with a contracted capacity of up to 213MW that can accommodate up to 38 turbines. The entire project site is located within the Cookhouse Renewable Energy Development Zone (REDZ). Due to the location of the project site within the REDZ, a Basic Assessment (BA) process will be undertaken in accordance with GN114 as formally gazetted on 16 February 2018. The project site comprises the following eight (8) farm portions:

- Remainder of Farm Table Hill Farm No 187
- Portion 2 of Table Hill Farm No 187
- Portion 3 of the Farm Table Hill Farm No 187

- Remainder of the Farm Hounshow No 131
- Portion 1 of Farm Draai Farm No 184
- Portion 1 of Farm No 132
- Portion 1 of Farm Burnt Kraal No 189
- Portion 1 of Farm Table Hill No 187

The Fronteer Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 213MW:

Up to 38 wind turbines with a maximum hub height of up to 120m. The tip height of the turbines will be up to 200m;

A 132kV switching station and a 132/33kV on-site collector substation to be connected via a 132kV overhead power line (twin turn dual circuit). The wind farm will be connected to the national grid through a connection from the 132/33kV collector substation via the 132kV power line which will connect to the 132kV switching station that will loop in and loop out of the existing Poseidon – Albany 132kV line;

- Concrete turbine foundations and turbine hardstands;
- Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
- Cabling between the turbines, to be laid underground where practical;
- Access roads to the site and between project components with a width of approximately 4,5m;
- A temporary concrete batching plant;
- Staff accommodation (temporary); and
- Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

A development envelope for the placement of the wind energy facility infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~2689ha in extent and the much smaller development footprint of ~49.4ha will be placed and sited within the development envelope.

## 4. Methodology

This study followed the approaches of several national guidelines regarded for aquatic assessment and wetland assessments. These have been modified by the author, to provide a relevant mechanism of assessing the present state of the study area systems applicable to the specific environment and in a clear and objective manner, assess the potential impacts associated with the proposed development area based on information collected over a number of years for this and other proposed projects.

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, a system that also differentiates between riverine and wetland aquatic systems.

### 4.1 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, 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.

**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 (DWAF) 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.

## 4.2 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).

The site surveys included sampling (soil auguring) and species identification to ascertain the presence of any of the listed attributes.

*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 1: 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 <sup>1</sup>	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>

Where:

<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.

### 4.3 National Wetland Classification System method

During this study, due to the nature of the wetlands and watercourses observed, it was determined that the newly accepted NWCS 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 – 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.

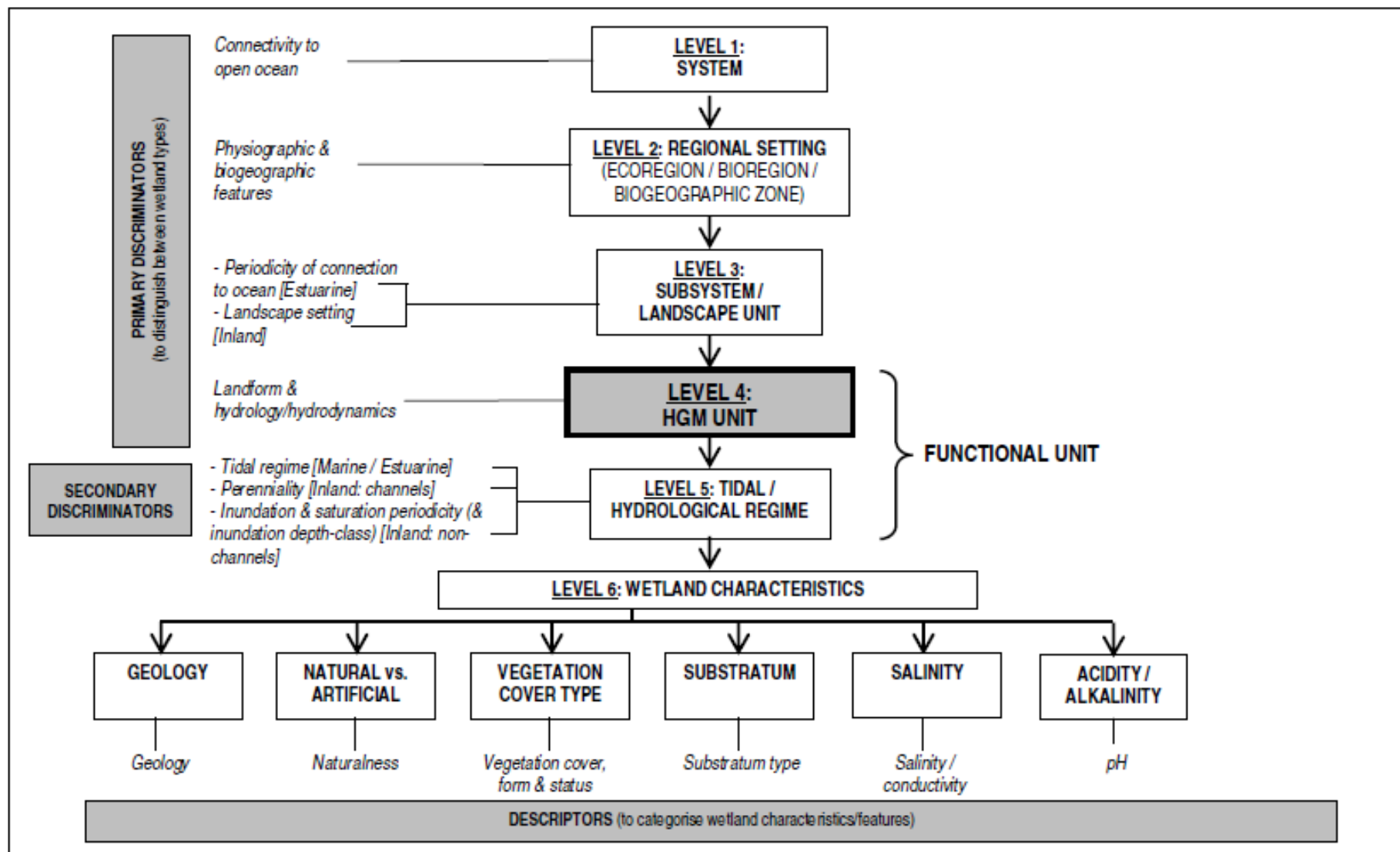


Figure 2: Basic structure of the NWCS, showing how ‘primary discriminators’ are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with ‘secondary discriminators’ applied at Level 5 to classify the tidal/hydrological regime, and ‘descriptors’ applied at Level 6 to categorise the characteristics of wetlands classified up to Level 5 (From Ollis *et al.*, 2013).

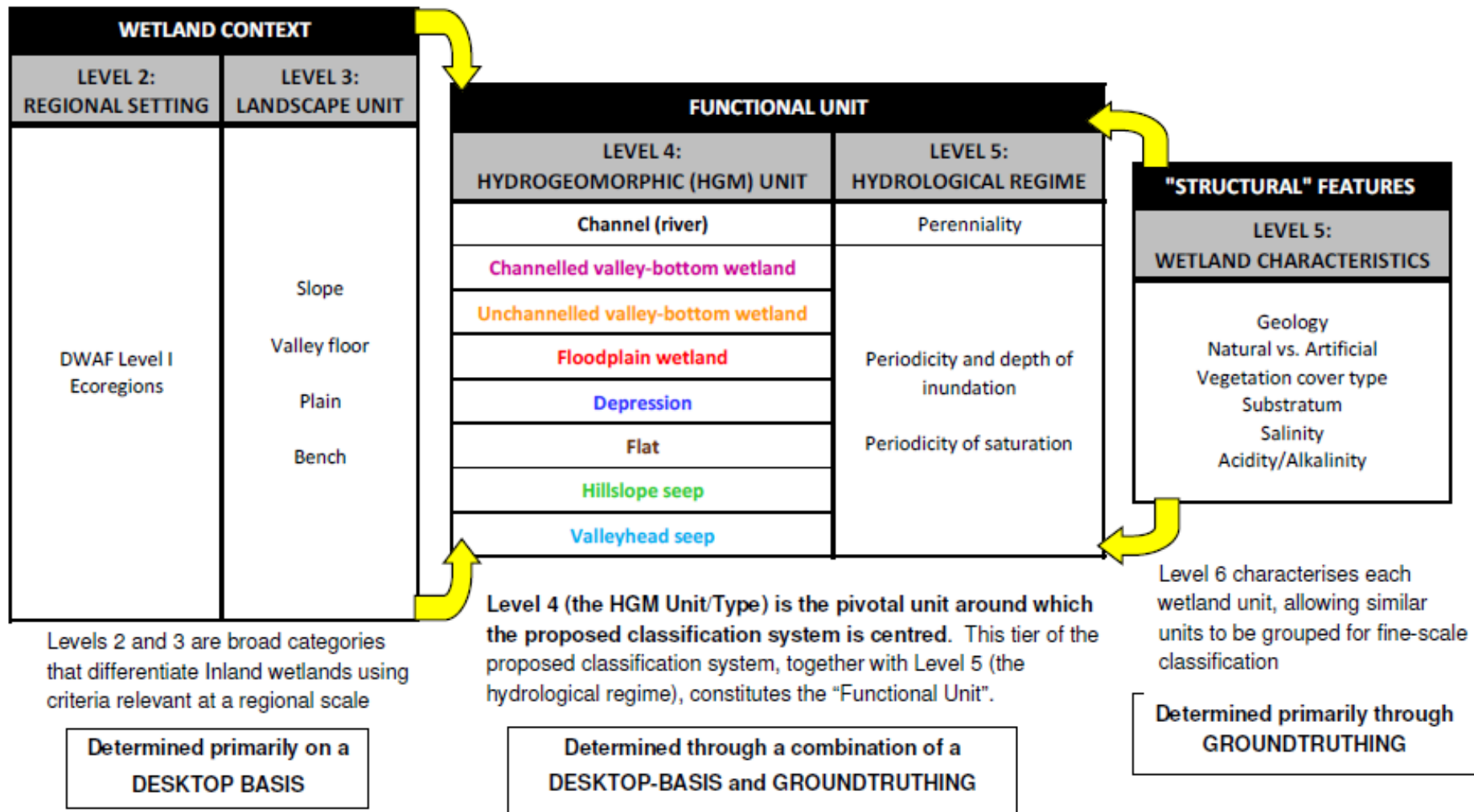


Figure 3: Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al.*, 2013).

#### 4.4 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 2) 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 size and functioning 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 2: 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.

#### **4.5 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 3 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 3: Summary of direct and indirect ecoservices provided by wetlands from Kotze *et al.*, 2008**

<b>Ecosystem services supplied by wetlands</b>	Indirect benefits	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		
		Direct benefits	<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 wetlands were 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 must be included into stormwater management features and should not be developed to retain the function of any ecological corridors.

#### 4.6 Relevant Wetland Legislation and Policy

Locally the South African Constitution, seven (7) Acts and two (2) international treaties allow for the protection of wetlands and rivers. These systems are protected from destruction or pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa, 1996;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- The Ramsar Convention, 1971 including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000);
- 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); and
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Nature and Environmental Conservation Ordinance, 1974 (No. 19 of 1974)
- National Forest Act, 1998 (No. 84 of 1998)
- National Heritage Resources Act, 1999 (No. 25 of 1999)

NEMA and the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) would also apply to this project. These Acts have categorised many invasive plants together with associated obligations on the landowner.

#### 4.7 Provincial Legislation and 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.

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 results with those highlighted in RED being found within 500m of the development site:

Rivers with structured riparian systems

- Construction period: 80 m
- Operation period: 65 m
- Final: 80 m

#### Wetlands (Pans)

- **Construction period:** 57 m
- **Operation period:** 45 m
- **Final:** 57 m

Wetlands (Seeps)

- Construction period: 51 m
- Operation period: 39 m
- Final: 51 m

Wetlands (Channelled and Unchannelled Valley Bottom Wetlands)

- Construction period: 43 m
- Operation period: 36 m
- Final: 43 m

Minor water courses with no riparian vegetation zone

- Construction period: 28 m
- Operation period: 20 m
- Final: 28 m

**However to try and minimise the impact on the watercourses and reduce the number of Water Use Licenses needed, the applicant has buffered these systems by 50m. Thus only a few crossings are required, mostly within existing disturbed areas such as cattle track, farm roads or district roads.**

Other policies that are relevant include:

- Provincial Nature Conservation Ordinance (PNCO) – Protected Flora. Any plants found within the development area are described in the ecological assessment.
- National Freshwater Ecosystems Priority Areas (NFEPAs) – (Nel *et al.*, 2011). This mapping product highlights potential rivers and wetlands that should be earmarked for conservation on a national basis.



## 5. Description of the affected environment

The proposed development occurs within the following Subquaternary (Quinary) catchments with the respective mainstem rivers all within the Southern Folded Mountains Ecoregion (Figure 4):

- Q91C Brak River
- P10A New Year's River

The development area contains short tributaries that link to these systems, consisting mostly of non-perennial rivers, within incised valleys that contain narrow riparian systems, more typical of the Drought Corridor Ecoregion, 9km north of the area.

Overall, these watercourses are largely in a natural state, when compared to other mainstem systems within the greater region (e.g. Great Fish River). Current or existing impacts occur in localised areas within the development area and these include existing roads /tracks, evidence of grazing (livestock), bush encroachment (*Vachellia karroo*) and various farm dams (surface water impoundments).

The National Wetland Inventory v5.2 spatial data (NWI), only indicated natural riverine systems and depression/pan within the study area, as well as the high number of artificial farm dams (Figure 5). The presence of the pans, Critical Biodiversity Areas (2007) and National Freshwater Ecosystems Priority Areas (NFEPAs) (Figure 6), resulted in portions of the study area, receiving a Very High Aquatic sensitivity rating in the DEFF Screening Tool. Based on this, and Aquatic Biodiversity Assessment (this report) is required as part of the Basic Assessment process being undertaken for the project.

The only natural wetlands observed within or in close proximity to the development area, included seven Depression/Pans. These features, inclusive of the proposed buffers (57m), will be avoided by the development footprint (including the access roads) through limited adjustment based on information supplied in this report. Any activities within 500m of these Depression/pan boundaries will however require a Water Use License, which has been initiated by the Applicant (Figure 8).

The development area watercourses are ephemeral and only carried water for short periods, thus the observed systems do not support any wide riparian zones and the vegetation associated with these watercourses were between 0.25 m and 20 m wide and contain mostly terrestrial species.

The only dense riparian vegetation was found along reaches of the Fish and Brak Rivers, dominated by sedges and grasses (*Cynodon dactylon*, *Cyperus textilis*, *Phragmites australis*) on the river edge, while tall trees on the steep banks (*Searsia lancea*, *Combretum caffrum*), and thicket trees and shrubs on the upper slope of the banks included, *Azima tetraacantha*, *Buddleja saligna*, *Ehretia rigida*, *Gymnosporia heterophylla*, *Lycium* spp., *Olea europea* subsp. *africana*, *Vachellia karroo* and *Ziziphus mucronate*.

Climbers, including *Asparagus* spp. and *Cynanchum* spp., dwarf shrubs (*Felicia* spp.), and grasses (*Panicum deustum*, *P. maximum*) and succulents (*Drosanthemum hispidum*, *Malephora lutea*) occur in the open patches and disturbed margins of the riparian zones.

### **No aquatic species of special concern were observed within the development area.**

The National Freshwater Ecosystems Priority Areas (NFEPAs) (Nel *et al.*, 2011), also earmarked sub-quaternaries, based either on the presence of important biota (e.g. rare or endemic fish species) or conversely the degree of riverine degradation, i.e. the greater the catchment degradation the lower the priority to conserve the catchment. The important catchment areas are then classified as Freshwater Ecosystems Priority Areas (FEPAs).

The development area falls spans an Upstream Support Area, which is earmarked as a support catchment for FSAs (Fish Support Areas) and a Phase 2 FEPA, while portions of the development area are located within a Ecological Support Area Type 1 as per the Eastern Cape Biodiversity Conservation Plan or ECBCP (ECBCP, 2019).

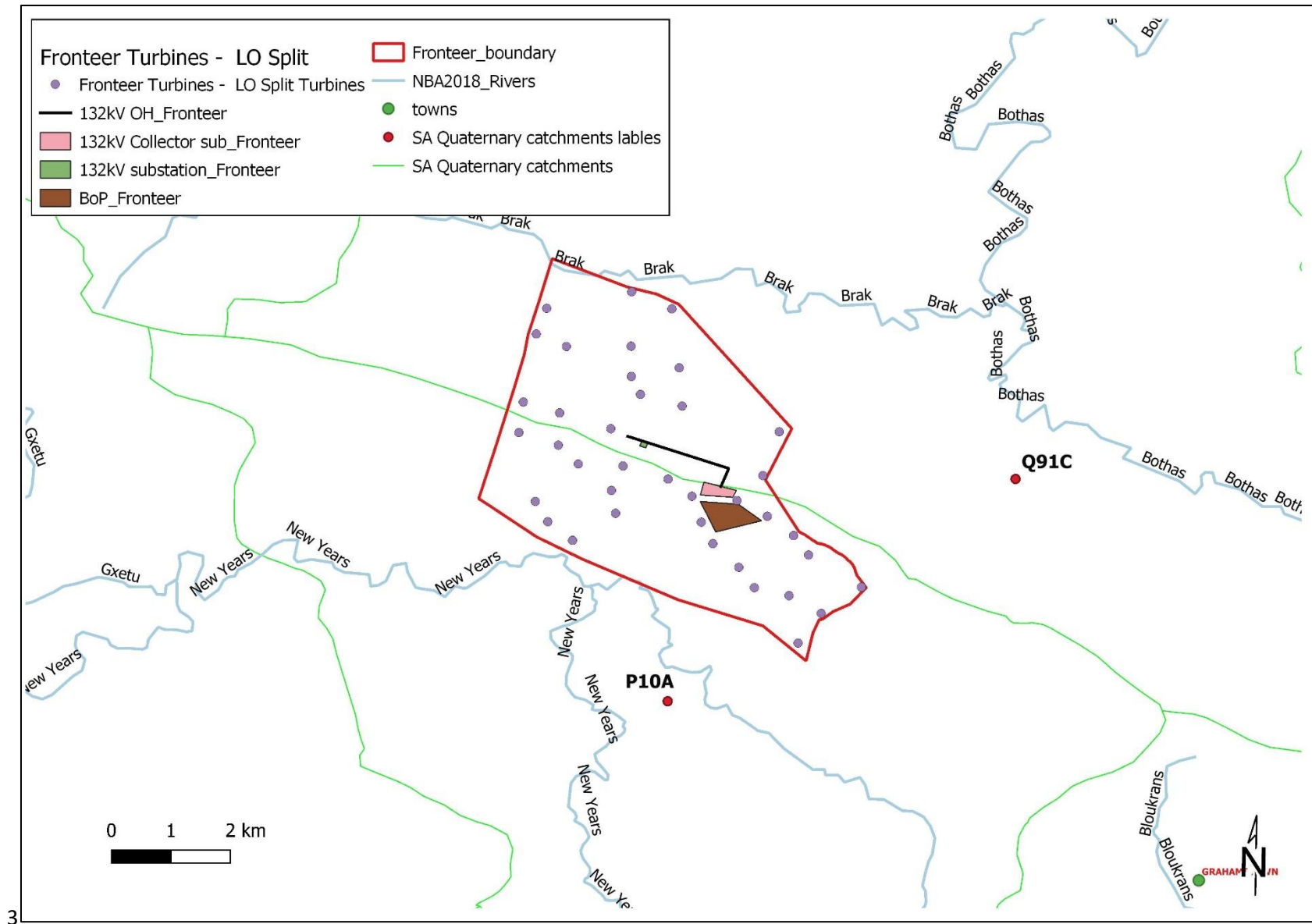


Figure 4: Project locality map indicating the various quaternary catchment boundaries (green line) in relation to the development area (Source DWS and NGI).

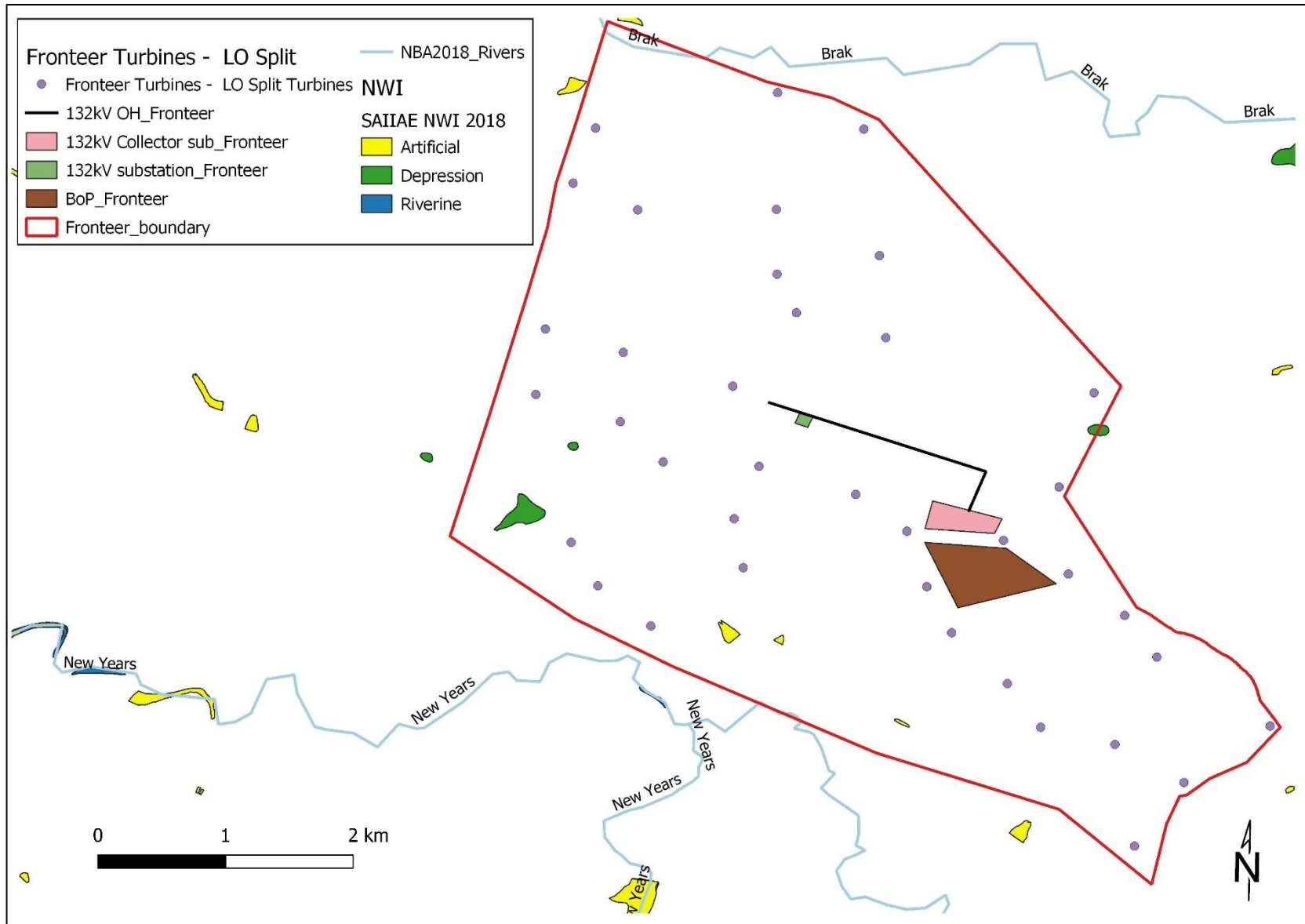


Figure 5: The various waterbodies identified in the National Wetland Inventory as shown in the National Spatial Biodiversity Spatial data

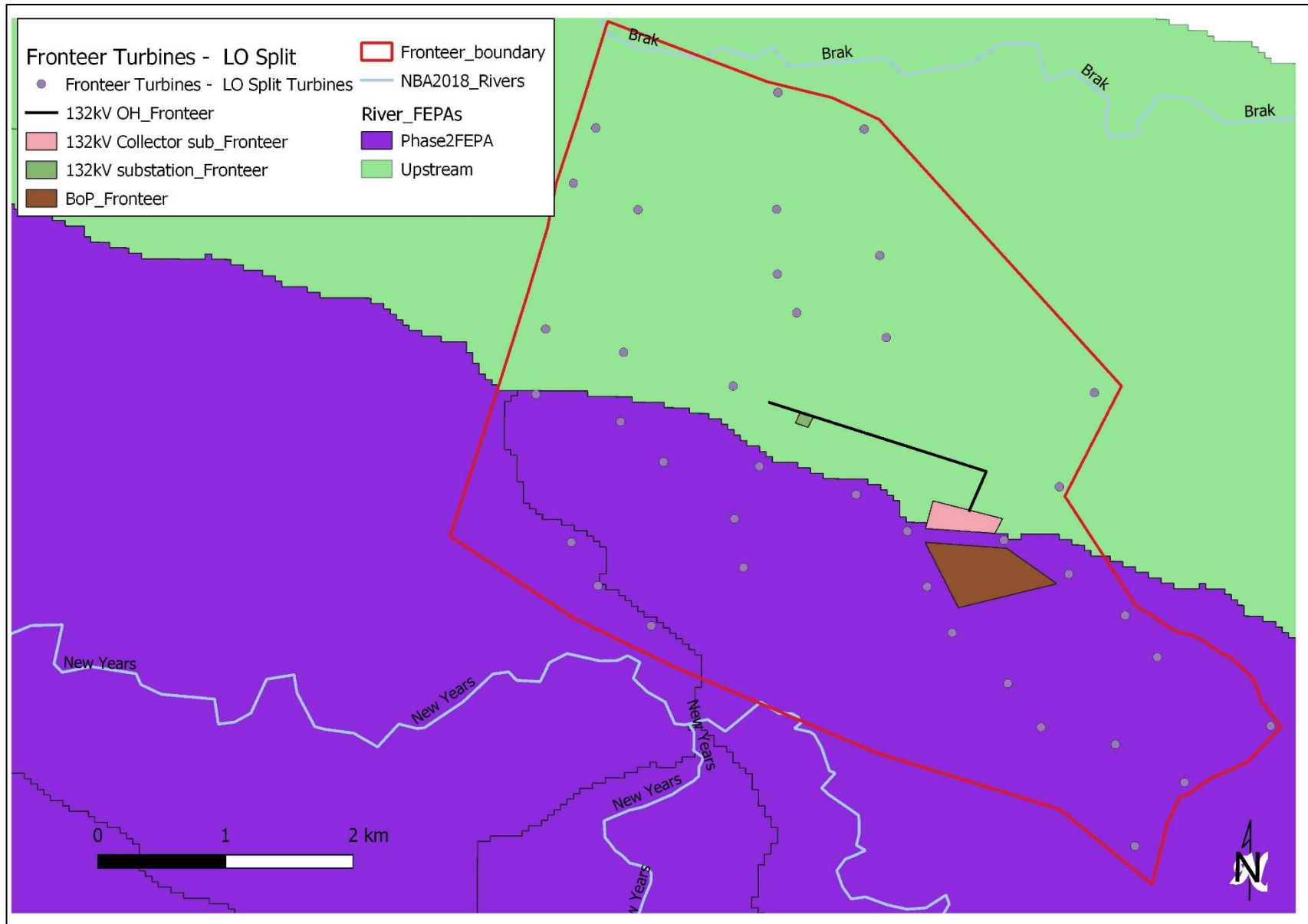


Figure 6: The respective sub quaternary catchments rated in terms of Freshwater Ecosystem Priority Areas (FEPAs) in relation to the development area

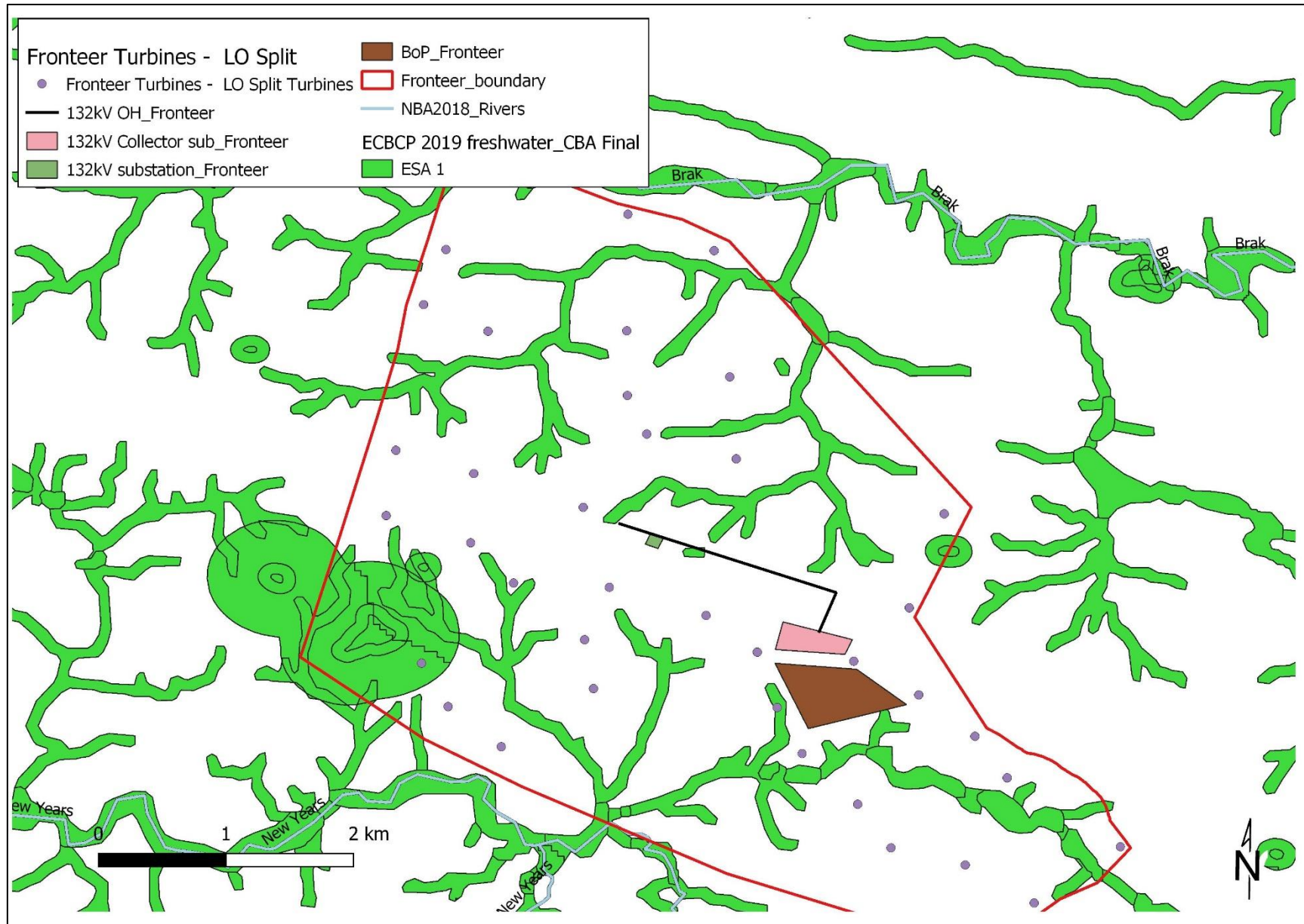


Figure 7: The results of the Eastern Cape Biodiversity Conservation Plan (ECBCP, 2019)

## 6. Present Ecological State, conservation importance and final sensitivity rating

The Present Ecological State (PES) of an aquatic system 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 Present Ecological State (PES) and the Ecological Importance and Sensitivity Scores (EIS) were based on the current state and function of the natural systems observed, or where systems contributed to the ecological character of the development footprint. These ratings were then translated in the respective sensitivity ratings of the various aquatic systems (High to Low), and used to prepare a sensitivity map, used in guiding the preparation of the layout. This was also conducted in conjunction with the other specialists to determine the layout to reduce the number of overall impacts.

The following summary is present of the PES/EIS score of the natural wetlands found (Plate 1) within or adjacent to the development footprint of this project.

Feature number	Hydrogeomorphic Type	Present Ecological State	Ecological Importance and Sensitivity	Overall Sensitivity	Buffer as per Macfarlane & Bredin (2017) Model
1	Pan/Depression	D/E	Low	Low	57
2	Pan/Depression	B/C	High	High	57
3	Pan/Depression	B	High	High	57
4	Pan/Depression	B	High	High	57
5	Pan/Depression	D/E	Low	Low	57
6	Pan/Depression	D/E	Low	Low	57
7	Pan/Depression	B	High	High	57

With regard to the watercourses, none of the complex riparian zones as described above are located within the development footprint (Plate 2), with only small drainage lines and watercourses being affected by the proposed access roads connecting the wind turbines. It has however been recommended that the BoP will be adjusted to exclude any drainage areas.

In this assessment the PES / EIS of these systems was rated a C or Moderately Modified, mostly due to grazing activities and a LOW EIS, due to the features being ephemeral with little to no aquatic features. Therefore, these were rated as having a LOW sensitivity, but must still be avoided by the larger infrastructure (turbines, hardstands and buildings/substations). Therefore, all road crossings of these small drainage features are considered to be acceptable from an aquatic perspective.

Thus, the layout for the most part, will need to be developed further to avoid the Pans 1 and 3 (inclusive of the associated buffers) based on this report (Figure 8), as these areas corresponded to the Very High Sensitivity systems considered in the DEFF Screening Tool spatial data. Similarly the BoP will also be adjusted to avoid the minor water course and the proposed buffer.

While the watercourses will be only be impacted upon by a limited number of water course crossings that will be mitigated by appropriate measures which include erosion protection etc.

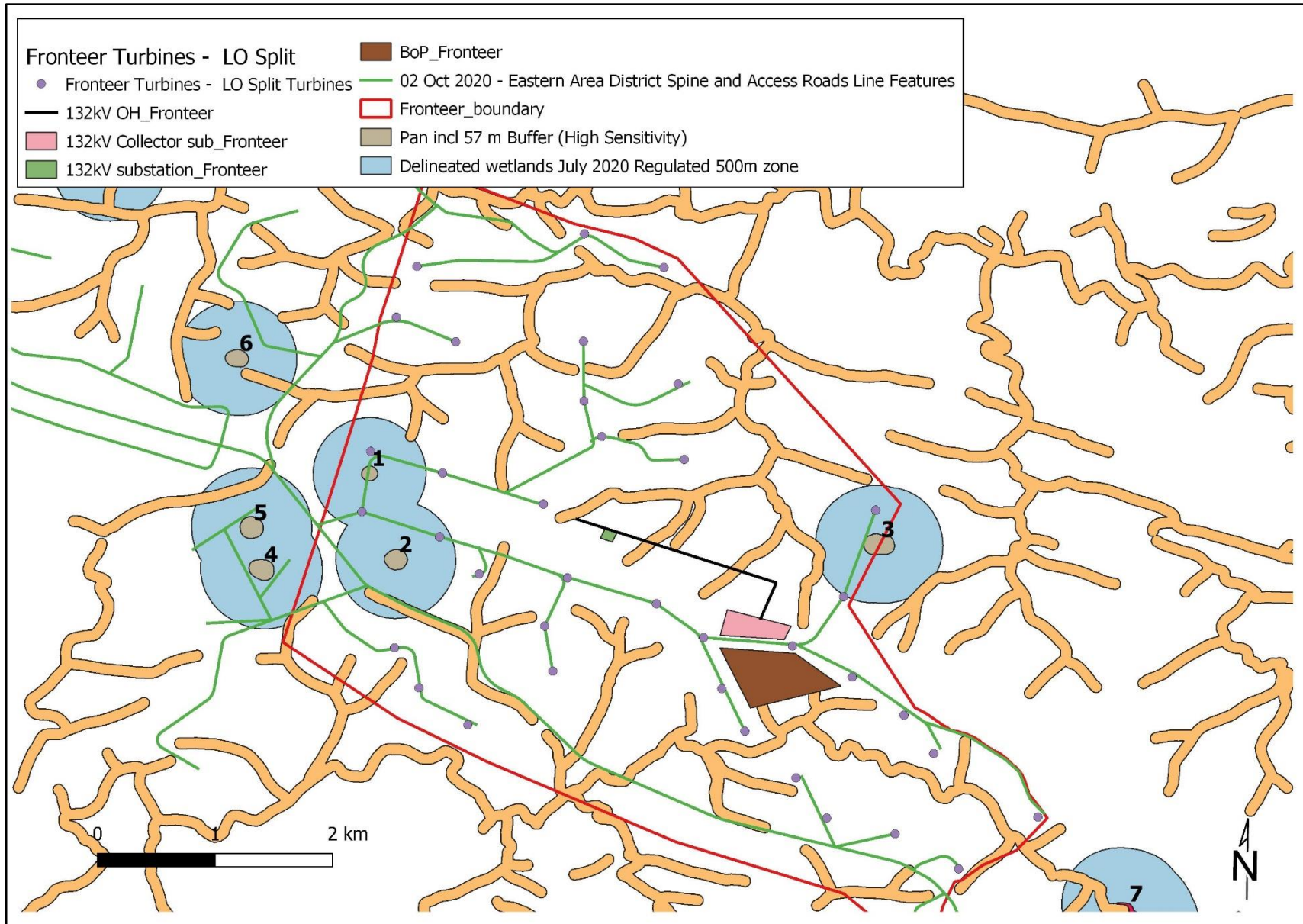


Figure 8: Delineated wetlands (pans = HIGH sensitivity areas) and watercourses (= Low sensitivity areas) in relation to the activities, with buffers and the 500m regulated WULA zone.



**Plate 1: Typical small pan, with small catchment within the study area, after heavy rainfall in January 2019**



**Plate 2: A view one of the large unknown tributaries of the Brak River, that has been avoided by the project**



## 7. Permit requirements

Based on an assessment of the proposed activities and past engagement with DWS, the following WULs/ GA's could be required based on the following thresholds as listed in the following Government Notices, however ultimately the Department of Water and Sanitation (DWS) will determine if a GA or full WULA will be required during the pre-application process:

- **DWS Notice 538 of 2016, 2 September in GG 40243**– Section 21 a & b, Abstraction and Storage of water.
- **Government Notice 509 in GG 40229 of 26 August 2016** – Section 21 c & i, 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 Disposing of waste in a manner that may detrimentally impact on a water source which includes temporary storage of domestic waste water i.e. conservancy tanks under Section 37 of the notice, where storage is between 5000 – 10 000m<sup>3</sup> a General Authorisation is applicable.

	Water Use Activity	Applicable to this development proposal
S21(a)	Taking water from a water resource	Yes if not sourced from the local Water Board or a municipal supply.
S21(b)	Storing water	No, if temporary storage tanks are used, and the water stored is from a licensed source
S21(c)	Impeding or diverting the flow of water in a watercourse	Yes – several new crossings of watercourses will be required, as well as activities within 500m of a wetland boundary.
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 GA as volumes are applicable.
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
S21(i)	Altering the bed, banks, course or characteristics of a watercourse	Yes – several new crossings of watercourses will be required, as well as activities within 500m of a wetland boundary.
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

## 8. Impact assessment

The following direct impacts were assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and assessed against the layout:

<b>Biodiversity Assessment Protocol Impacts found applicable to this project</b>	<b>Impacts assessed in this report below</b>
Fragmentation (physical loss of ecological connectivity and or CBA corridors)	Impact 1 & 2
Changes in numbers and density of species	Impact 1 & 2
Faunal and vegetation communities inhabiting the site	Impact 1 & 2
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 3
Streamflow regulation	Impact 3
Erosion control	Impact 4
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication)	Impact 5
Cumulative Impacts	Impact 6

- Impact 1: Loss of High Sensitivity systems, namely the pans through physical disturbance, the proposed layout will need to be altered to avoid these systems inclusive of the associated buffers (Figure 8).
- Impact 2: Impact on water courses (Low Sensitivity), through physical disturbance
- Impact 3: Impact on all watercourse and wetland systems through the possible increase in surface water runoff on riparian form and function through hydrological changes
- Impact 4: Increase in sedimentation and erosion
- Impact 5: Risks on the aquatic environment due to water quality impacts
- Impact 6: Cumulative impacts

The impacts were assessed as follows:

<b>Nature:</b> Impact 1: Loss of High Sensitivity systems, namely the pans through physical disturbance, the proposed layout will need to avoid any of these systems (Figure 8) during the construction phase.		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	Regional (3)	Local (1)
<b>Duration</b>	Long-term (4)	Long-term (4)
<b>Magnitude</b>	High (7)	Low (4)
<b>Probability</b>	Definite (5)	Probable (3)
<b>Significance</b>	<b>High (70)</b>	<b>Low (27)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Medium	Medium
<b>Irreplaceable loss of resources</b>	No	No
<b>Can impacts be mitigated</b>	Yes	
<b>Mitigation:</b>		
<p>The most significant form of mitigation would be to select development options that avoided all aquatic features that were rated with a High sensitivity, which will be proposed by the layout based on information contained in this report, i.e. the avoidance of any pans and the appropriate placement of the BoP.</p> <p>All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor.</p> <p>It is further recommended that a comprehensive rehabilitation / monitoring plan be implemented from the project onset i.e. during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed.</p>		
<b>Cumulative impacts:</b>		
None – no direct connection between this and other systems, such as the Orange River, exist.		
<b>Residual impacts:</b>		
Possible impact on the remaining catchment due to changes in run-off characteristics in the development area.		

**Nature:** Impact 2 - Impact on watercourses (Low Sensitivity), through physical disturbance during the construction phase.

The physical removal of narrow strips of woody riparian zones within watercourses, however this would be localised as the number of watercourses is of low sensitivity and located in areas with minimal vegetation (riparian) and/ or previously disturbed areas.

	Without mitigation	With mitigation
<b>Extent</b>	Local (1)	Local (1)
<b>Duration</b>	Long-term (4)	Long-term (4)
<b>Magnitude</b>	Low (4)	Low (4)
<b>Probability</b>	Definite (5)	Probable (3)
<b>Significance</b>	<b>Medium (45)</b>	<b>Low (27)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	High	High
<b>Irreplaceable loss of resources</b>	No	No
<b>Can impacts be mitigated</b>	Yes	

**Mitigation:**

The most significant form of mitigation would be to select a development area, which contained no drainage lines. The proposed layout will developed to avoid the important systems, thus requiring only crossings or footprints within areas rated as having a Low sensitivity to physical disturbance, although hydrological function (surface flows) would still remain, i.e. the BoP will be adjusted and the Pans will be avoided.

Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. Suitable dust and erosion control mitigation measures should be included in the EMP to mitigate these impacts.

**Cumulative impacts:**

The increase in surface run-off velocities and a reduction in the potential for groundwater infiltration is likely to occur, considering that the development area is near several drainage channels, but with stormwater management the impacts can be mitigated

**Residual impacts:**

Sizable portion of intact natural environment remain within the greater region.

**Nature:** Impact 3 - Impact on all watercourse and wetland systems through the possible increase in surface water runoff that could alter the aquatic state and function through hydrological changes during the operation phase

Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within the aquatic systems, which are currently ephemeral, i.e. aquatic vegetation species composition changes, which then results in habitat change / loss.

	Without mitigation	With mitigation
<b>Extent</b>	Local (1)	Local (1)
<b>Duration</b>	Long-term (4)	Long-term (4)
<b>Magnitude</b>	Low (2)	Low (2)
<b>Probability</b>	Definite (5)	Probable (3)
<b>Significance</b>	<b>Medium (35)</b>	<b>Low (21)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Medium	Medium
<b>Irreplaceable loss of resources</b>	No	No
<b>Can impacts be mitigated</b>	Yes	

**Mitigation:**

A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. The stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks.

No runoff may be discharged or directed into the Pans, as these are not tolerant of excessive / regular volumes of water and would then change in nature and attributes, i.e. stormwater detention pond.

**Cumulative impacts:**

The cumulative impact assessment considers the combined impact of the surrounding wind farms on the natural environment. Although the current state of the surrounding landscape is largely natural the cumulative impact would be Negligible.

**Residual impacts:**

Possible impact on the remaining catchment due to changes in run-off characteristics in the development area.

**Nature:** Impact 4 - Increase in sedimentation and erosion within the development footprint during the operation phase

An increase in hard surface areas, and or roads that require stormwater management increases runoff from a site through the concentration of surface water flows. These higher volume flows, with increased velocity can result in downstream erosion and sedimentation if not managed.

	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	Local (1)	Local (1)
<b>Duration</b>	Long-term (4)	Long-term (4)
<b>Magnitude</b>	Low (2)	Low (1)
<b>Probability</b>	Definite (5)	Probable (3)
<b>Significance</b>	<b>Medium (35)</b>	<b>Low (18)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Medium	Medium
<b>Irreplaceable loss of resources</b>	No	No
<b>Can impacts be mitigated</b>	Yes	

**Mitigation:**

A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. The stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks.

No runoff may be discharged or directed into the Pans, as these are not tolerant of excessive / regular volumes of water and would then change in nature and attributes, i.e. stormwater detention pond.

**Cumulative impacts:**

Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream will be washed into the mainstem systems, that already have high sediment loads.

**Residual impacts:**

Possible impact on the remaining catchment due to changes in run-off characteristics in the development area.

<b>Nature:</b> Impact 5 – Impact on localised surface water quality		
During both preconstruction, construction and, to a limited degree, the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities, as well as maintenance activities, could be washed downslope via the watercourses.		
	<b>Without mitigation</b>	<b>With mitigation</b>
<b>Extent</b>	Local (1)	Local (1)
<b>Duration</b>	Long-term (4)	Long-term (4)
<b>Magnitude</b>	Low (2)	Low (1)
<b>Probability</b>	Definite (5)	Probable (3)
<b>Significance</b>	<b>Medium (35)</b>	<b>Low (18)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Medium	Medium
<b>Irreplaceable loss of resources</b>	No	No
<b>Can impacts be mitigated</b>	Yes (high)	
<b>Mitigation:</b>		
<ul style="list-style-type: none"> <li>• Strict use and management of all hazardous materials used on site.</li> <li>• Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles &amp; machinery, cement during construction, etc.) within demarcated / bunded areas</li> <li>• Containment of all contaminated water by means of careful run-off management on site.</li> <li>• Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility. These must be situated outside of any delineated watercourses and pans/depressions or the buffers shown.</li> <li>• Strict control of the behaviour of construction workers.</li> <li>• Appropriate waste management.</li> <li>• Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.</li> </ul>		
<b>Cumulative impacts:</b>		
The cumulative impact assessment considers the combined impact of the surrounding wind farms on the natural environment. Although the current state of the surrounding landscape is largely natural the cumulative impact would be Negligible, coupled to the fact that the aquatic systems are largely ephemeral.		
<b>Residual impacts:</b>		
Residual impacts will be negligible after appropriate mitigation.		

**Nature:** Impact 6 – Cumulative Impacts

In the assessment of this project, a number of projects have been assessed by the report author within a 35km radius and or other sites were accessed during the course of travelling between the various projects. Of these potential projects, this report author has been involved in the initial EIA aquatic assessments or has managed / assisted with the WUL process and or Plant & Animal Search & Rescue for several of these projects.

All of the projects have indicated that their intention with regard to mitigation, i.e. selecting the best possible sites to minimise the local and regional impacts, or improving the drainage or hydrological conditions within these rivers, and therefore the cumulative impact could be seen as a net benefit. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects such as stormwater management, and that flows within these systems are sporadic.

	<b>Overall impact of the proposed project considered in isolation</b>	<b>Cumulative impact of the project and other projects in the area</b>
<b>Extent</b>	Local (1)	Local (1)
<b>Duration</b>	Long-term (4)	Long-term (4)
<b>Magnitude</b>	Low (1)	Low (2)
<b>Probability</b>	Probable (3)	Definite (5)
<b>Significance</b>	<b>Low (18)</b>	<b>Medium (35)</b>
<b>Status (positive or negative)</b>	Negative	Negative
<b>Reversibility</b>	Medium	Medium
<b>Irreplaceable loss of resources</b>	No	No
<b>Can impacts be mitigated</b>	Yes (high)	

**Mitigation:**

- Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region by local landowners / public works entities where possible
- Install properly sized culverts with erosion protection measures at the present road / track crossings where already installed by local landowners / public works entities

**Residual impacts:**

Residual impacts will be negligible after appropriate mitigation.



## 9. Conclusion and Recommendations

In summary, the proposed layout for the facility would not have a direct impact on the following:

- Any Very High sensitivity areas identified by the DEFF Screening Tool for the development footprint
- Mainstem riparian systems (outside of the development footprint) and Pans that do contain functioning aquatic environments that received a High sensitivity rating will also be avoided with slight infrastructure adjustment

Therefore, based on the results of this report, the significance of the remaining impacts assessed for the aquatic systems after mitigation would be LOW. This includes the internal roads proposed that would need to cross some of these systems. Thus, based on the findings of this study no objection to the authorisation of any of the proposed activities is made at this point based on the current layout as provided by the developer. This is subject to the final layout being updated to include the recommendations, i.e. avoidance of the pans 1 and 3, and move the BoP area away from a drainage line.

This report also indicates the watercourses and pans within 500m of the development area. Any activities within these areas, the buffers or 500m from the wetland boundary will require a Water Use license under Section 21 c and i of the National Water Act (Act 36 of 1998).

As the proposed activities have the potential to create erosion, the following recommendations are proposed:

- Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment, and suitable dust and erosion control mitigation measures should be included in the EMP to mitigate the impact.
- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid the spread of any contamination / leaks outside of any delineated waterbodies and their buffers. Washing and cleaning of equipment should also be done in berms or bunds to trap any cement / hazardous substances and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any watercourse
- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO must be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas along aquatic features, using selected species detailed in this report.
- All alien plant re-growth must be monitored and should these alien plants reoccur these plants must be re-eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.

It is further recommended that a comprehensive rehabilitation plan be implemented from the project onset within watercourse areas (including buffers) to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMP preparation during the pre-construction phase.

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## 12. Appendix 1 - Specialist CV

### CURRICULUM VITAE

- **Dr Brian Michael Colloty**

- **7212215031083**

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Port Elizabeth, 6070

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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 Pivililli, 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 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 – current.
- 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 - current
- 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 105 renewable projects in the past 6 years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, RedCap, 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 farm), 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).