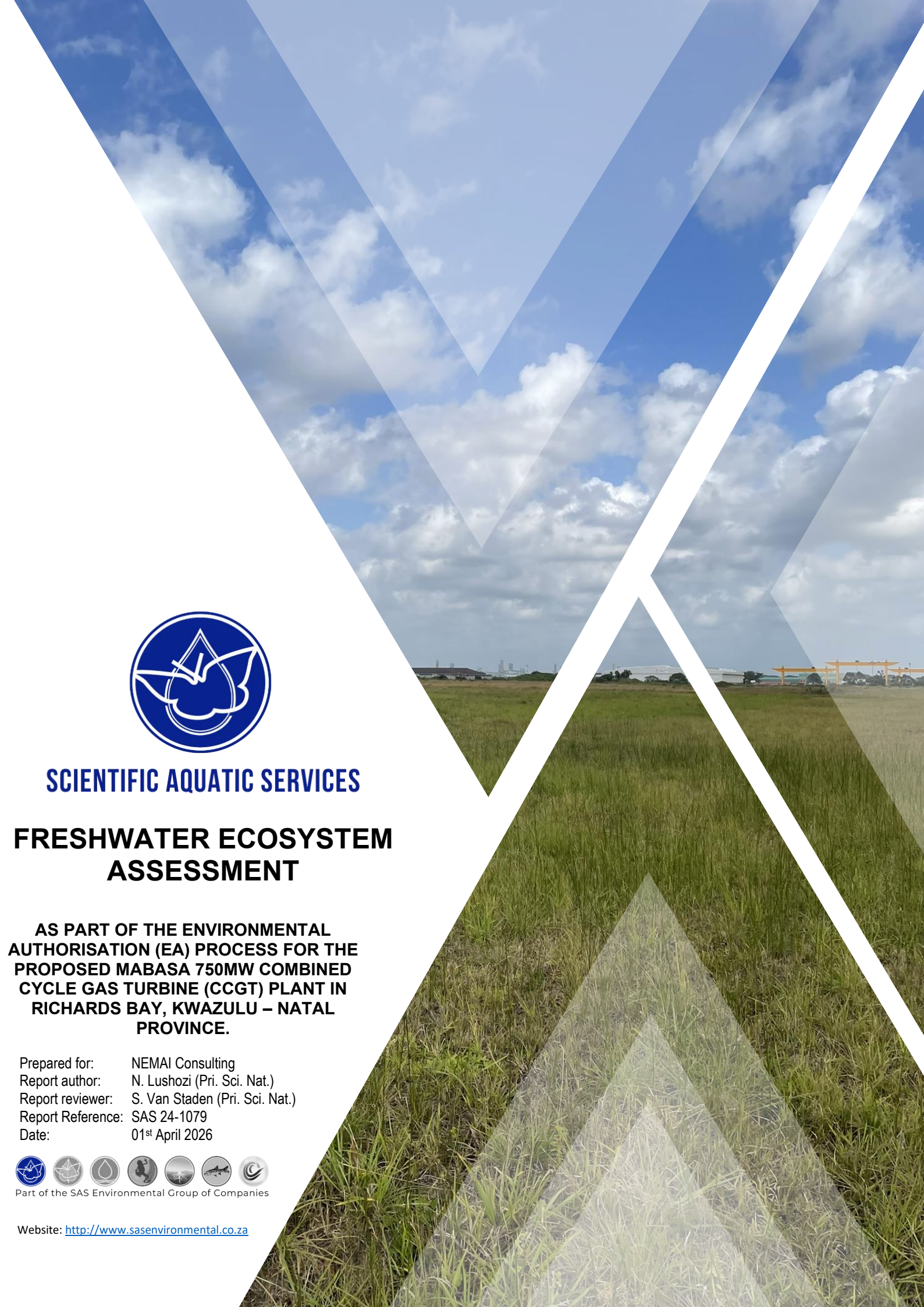
APPENDIX E3 – Freshwater Ecosystem Assessment



SCIENTIFIC AQUATIC SERVICES

FRESHWATER ECOSYSTEM ASSESSMENT

AS PART OF THE ENVIRONMENTAL AUTHORISATION (EA) PROCESS FOR THE PROPOSED MABASA 750MW COMBINED CYCLE GAS TURBINE (CCGT) PLANT IN RICHARDS BAY, KWAZULU – NATAL PROVINCE.

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Report Reference:	SAS 24-1079
Date:	01st April 2026

Part of the SAS Environmental Group of Companies

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EXECUTIVE SUMMARY

Scientific Aquatic Services (Pty) Ltd (SAS) was appointed by NEMAI Consulting to conduct a freshwater ecosystem assessment as part of the Environmental Authorisation (EA) and Water Use License (WUL) process for the proposed Mabasa 750MW Combined Cycle Gas Turbine (CCGT) power plant near Richards Bay, KwaZulu-Natal Province.

During the assessment, two wetlands were identified within the study area, namely a seep wetland and wetland flat. The ecological integrity of both wetlands was ascertained to be in a moderately modified (PES Category C) and considered to be of low to moderate ecological importance and sensitivity (EIS).

An Environmental Authorisation (EA) (Ref: 14/12/16/3/3/2/665) and associated Water Use Authorisation (WUA) were previously granted for RBIDZ Phase 1F, which included the infilling of wetlands and the development of service infrastructure to support industrial development within the study area. As these activities have already been authorised and are not being reapplied for as part of the current application, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was not applied as no additional significant quantum of risk to the adjacent wetlands is deemed likely as a result of the proposed development.

While the loss of wetlands within the authorised development footprint is therefore acknowledged, it remains essential that construction activities are undertaken in accordance with best practice and environmental management measures to minimise further impacts. This includes the implementation of appropriate housekeeping measures, such as erosion and sediment control, prevention of pollution, and careful management of stormwater, to ensure that adjacent and remaining aquatic features are protected and that the broader ecological integrity of the area is maintained.

MANAGEMENT SUMMARY

Scientific Aquatic Services (Pty) Ltd (SAS) was appointed by NEMAI Consulting to conduct a freshwater ecosystem assessment as part of the Environmental Authorisation (EA) and Water Use License (WUL) process for the proposed Mabasa 750MW Combined Cycle Gas Turbine (CCGT) power plant in the city of uMhlathuze Local Municipality and the King Cetshwayo District Municipality, KwaZulu-Natal Province. The proposed Mabasa 750MW CCGT power plant and associated infrastructure is referred throughout the report as the proposed Mabasa gas project.

To identify all freshwater ecosystems that may potentially be impacted by the activities associated with the proposed Mabasa project, a 500 m "zone of investigation" around the proposed Mabasa project, in accordance with Government Notice (GN) 4167 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (as amended) (NWA) was used as a guide in which to assess possible sensitivities of the receiving environment. This 500 m "zone of investigation" will henceforth be referred to as the 'investigation area'. The assessment took the following approach:

- A desktop study was conducted, in which possible freshwater ecosystems were identified for on-site investigation, and relevant national and provincial databases were consulted;
- In addition, the freshwater ecosystems within the study area were delineated and ground-truthed during a single site assessment conducted in June 2024. A detailed assessments of the delineated freshwater ecosystems were undertaken;
- They were then classified according to the Ollis *et al*. (2013) classification system; and
- The characteristics of the freshwater ecosystems were defined including the Present Ecological State (PES), Ecological Importance and Sensitivity (EIS), Recommended Ecological Class (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS).

An Environmental Authorisation (EA) (Ref: 14/12/16/3/3/2/665) and associated Water Use Authorisation (WUA) were previously granted for RBIDZ Phase 1F, which included the infilling of wetlands and the development of service infrastructure to support industrial development within the study area. As these activities have already been authorised and are not being reapplied for as part of the current application and as no additional significant quantum of risk to the adjacent wetlands is deemed likely as a result of the proposed development, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was not applied.

All possible measures were undertaken to ensure all freshwater ecosystems which may be affected by the proposed Mabasa project were identified, delineated and assessed. The site assessment also confirmed the presence of wetlands comprising of the following seep wetland and wetland flat Hydrogeomorphic (HGM) units within the study area. The result of the ecological assessment is summarised in Table A below.

Table A: Summary of the freshwater ecological assessment results.

Freshwater Ecosystem	Present Ecological State (PES) / Ecostatus	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
Seep Wetland	Category C (Moderately Modified)	Moderate	Intermediate	REC Category: C BAS Category: C RMO: Maintain
Wetland flat	Category C (Moderately Modified)	Moderate	Intermediate	REC Category: C BAS Category: C RMO: Maintain
Extent of modification anticipated to the seep wetland and wetland flat	**High** The extent of modification to the seep wetland was high given that the seep wetland within the study area will be completely lost due to infilling. This will result in a complete loss of ecological functioning for these wetlands.			

An Environmental Authorisation (EA) (Ref: 14/12/16/3/3/2/665) and associated Water Use Authorisation (WUA) were previously granted for RBIDZ Phase 1F, which included the infilling of wetlands and the development of service infrastructure to support industrial development within the study area. As these activities have already been authorised and are not being reapplied for as part of the current application, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was not applied as no additional significant quantum of risk to the adjacent wetlands is deemed likely as a result of the proposed development.

Although the infilling of wetlands within the study area was authorised, it is important to consider the potential indirect impacts on adjacent wetlands which have the potential to arise from the operation of the proposed Mabasa gas project. During the operation phase, activities including combustion processes, may result in atmospheric emissions and particulate (dust) fallout, which have the potential to deposit particulate within surrounding wetland areas. This has the potential to alter water quality, while the deposition of particulates may also potentially change soil characteristics and contribute to changes in nutrient dynamics.

In terms of habitat and biota, the settling of dust may alter the vegetation composition particularly to the surrounding wetlands. While these impacts are expected to be localised and of low in magnitude relative to the direct loss of wetlands within the development footprint, they must be managed accordingly given that they represent indirect influences the project may have on the ecological integrity and functioning of adjacent freshwater systems which are not directly impacted by the proposed project.

It therefore recommended that monitoring measures be implemented, including dust monitoring, and dust suppression (where applicable) in line with relevant standards, and periodic (three yearly) monitoring of adjacent wetland condition to ensure that indirect impacts remain low. should any changes in wetland structure and function be observed that are attributable to Mabasa, appropriate adaptive management should be initiated.

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environmental Affairs screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirements	Section in report
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Front Page and Appendix E
2.2	Description of the preferred development site, including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution, and movement patterns	Section 4
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Section 3 and 4
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 3
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 3
2.3	Identify any alternative development footprints within the preferred development site which would be of a "low" sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	Section 5
2.4	Assessment of impacts - a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 6
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Section 6
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	Section 6
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). d. Assessment of the risks associated with water use/s and related activities.	Section 6
2.4.4	How will the development impact on the functionality of the aquatic feature including: a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system); b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over abstraction or instream or off-stream impoundment of a wetland or river);	Section 6

	c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); and e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal).	
2.4.5	How will the development impact on key ecosystem regulating and supporting services especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage.	Section 6
2.4.6	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 6
2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	Section 6
3.	**The report must contain as a minimum the following information:**	
3.1	Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise and their curriculum vitae;	Appendix G
3.2	A signed statement of independence by the specialist;	Appendix G
3.3	The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2
3.4	The methodology used to undertake the impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 1.2, 2 and Appendix C
3.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.3
3.6	Areas not suitable for development, to be avoided during construction and operation (where relevant);	Section 7
3.7	Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts;	Section 6
3.8	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted protocol;	NA
3.9	Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr;	Section 7
3.10	A motivation where the development footprint identified as per 2.3 were not considered stating reasons why these were not being not considered; and	Section 7
3.11	A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected.	Section 7
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	NA
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 7
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a “low” aquatic biodiversity and sensitivity and that were not considered appropriate.	
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	Section 7
3.16	Any conditions to which this statement is subjected.	Section 7

TABLE OF CONTENTS

EXECUTIVE SUMMARY ..... **ii**
DOCUMENT GUIDE ..... **v**
TABLE OF CONTENTS ..... **vii**
LIST OF FIGURES ..... **viii**
LIST OF TABLES ..... **viii**
GLOSSARY OF TERMS ..... **ix**
ACRONYMS ..... **x**
1 INTRODUCTION **1**
1.1 Background 1
1.2 Project Description 6
1.3 Scope of Work 8
1.4 Assumptions and Limitations 9
1.5 Legislative Requirements and Provincial Guidelines 10
2 ASSESSMENT APPROACH **11**
2.1 Freshwater Ecosystem Definition 11
2.2 Freshwater Ecosystem Field Verification 12
2.3 Sensitivity Mapping 13
2.4 Risk Assessment and Recommendations 13
3 RESULTS OF THE DESKTOP ANALYSIS **14**
3.1 Analyses of Relevant Databases 14
4 RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT **20**
4.1 Freshwater Ecosystem Characterisation 20
4.2 Freshwater Ecosystem Delineation 21
4.3 Field Verification Results 24
5 LEGISLATIVE REQUIREMENTS, NATIONAL AND PROVINCIAL GUIDELINES PERTAINING TO THE APPLICATION OF BUFFER ZONES **29**
6 RISK ASSESSMENT **31**
6.1 Risk Assessment Statement 31
6.2 Cumulative Impacts 31
7 CONCLUSION **33**
REFERENCES **34**
APPENDIX A – Terms of Use and Indemnity **36**
APPENDIX B – Legislation **37**
APPENDIX C – Method of Assessment **40**
APPENDIX D – Freshwater Results **47**
APPENDIX E – Risk Analysis and Mitigation Measures **49**
APPENDIX F – Specialist information **51**

LIST OF FIGURES

Figure 1: The location of the study and investigation areas in relation to the surrounding environment. 3
Figure 2: The study and investigation areas depicted on a topographical map. 4
Figure 3: Conceptual layout of the proposed Combined Cycle Power Plant. 5
Figure 4: Wetland hydrogeomorphic units associated with the study area and investigation areas according to the NFEPA database (2011). 16
Figure 5: Wetland hydrogeomorphic units associated with the study area and investigation areas according to the NBA (2018) database. 17
Figure 6: Irreplicable Critical Biodiversity Areas (CBAs) according to the KwaZulu – Natal Spatial Biodiversity Areas database. 18
Figure 7: Aquatic Biodiversity Theme Sensitivity associated with the study area according to the National Web-based Screening Tool (2020; Accessed 2024). 19
Figure 8: The location of the delineated wetlands associated with the proposed Mabasa project. 22
Figure 9: The location of the delineated wetlands associated with the proposed Mabasa project. 23

LIST OF TABLES

Table 1: Desktop data (from available databases only) relating to the character of the freshwater ecosystems within the investigation area. 15
Table 2: Characterisation of the freshwater ecosystems associated with the proposed Mabasa project according to the Classification System (Ollis et. al., 2013). 20
Table 3: Summary of the assessment of the seep wetland within the study area. 25
Table 4: Summary of the assessment of the wetland flat located within the study area. 27
Table 5: Articles of Legislation and the relevant zones of regulation applicable to each article. 29
Table 6: Summary of results of the field assessment as discussed in Section 4. 33

GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animans and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Endorheic	As it relates to a depression wetland: inward-draining with no transport of water into downstream systems via subsurface or surface flow. Water leaves via evapotranspiration and infiltration only.
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas.
Fluvial:	Resulting from water movement.
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydrophyte:	Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Perched water table:	The upper limit of a zone of saturation that is perched on an unsaturated zone by an impermeable layer, hence separating it from the main body of groundwater
Perennial:	Flows all year round.
RAMSAR:	The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilisation of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	the outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius.
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
BOP	Balance of Plant
CBA	Critical Biodiversity Area
CSIR	Council of Scientific and Industrial Research
DRDLR	Department of Rural Development and Land Reform's
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GE	General Electric
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HSRG	Heat Recovery Steam Generator
HGM	Hydrogeomorphic
HV	Heat Voltage
kV	Kilovolt
KZN	KwaZulu-Natal
m	Meter
MAP	Mean Annual Precipitation
MW	Megawatt
MR	Mining Right
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NBA	National Biodiversity Assessment
NWA	National Water Act
PES	Present Ecological State
RBIDZ	Richards Bay Industrial Development Zone
REC	Recommended Ecological Category
RMO	Resource Management Objective
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SQR	Sub quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission
WULA	Water Use License Application

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (Pty) Ltd (SAS) was appointed by NEMAI Consulting to conduct a freshwater assessment as part of the Environmental Authorisation (EA) process for the proposed Mabasa 750MW Combined Cycle Gas Turbine (CCGT) power plant in the city of uMhlathuze Local Municipality and the King Cetshwayo District Municipality, KwaZulu-Natal Province. The project is located in the Richards Bay Industrial Development Zone (IDZ): Special Economic Zone Phase 1F, approximately 5 km east of the Nseleni Nature Reserve and 2 km north-west of Richards Bay central.

To identify all freshwater ecosystems that may potentially be impacted by the activities associated with the proposed Mabasa project, a 500 m “zone of investigation” around the study area where the project is located, in accordance with Government Notice (GN) 4167 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (as amended) (NWA) was used as a guide in which to assess possible sensitivities of the receiving environment. This 500 m “zone of investigation” will henceforth be referred to as the ‘investigation area’.

The purpose of this report is to define the ecology of the area in terms of freshwater ecosystems characteristics, including mapping of the freshwater ecosystems, discuss key ecological drivers and to define the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS), as well as the socio-cultural and ecological service provision of the freshwater ecosystems utilising current industry “best practice” assessment methods in order to ascertain what, if any, impact the activities will have on the freshwater ecosystems associated with the proposed Mabasa project. Additionally, this report aims to define the Recommended Management Objectives (RMO) and Recommended Ecological Category (REC) for the freshwater ecosystems. The objective of the study is to provide detailed information when considering the existing activities in the vicinity of the freshwater ecosystems, to ensure the ongoing functioning of the ecosystem such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development.

The Department of Water and Sanitation (DWS) prescribed Risk Assessment Matrix (as prescribed by GN 4167 of December 2023) as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was applied to determine the significance of the perceived impacts associated with the proposed Mabasa project construction and operation activities on the receiving environment. In addition, mitigatory measures were developed, which aim to minimise the

perceived impacts associated with the existing activities, followed by an assessment of the significance of the impacts post-mitigation. This report, after consideration and a description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP) and relevant authorities, by means of a reasoned opinion and recommendations, as to the viability of the activities from a freshwater ecosystems management point of view.

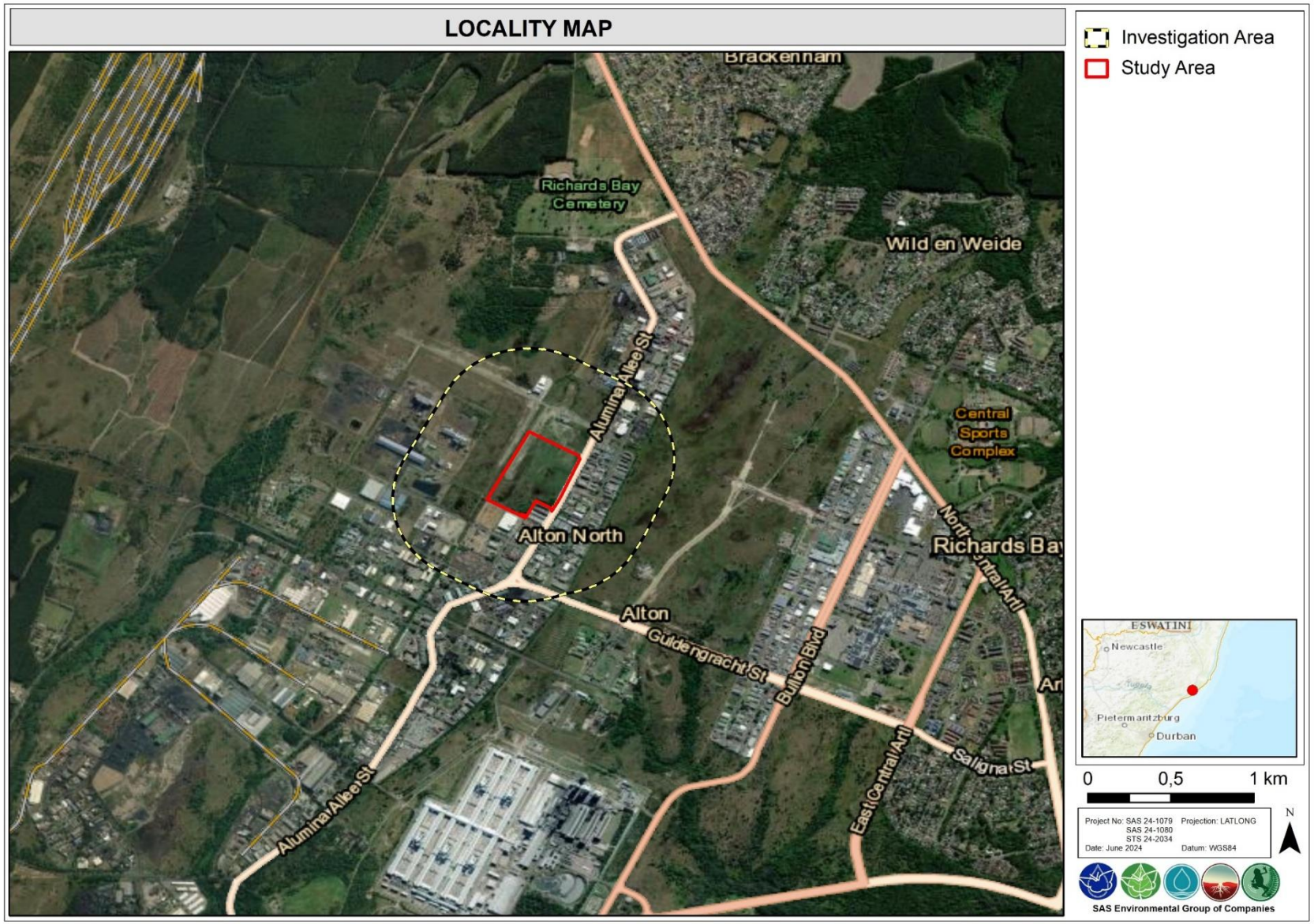


Figure 1: The location of the study and investigation areas in relation to the surrounding environment.

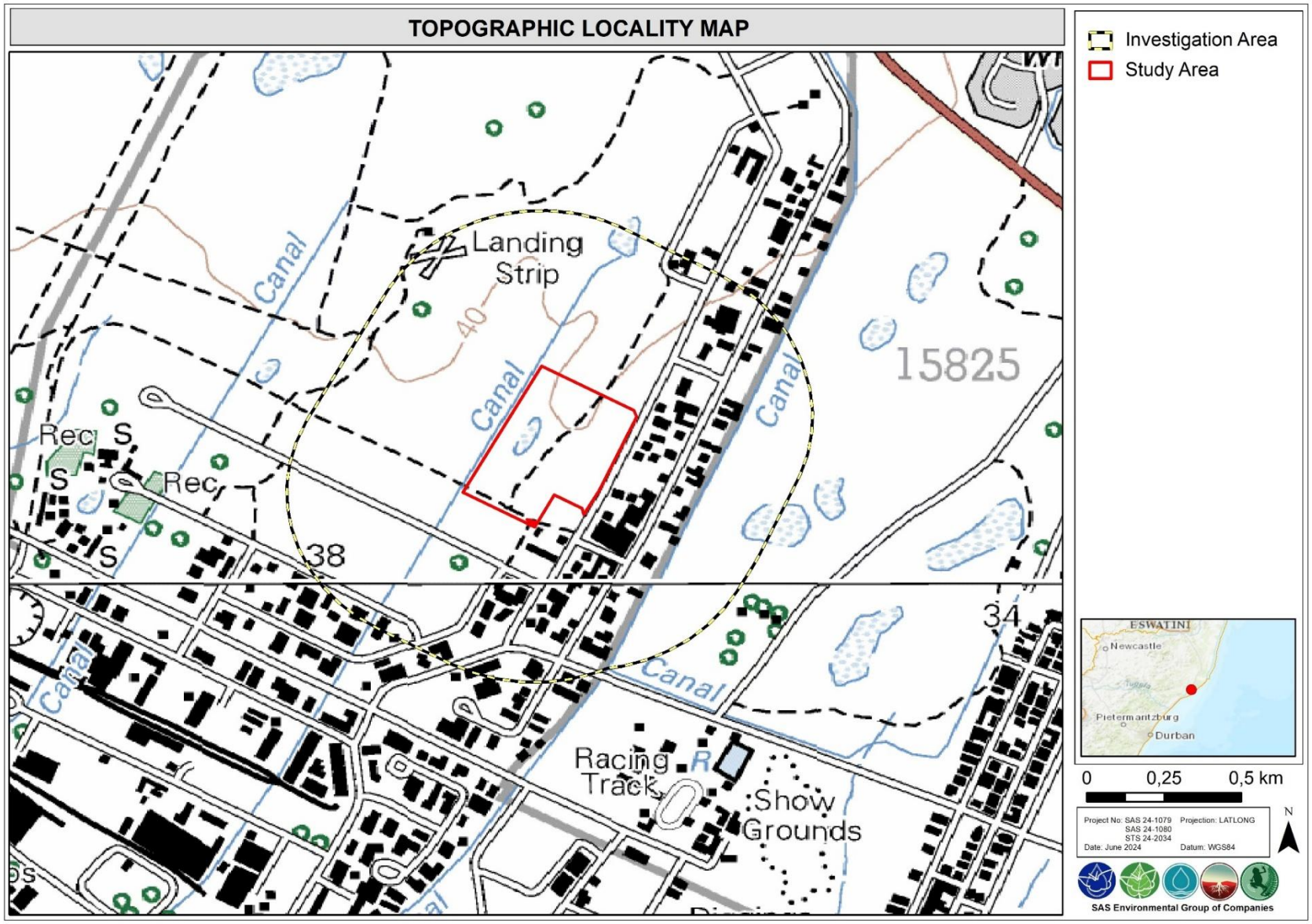


Figure 2: The study and investigation areas depicted on a topographical map.

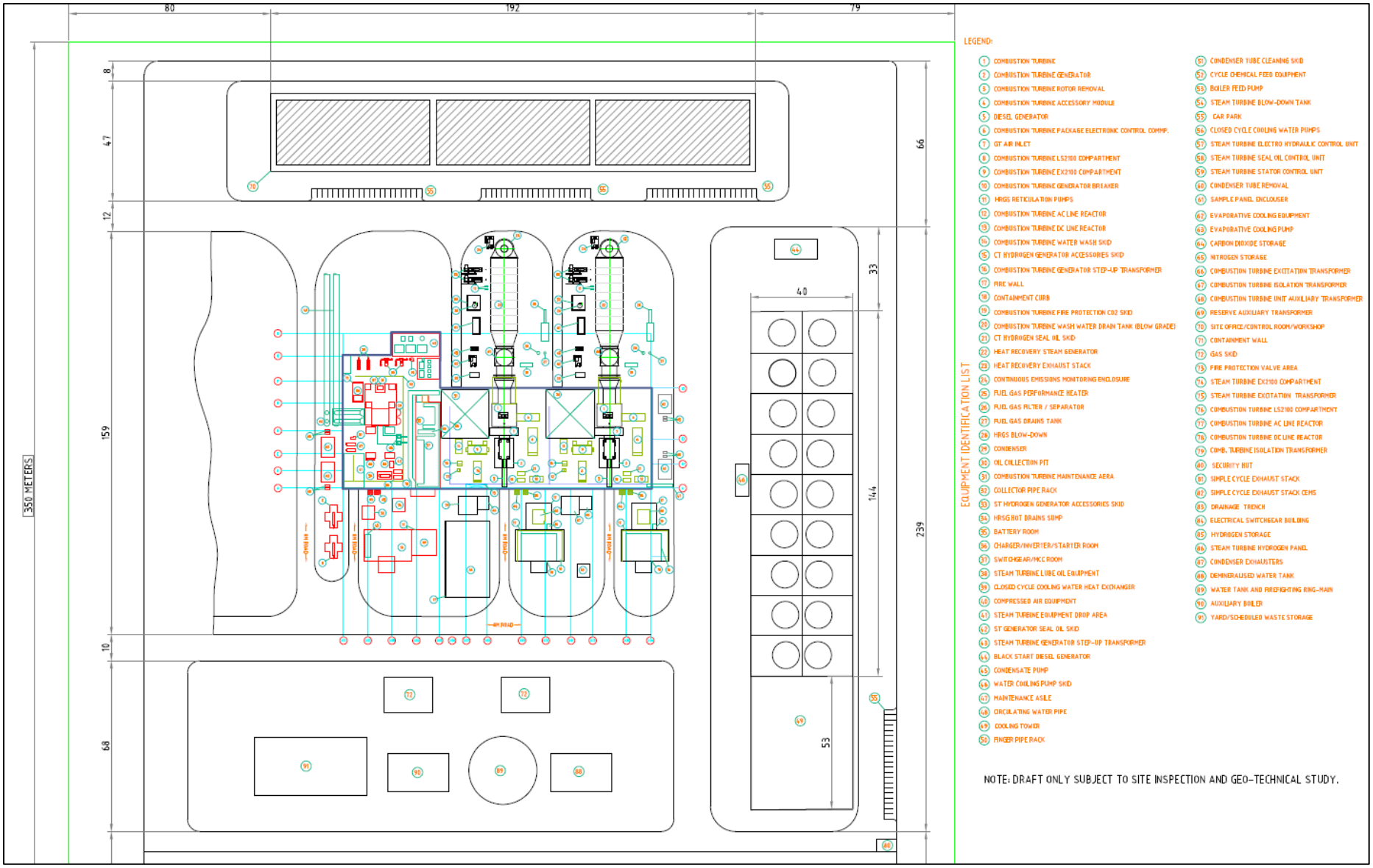


Figure 3: Conceptual layout of the proposed Combined Cycle Power Plant.

1.2 Project Description

The Combined Cycle Power Plant (the “Plant”) will be designed to provide a highly reliable, efficient, and low cost means of generating electricity. Design features of the Plant will be carefully considered to provide the optimum balance between capital cost and operation and maintenance benefits, whilst considering environmental impacts associated with combustion of fuel and using the best available technologies.

The scope of supply for the Plant will be based on a “2+2+1 combination” comprising of two GE Frame gas turbines (the “Combustion Turbine”) each with a dedicated Heat Recovery Steam Generator (the “HSRG”) to generate and supply steam to a shared steam turbine (the Combustion Turbine, HRSG and steam turbine together known as the “Power Plant”).

Generators attached to each of the Combustion Turbines and steam turbines will supply electrical power to a grid. The Combustion Turbines are capable of firing on a variety of fuels however most commonly natural gas or light distillate oil. Specific calculations will be made based on the fuel availability for a specific Project.

The Plant will comprise of the following key equipment:

- Two (2) General Electric Frame 9 (model 9F.03) combustion turbines and generators;
- Two (2) triple pressure, 3 drum, natural circulation Heat Recovery Steam Generators (HRSG);
- One (1) condensing steam turbine and generator;
- One (1) de-aerating surface condenser;
- One (1) induced draft cooling tower;
- Balance of plant (BOP) equipment consisting of Pumps, Heat Exchangers, Transformers, Power Electrics, etc;
- One (1) integrated plant distribution control system; and
- 275 kV Switchyard comprising of three (3) x 15kV to 275kV step-up transformers and one (1) station auxiliary transformer (the rating to be defined during detailed design).

The Plant will be designed for base load operations at 500MW in Simple Cycle and 750MW in Combined Cycle on 24 hours a day, seven days a week basis.

Project Site and Plant Arrangement

The overall site and building arrangement has been developed to minimize space requirements while maintaining ample access for operation and maintenance activities. The land area required for the Project is 130,000m2.

The plant arrangement is conceptual and should be finalized after i) a site visit, ii) completion of a geotechnical soil study, iii) location and direction of the transmission line / grid connection point, iv) the location of the fuel gas pipeline on site, v) utilities on site, and vi) any environmental impact study considerations.

The electrical switchgear and associated auxiliary equipment will be located within constructed buildings. The steam turbines will also be located within a building construction (the “Steam Hall”). The Steam Hall will house an office for technical staff, locker / toilet facility a workshop, a laboratory and storage area.

All other major equipment will be designed for outdoor use.

Sufficient operations, administrative and support facilities are considered. A central control room provides a controlled environment to protect sensitive electrical equipment and for operators to monitor and control plant functions. A main office will accommodate Plant management and administrative staff, facilities including a, kitchenette facility, toilet first aid room and a prayer room. All offices will have parking areas in front.

A demineralized water storage tank and system will provide boiler feed-water to the HRSG’s. The Plant will include one (1) induced draft cooling tower systems, with the source of the make-up water still to be defined. The Plant will have a dedicated fire protection system; comprising of water storage, pumping system and pressurized ring main complete with fire hydrants positioned along the ring main, firefighting equipment, a sprinkler system for the offices, fire extinguishers and a deluge system for the switchyard.

Site access roads will permit normal operations and lay-down areas / access adjacent to major equipment to facilitate maintenance. Roads, including ducting and open drains and ditches crossing below a road, will be designed considering axel loads and tuning circles of large trucks and mobile cranes. The Plant will have adequate drainage to remove surface water from the site. Oily water separators positioned around the site will collect any spillage and or wash from maintenance operations on key equipment. The oily water separators will be designed to discharge grey water into the drains treated to a satisfactory cleanliness level.

Fencing will be provided around the perimeter of the HV switchyard and the Plant perimeter. Appropriate lighting and security system will be provided. The proposal assumes Potable water, telecommunications, power evacuation and sewage system raw water / sanitary waste will be available at the proposed Plant site boundary.

1.3 Scope of Work

Specific outcomes in terms of this report are outlined below:

Freshwater Ecological Assessment

- A background study of relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA] 2011 database; the Department of Water and Sanitation Research Quality Information Services [DWS RQIS PES/EIS], (2014) database, National Biodiversity Assessment (NBA) (2018), and the Guideline: Biodiversity Impact Assessment in KwaZulu-Natal (EKZN, 2013), were undertaken to aid in defining the PES and EIS of the freshwater ecosystems;
- All freshwater ecosystems within the investigation area were delineated using desktop methods in accordance with GN 4167 of December 2023 as it relates to activities as stipulated in the National Water Act, 1998 (Act No. 36 of 1998) and verified where possible according to the "Department of Water Affairs and Forestry (DWAF)[1] (2005)[2]: A practical field procedure for identification of wetlands and riparian areas". Aspects such as soil morphological characteristics, vegetation types and wetness were used to verify the freshwater ecosystems;
- The freshwater ecosystem classification assessment was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The EIS of the freshwater ecosystem was determined according to the method described by Rountree and Kotze (2013);
- The PES of the freshwater ecosystems was assessed according to the resource directed measures guideline as advocated by Macfarlane *et al*., (2008);
- The freshwater ecosystems were mapped according to the hydrogeomorphic units in relation to the proposed Mabasa project. In addition to the freshwater ecosystem boundaries, the appropriate provincial recommended buffers and legislated zones of regulation were depicted where applicable;
- Allocation of a suitable RMO, REC and Best Attainable State (BAS) to the freshwater ecosystems based on the results obtained from the PES and EIS assessments; and
- To present management and mitigation measures which should be implemented going forward to assist in minimising the impact on the receiving environment.

[1] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA) and subsequently as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.

[2] Even though an updated manual is available since 2008 (Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas), this is still considered a draft document currently under review.

DWS Risk Assessment

- An Environmental Authorisation (EA) (Ref: 14/12/16/3/3/2/665) and associated Water Use Authorisation (WUA) were previously granted for RBIDZ Phase 1F, which included the infilling of wetlands and the development of service infrastructure to support industrial development within the study area. As these activities have already been authorised and are not being reapplied for as part of the current application, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was not applied as no additional significant quantum of risk to the adjacent wetlands is deemed likely as a result of the proposed development.

1.4 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- An Environmental Authorisation (EA) was granted by the former Department of Environmental Affairs (DEA), now the Department of Forestry, Fisheries and the Environment (DFFE), for the RBIDZ Phase 1F development in September 2016 (Reference No.: 14/12/16/3/3/2/665). The authorised development included the following infrastructure components: water infrastructure, sewer infrastructure, stormwater infrastructure, roads, electrical services, and the infilling of wetlands to facilitate industrial development. The access roads and associated services required for the proposed project are therefore already covered under the existing EA and do not form part of the current application. Importantly, the infilling of wetlands within the site has also been authorised under the existing EA and is excluded from the present assessment. As such, impacts to freshwater ecosystems from the authorised infilling are not assessed as part of this report. However, for completeness and to inform the broader ecological context of the site, baseline information relating to the freshwater habitats present within the study area has been included;
- All freshwater ecosystems associated with the proposed Mabasa project were ground-truthed, however freshwater ecosystems within 500 m of the proposed Mabasa project were delineated in fulfilment of GN 4167 of the National Water Act, 1998 (Act No. 36 of 1998) using various desktop methods including use of topographic maps, historical and current digital satellite imagery and aerial photographs. Desktop delineations were ground-truthed where feasible;
- Due to presence of various activities and disturbances in the area, such as vegetation clearing, for development of surface infrastructure such as includes service buildings and roads, vegetation was not always a reliable indicator of the presence of freshwater ecosystems throughout the areas assessed. As such, in highly disturbed areas, the

vegetation indicator may have affected the accuracy of the delineation. Under such circumstances satellite imagery was used to improve accuracy of the delineations;

- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the freshwater ecosystems will need to be surveyed and pegged according to surveying principles and with survey equipment;
- With regards to data sources used to provide background information on the sensitivity of the assessed areas, it is important to note that although all data sources provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the study area's actual site characteristics at the scale required to inform the environmental authorisation process;
- Wetland, riparian and terrestrial ecosystem zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the freshwater ecosystem boundary may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results;
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. A more reliable assessment of the biota would require seasonal sampling, with sampling being undertaken under both low flow and high flow conditions. However, it is expected that the existing activities have been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of aquatic, riparian and wetland ecology.

1.5 Legislative Requirements and Provincial Guidelines

The following legislative requirements and relevant provincial guidelines were taken into consideration during the assessment. A detailed description of these legislative requirements is presented in Appendix B:

- Constitution of the Republic of South Africa, 1996[3];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Government Notice (GN) 4167 of 2023 published in December 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);

[3] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The National Environmental Management: Biodiversity Act: Alien and Invasive Species Regulations, 2014;
- Guideline: Biodiversity Impact Assessment in KwaZulu-Natal (EKZN, 2013); and
- The Department of Environment, Forestry and Fisheries (DEFF), (2020) National Web-based Environmental Screening Tool (hereafter the "screening tool").

2 ASSESSMENT APPROACH

2.1 Freshwater Ecosystem Definition

For the purposes of this investigation, the definition of a watercourse riparian and wetland habitats were taken as per that in the National Water Act, 1998 (Act No. 36 of 1998). The definitions are as follows:

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

Wetland habitat is "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 typically adapted to life in saturated soil."

Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

Thus, for the purposes of this investigation, the definition of a freshwater ecosystem is considered to be synonymous with the definition of a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998) and the terms may be used interchangeably in this report.

2.2 Freshwater Ecosystem Field Verification

As mentioned in Section 1.3 use was made of historical aerial photographs, historical and current digital satellite imagery, topographic maps, and available provincial and national wetland databases to aid in the delineation of those portions of the freshwater ecosystems associated with the proposed Mabasa project following the field assessment. The following was taken into consideration when utilising the above during delineation:

- Linear features: since water flows/moves through the landscape, freshwater ecosystems often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with watercourses: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often show as white/grey or black and outcrops or bare soil displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with watercourse vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

The freshwater ecosystem delineation was verified in the field at pre-selected points, and this delineation took place according to the method presented in the “Updated manual for the identification and delineation of wetland and riparian resources” (DWAF, 2008). The foundation of the method is based on the fact that freshwater ecosystems have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soil;
- Vegetation adapted to saturated soil; and
- The presence of alluvial soil in stream systems.

A field assessment was undertaken in June 2024 during the Winter season, during which the presence of any riparian or wetland characteristics as defined by DWAF (2008) and by the National Water Act, 1998 (Act No. 36 of 1998) were noted (please refer to Section 4 of this

report). In addition to the delineation process, detailed assessments of the delineated freshwater ecosystems were undertaken, at which time, factors affecting the integrity of the freshwater ecosystems were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the freshwater ecosystems. A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

2.3 Sensitivity Mapping

All freshwater ecosystems associated with the proposed Mabasa project were delineated on a desktop basis, with these delineations being ground-truthed in the field at certain pre-selected points where possible with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project these features onto digital satellite imagery and topographic maps.

2.4 Risk Assessment and Recommendations

An Environmental Authorisation (EA) (Ref: 14/12/16/3/3/2/665) and associated Water Use Authorisation (WUA) were previously granted for RBIDZ Phase 1F, which included the infilling of wetlands and the development of service infrastructure to support industrial development within the study area. As these activities have already been authorised and are not being reapplied for as part of the current application and as no additional significant quantum of risk to the adjacent wetlands is deemed likely as a result of the proposed development, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was not applied.

3 RESULTS OF THE DESKTOP ANALYSIS

3.1 Analyses of Relevant Databases

The following section contains data accessed as part of the desktop assessment and is presented as a “dashboard” report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for the integration of results by the reader to take place. Where required, further discussion and interpretation are provided, and information that was considered of importance was emboldened.

It is important to note that although all data sources are used to provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the proposed Mabasa project actual site characteristics at the scale required to inform the EA processes. Nevertheless, this information is considered useful as background information to the study, is important in legislative contextualisation of risk and impact, and was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance. It must, however, be noted that site assessment of key areas may potentially contradict the information contained in the relevant databases, in which case the site-verified information must carry more weight in the decision-making process. The information contained in the dashboard report below is intended to provide background to the landscape of the proposed Mabasa project and the associated investigation area. Actual site conditions at the time of the assessment may differ from the background information provided by various datasets. Please refer to Section 4 for details pertaining to the site investigation results.

Table 1: Desktop data (from available databases only) relating to the character of the freshwater ecosystems within the investigation area.

Aquatic ecoregion and sub-regions in which the study area is located		Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
Ecoregion	Natal Coastal Plain	FEPACODE	The study and investigation areas fall within a sub quaternary catchment currently not considered important in terms of fish or freshwater conservation.
Catchment	Mfolozi / Pongola		
Quaternary Catchment	W12F	NFEPA Wetlands	According to the NFEPA database a natural unchannelled valley bottom wetland is within the study area and two natural valleyhead seeps and a natural flat wetland is situated within the investigation area. The abovementioned wetlands are all indicated to be unmodified to Largely Natural (Class AB).
WMA	Usutu to Mhlathuze		
subWMA	Mhlathuze		
Dominant characteristics of the Natal Coastal Plain Ecoregion Level 2 (13.03) (Kleynhans *et al.*, 2007)		Wetland Vegetation Type	The entire study area falls within the Indian Ocean Coastal Belt Group 1 wetland vegetation type – considered to be a least threatened ecosystem (Mbona *et al.*, 2015).
Dominant primary terrain morphology	Plains; Low Relief	NFEPA Rivers	According to the NFEPA database there are no rivers situated within the study and investigation areas.
Dominant primary vegetation types	Sand Forest, Valley Thicket	National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE)	
Altitude (m a.m.s.l)	0 – 300	According to the NBA database (2018), a natural depression wetland is within the study area and four depression wetlands are indicated to be located within the investigation area. Three depression wetlands within the investigation area are in a natural or good (Class AB) ecological condition, while the depression within the study area and directly to the west is considered largely to critically modified (D/E/F) ecological condition due to being affected by roads. The depressions wetlands are all vulnerable (Ecosystem Threat Status) and well protected (Ecosystem Protection Level).	
MAP (mm)	600 – 1000		
Coefficient of Variation (% of MAP)	< 20 to 30		
Rainfall concentration index	30 to 50		
Rainfall seasonality	Late summer		
Mean annual temp. (°C)	20 to >22		
Winter temperature (July)	>10 – >24 °C		
Summer temperature (Feb)	>20 – 30 °C		
Median annual simulated runoff (mm)	52 to 420p		
Details of the site in terms of FEPA's Soils/Land Type Database		Detail of the study area in terms of the Draft KwaZulu-Natal Biodiversity Spatial Planning Terms and Processes (2016)	
The majority of the study area and investigation area are within the Hb69 land type grouping, with the remaining southern portion within the Hb75 land type grouping. These Land Types accommodate land in which deep grey sands of the Fernwood are a prominent feature. Constantia and Shepstone and Vilafontes forms are also included. Hb indicates land where these soils occupy between 20 to 80% of the area.		According to the KZN Biodiversity Spatial Plan (2016) the majority of the investigation area and the entire study area is located within an area considered to be Critical Biodiversity Area (CBA) irreplaceable area. Irreplaceable CBAs are areas considered critical to meet biodiversity targets and thresholds, which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.	
Strategic Water Source Areas (SWSA, 2017 and 2021)			
The study and investigation areas are indicated to be within the Richards Bay GW Fed Estuary Groundwater Strategic Water Source Area. The study area is not associated with a surface water SWSA. The Strategic Water Source Areas for groundwater (SWSA-gw) reflect areas that have high groundwater recharge and where the groundwater forms a nationally important resource. The areas are delineated for the purposes of research, and the outcomes are useful to national level planners and decision makers as an indication of the location of strategic groundwater sources and resources. Sub-national WSAs for groundwater were also identified.			

DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; m.a.m.s.l = Metres above Mean Sea Level; MAP = Mean Annual Precipitation; mm = millimetres; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; WMA = Water Management Area

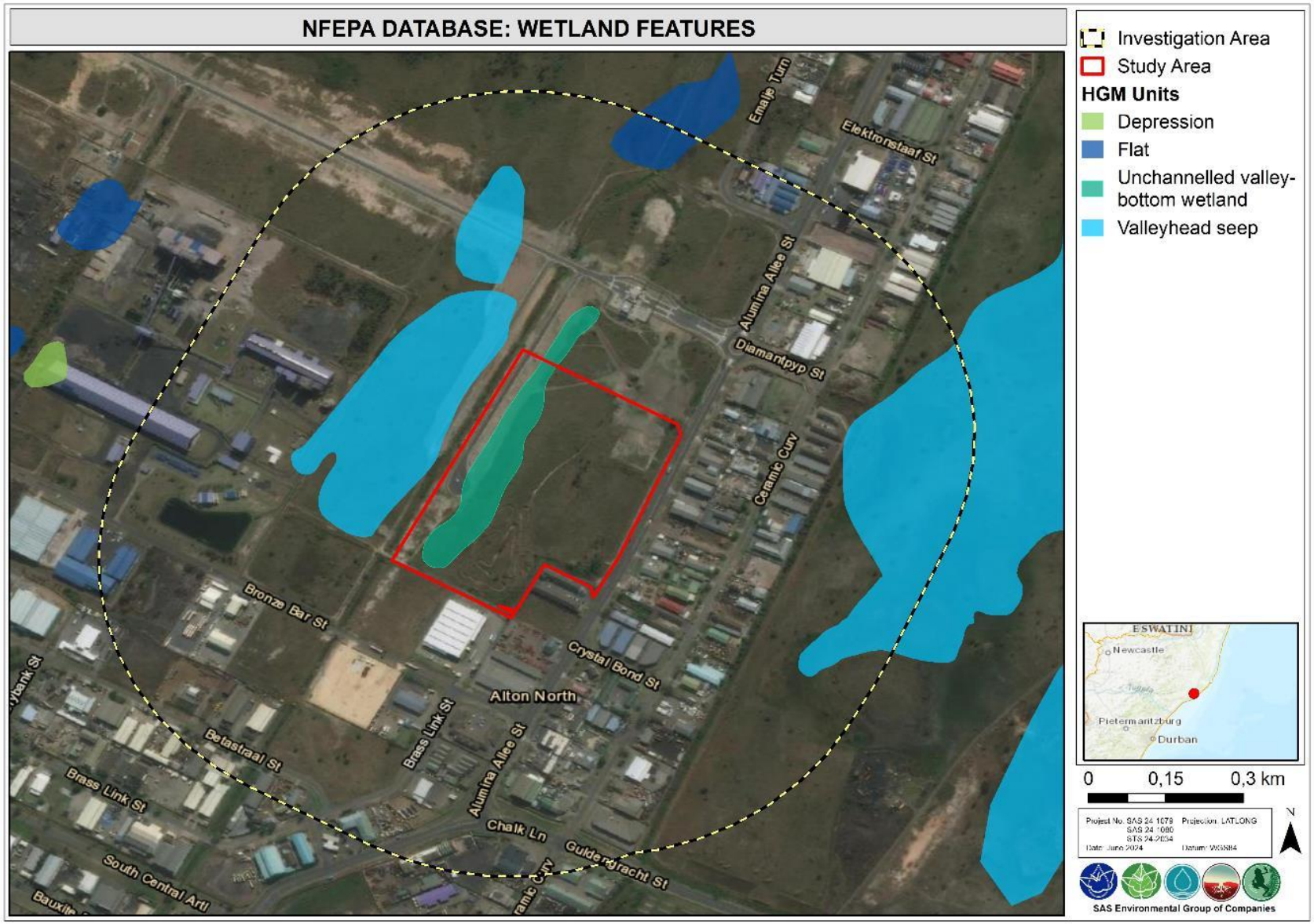


Figure 4: Wetland hydrogeomorphic units associated with the study area and investigation areas according to the NFEPA database (2011).

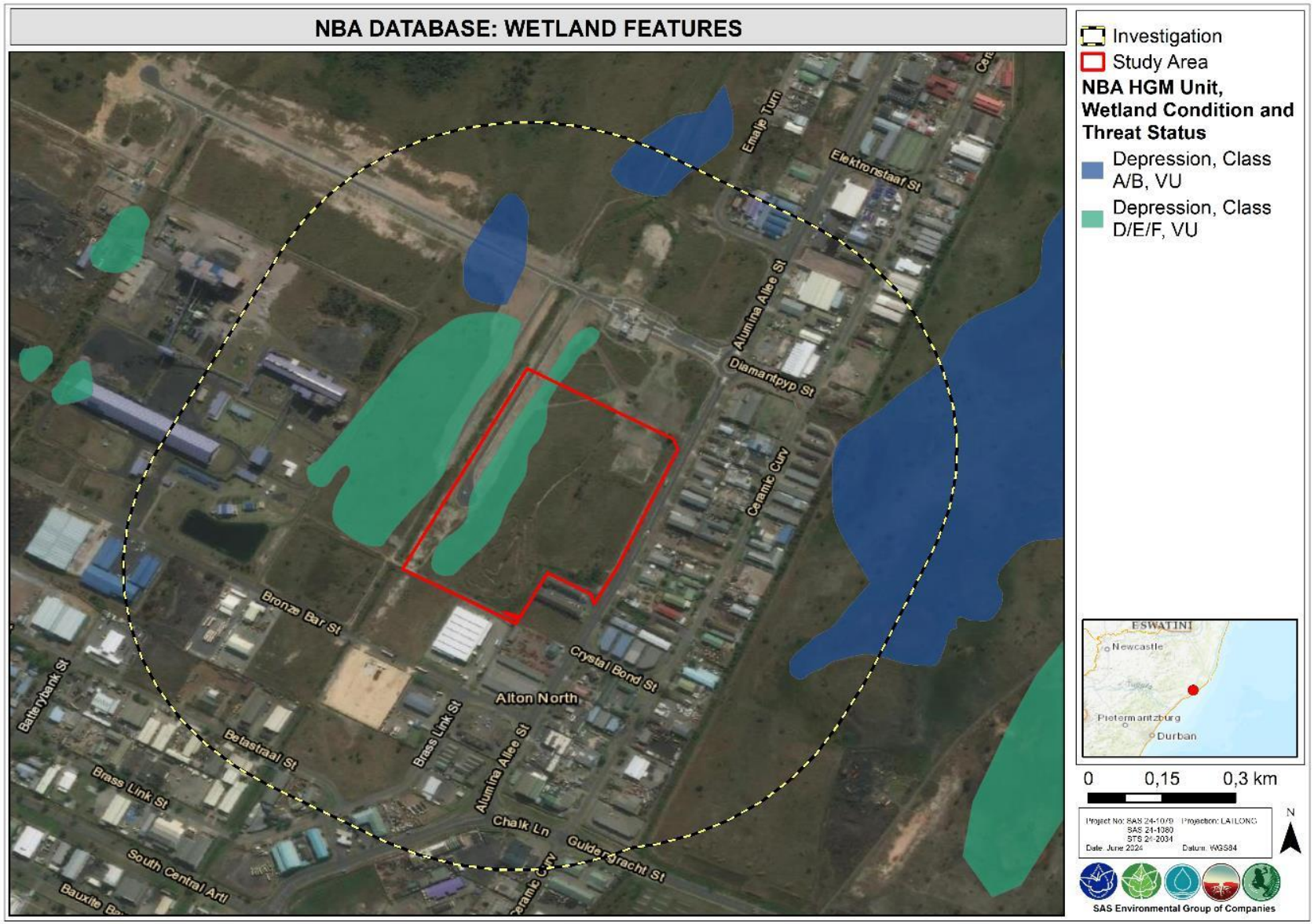


Figure 5: Wetland hydrogeomorphic units associated with the study area and investigation areas according to the NBA (2018) database.

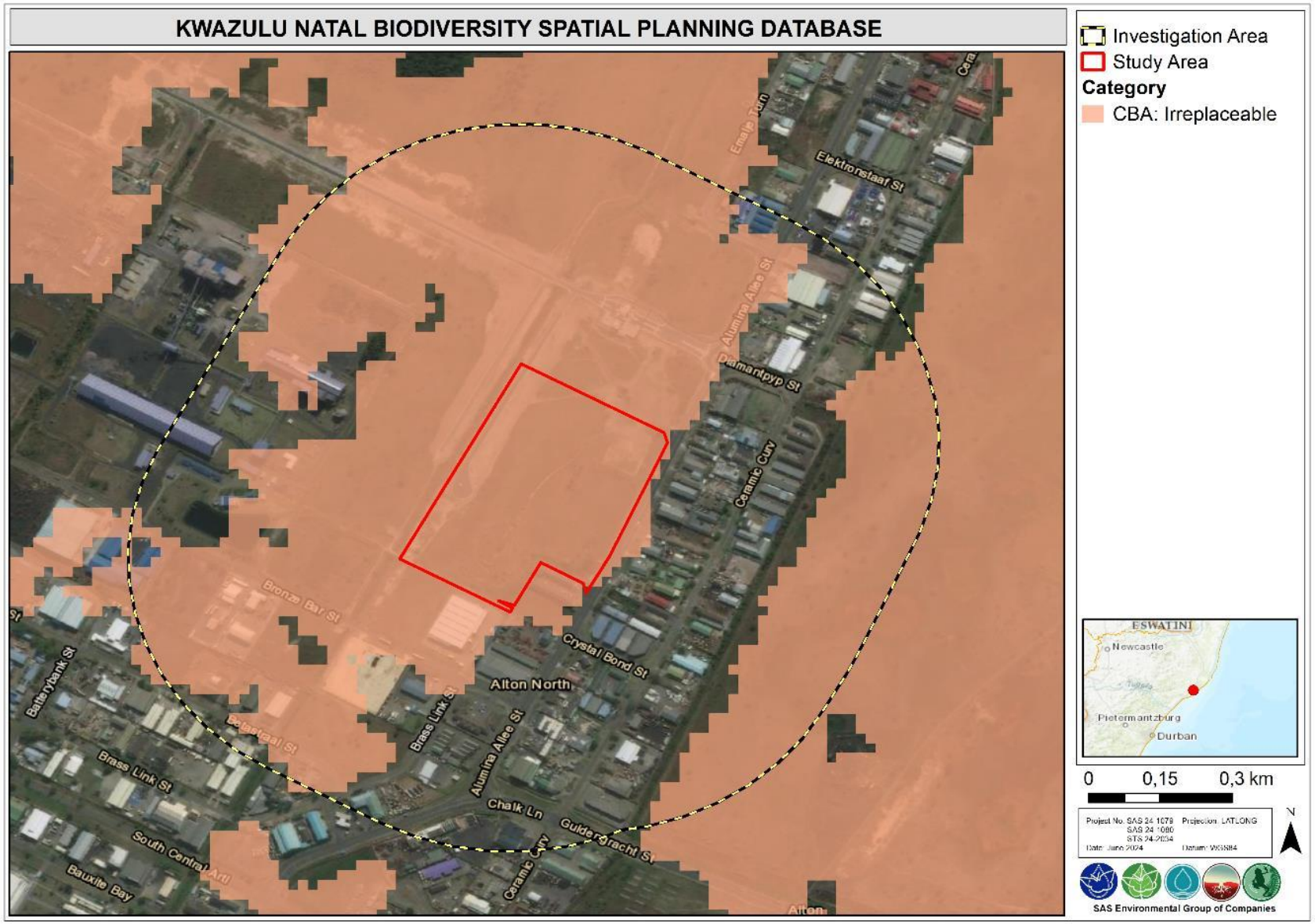


Figure 6: Irreplicable Critical Biodiversity Areas (CBAs) according to the KwaZulu – Natal Spatial Biodiversity Areas database.

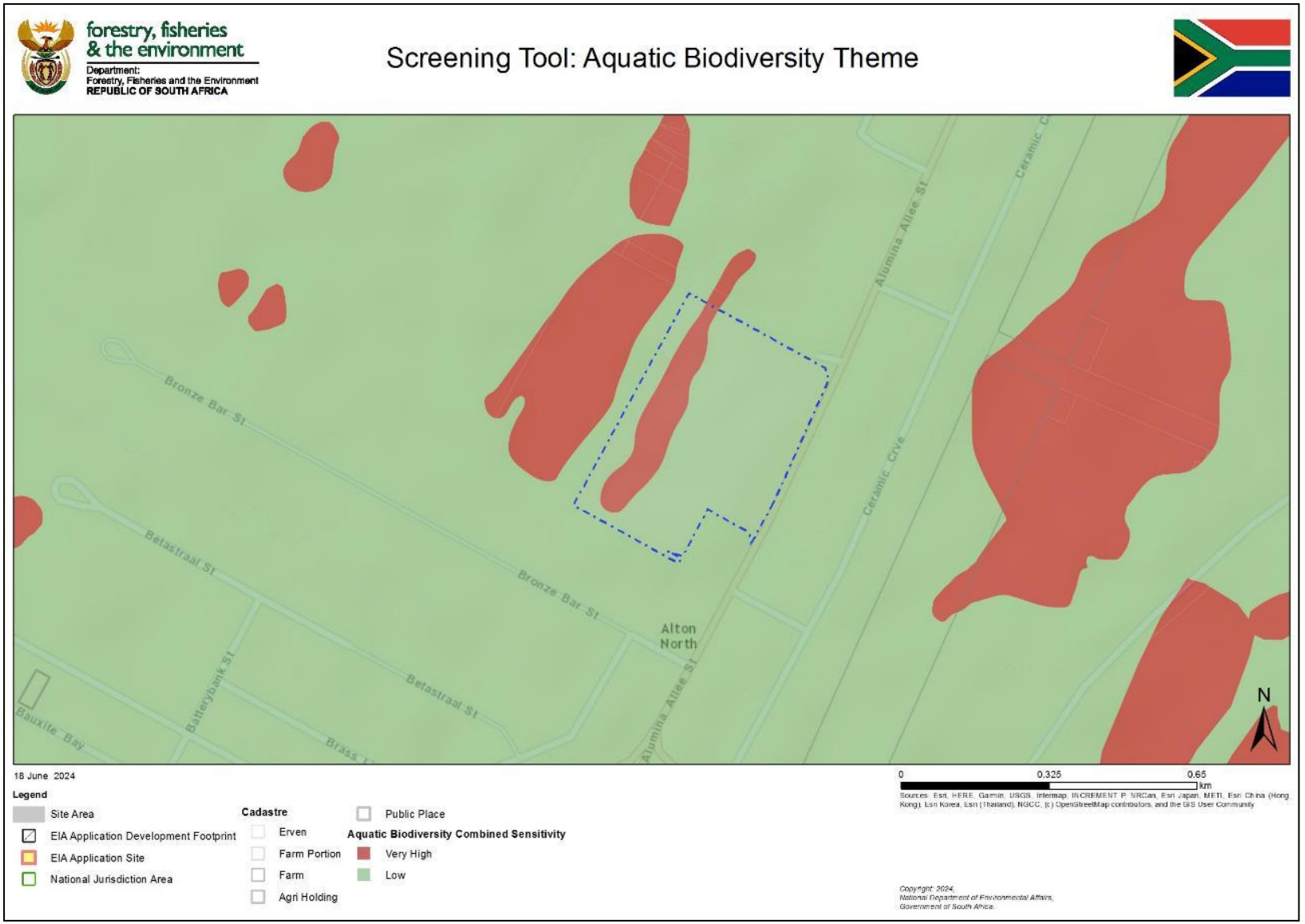


Figure 7: Aquatic Biodiversity Theme Sensitivity associated with the study area according to the National Web-based Screening Tool (2020; Accessed 2024).

4 RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT

4.1 Freshwater Ecosystem Characterisation

In preparation for the field assessment, aerial photographs, digital satellite imagery and provincial and national wetland databases (as outlined in Section 2 of this report) were used to identify areas of interest at a desktop level. All possible measures were undertaken to ensure all freshwater ecosystems which may be affected by the proposed Mabasa project were identified, delineated and assessed. During the assessment, two wetlands were identified within the study area, namely a seep wetland and wetland flat.

The freshwater ecosystems were classified according to the Classification System (Ollis *et al*., 2013) as Inland Systems, falling within the Natal Coastal Plain Ecoregion. The proposed Mabasa project and investigation areas fall within the Ocean Coastal Belt Group 1 wetland vegetation type – considered to be a least threatened ecosystem (Mbona *et al*., 2015). At Levels 3 (Landscape Unit) and 4 (HGM Type) of the Classification System, the systems were classified as per the summary in Table 2 below.

Table 2: Characterisation of the freshwater ecosystems associated with the proposed Mabasa project according to the Classification System (Ollis *et. al*., 2013).

Freshwater Ecosystem HGM Type	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) Type
Seep Wetland	Slope-an inclined stretch of ground typically located on the side of a mountain, hill or valley, not forming part of a valley floor. Includes scarp slopes, mid-slopes and foot-slopes.	A wetland area located on gently to steeply sloping land and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope.
Wetland flat	**Plain/ Flat:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land.	**Wetland flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat.

4.2 Freshwater Ecosystem Delineation

As noted in Section 2.1, the freshwater ecosystems associated with the proposed Mabasa project were initially delineated using desktop methods (use of aerial photographs, digital satellite imagery and topographical maps), and refined in the field by ground-truthing the desktop delineation at certain pre-selected points. The delineations as presented in this report are thus regarded as a best estimate of the freshwater habitat boundaries based on the site conditions present at the time of assessment. The following indicators were used to delineate the boundaries of the temporary zones associated with the identified freshwater ecosystems:

- Terrain units were used as the primary indicator. Despite transformation of the landscape associated with the study area, the terrain provided an indication of low-lying areas where water is likely to collect and/or move through the landscape and areas in the landscape where seep wetlands could potentially be expected to occur;
- Vegetation was utilised in conjunction with terrain as the secondary indicator, where feasible. Due to the extensive transformation due to historical activities, it was worth noting that the vegetation indicator was not always reliable, especially in areas that have undergone proliferation of alien invasive plants (AIP's), where vegetation has been extensively cleared and where a wet response has been due to significant rainfall which took place days prior to the sampling time;
- The soil wetness indicator, duration and frequency of saturation in the soil profile provides a diagnostic indicator since it influences the colour change in the soil. Low chroma (grey and muted colours) as well as mottles are more prominent in soil which is associated with fluctuating water table; and
- Similarly, the soil morphological characteristic indicator was also utilised especially in areas where no significant disturbance of soil has taken place. In unimpacted sites, the soil morphological characteristics typically associated with wetland conditions display gleying or mottling.

The figures below indicate the location of the delineated freshwater ecosystems associated with the proposed Mabasa project and investigation area.

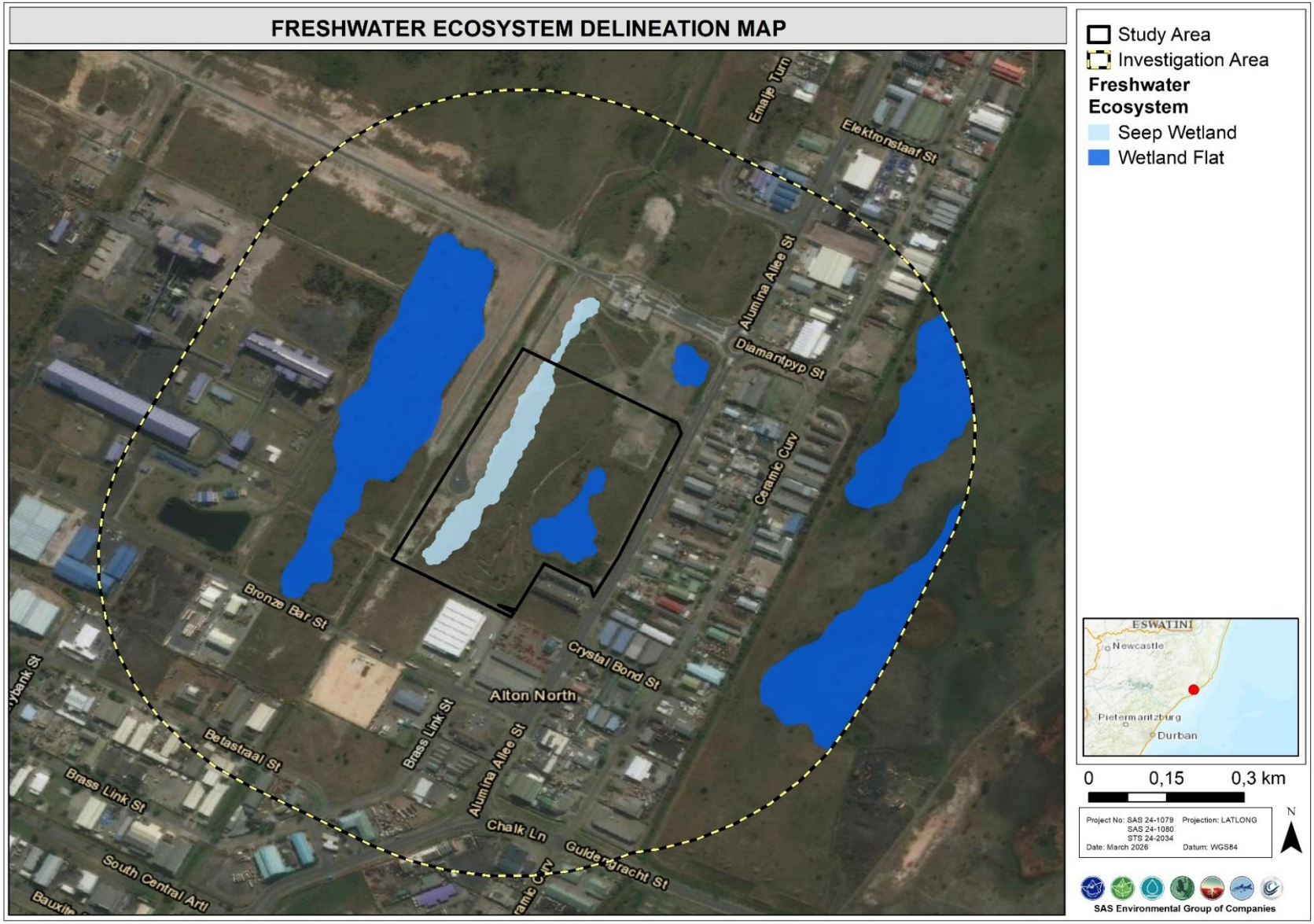


Figure 8: The location of the delineated wetlands associated with the proposed Mabasa project.

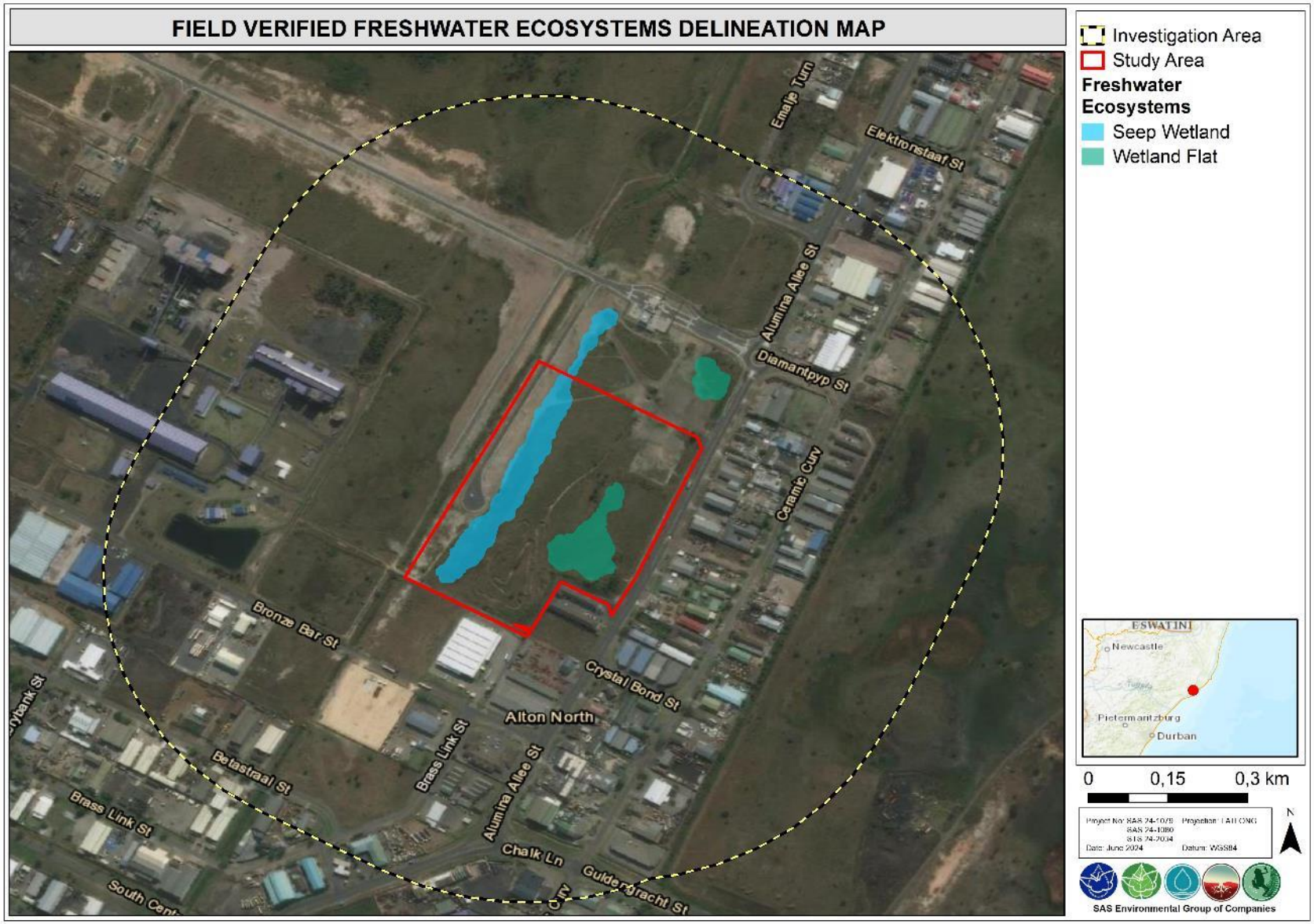


Figure 9: The location of the delineated wetlands associated with the proposed Mabasa project.

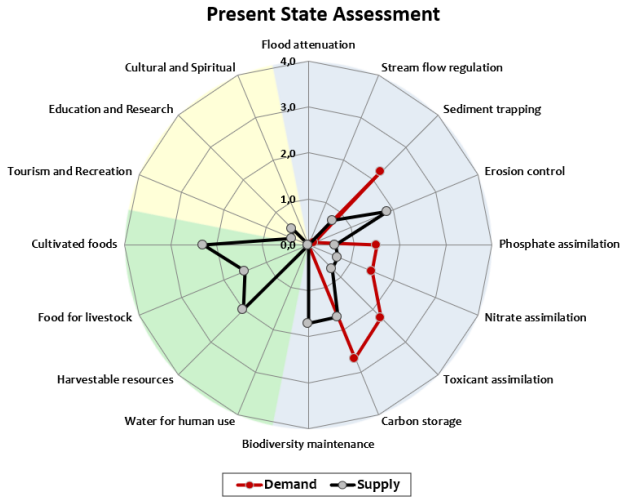
4.3 Field Verification Results

Following the site visit, various assessments were undertaken to determine the following:

- The PES, incorporating aspects such as hydrology, vegetation and geomorphology of the delineated wetlands;
- Service provision of the delineated riverine systems which incorporates biodiversity maintenance, flood attenuation, streamflow regulation and toxicant assimilation, to name a few;
- The EIS is guided by the results obtained from the assessment of the PES and service provision of the delineated wetlands; and
- Allocation of appropriate REC, RMO and BAS based on the PES, service provision, and EIS results to guide the management of the delineated wetlands with the intent of enhancing the ecological integrity of the systems, where feasible.

The results of the assessments are presented in the “dashboard style” reports below (Table 3).

Table 3: Summary of the assessment of the seep wetland within the study area.

<table>
<tr>
<td colspan="2">Ecological & socio-cultural service provision graph:

</td>
<td colspan="2"> 
Figure A: Representative photographs of the seep wetland within the study area.</td>
</tr>
<tr>
<td>PES discussion</td>
<td>PES: Moderately Modified (Category C)

The seep wetland identified were ascertained to be in a largely modified ecological condition at the time of the assessment. The wetland is located within a highly transformed landscape characterised by surrounding industrial infrastructure, road networks, and disturbed open areas. Hydrologically, the wetland's natural regime has been altered by adjacent roads and compacted surfaces, which concentrate and redirect runoff into the wetland, increasing flow velocities and reducing diffuse recharge. Geomorphologically, disturbance is evident through areas of bare soil, infilling, and altered topography, which contribute to sediment mobilisation and deposition within the wetland.</td>
<td>Ecoservice provision</td>
<td>Very Low to Moderate

The wetland's ecosystem service provision was assessed as very low to moderate overall. Despite this, sediment trapping, nitrate assimilation, and toxicant assimilation were ascertained to be provided at moderate levels, reflecting the influence of surrounding catchment activities.

Given the wetland's location within a predominantly industrial landscape, the provision of services directly beneficial to local communities, such as socio-cultural functions and harvestable natural resources, is considered limited.</td>
</tr>
</table>

EIS discussion	**EIS Category: Moderate** The overall ecological importance and sensitivity of the seep wetland is ascertained to be moderate. This is primarily driven by the wetland's role in providing key regulating ecosystem services, including nitrate and phosphate assimilation, as well as flood attenuation. The wetland falls within the Indian Ocean Coastal Belt Group 1 vegetation type, which is classified as Least Threatened (Mbona *et al*., 2015), further supporting the moderate ecological importance rating.	**REC, RMO & BAS Category**	**REC: C** **BAS: C** **RMO: Maintain** Given that the proposed infrastructure will result in the complete loss of the seep wetlands since the wetlands are going to be infilled, a recommended management objective (RMO) cannot be specified for the particular wetland.
Wetland drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):			
The hydraulic regime of the seep wetland has been impacted by current and historical activities within the wetland and its broader catchment. The wetland is confined within a narrow, linear corridor surrounded by industrial infrastructure and extensive road networks. As seep wetlands are primarily driven by subsurface inputs from upgradient areas, it is likely that surrounding industrial development and land transformation have altered both the quantity of water entering the system. The presence of adjacent roads and disturbed areas has further modified the natural pattern, timing of flow within the wetland as runoff now likely reaches the wetland as concentrated runoff from hard-infrastructure areas. No surface water was present at the time of the assessment; therefore, no in-situ water quality measurements were recorded. However, given the surrounding land uses, it is likely that water quality may be influenced by nutrient and contaminant inputs (e.g., nitrates and phosphates) from upstream and adjacent activities. Portions of the wetland show signs of desiccation, likely linked to reduced hydrological connectivity and altered recharge patterns. This has resulted in localised loss of hydrophytic vegetation and basal cover, increasing susceptibility to erosion. Disturbances associated with cleared areas, informal access tracks, and hardened surfaces have reduced infiltration and promoted the formation of preferential flow paths, further altering sediment transport and water distribution within the system. Infilling within the study area has also resulted in geomorphological impacts on the wetland. Vegetation within this habitat is dominated by grasses, sedges, and herbaceous species adapted to saturated conditions, including *Cyperus spp*., *Juncus spp*., *Phragmites australis*, *Typha capensis*, and *Leersia hexandra*. The graminoid and sedge layers are typically dense in less disturbed areas, forming the primary structural component of the habitat. Alien invasive plant (AIP) species, including *Eichhornia crassipes* (restricted to areas of standing or slow-moving open water), *Cenchrus clandestineus*, and *Chromolaena odorata*, are likely to occur within disturbed portions of the wetland system. These species are typically associated with anthropogenically altered conditions and increased nutrient availability. Their occurrence is generally limited in extent within more intact sections of the wetland, where indigenous hydrophilic vegetation remains dominant and ecological functioning is relatively better preserved (Scientific Terrestrial Services, 2026).		
Extent of modification anticipated	**High** The extent of modification to the seep wetland was considered to be high given that the seep wetland within the study area will be completely lost due to the authorised infilling. This will result in a complete loss of ecological functioning for these wetlands. While the loss of wetlands within the authorised development footprint is therefore acknowledged, it remains essential that construction activities are undertaken in accordance with best practice and environmental management measures to minimise further impacts. This includes the implementation of appropriate housekeeping measures, such as erosion and sediment control, prevention of pollution, and careful management of stormwater, to ensure that adjacent and remaining aquatic features are protected and that the broader ecological integrity of the area is maintained.		

Table 4: Summary of the assessment of the wetland flat located within the study area.

Ecological & socio-cultural service provision graph:

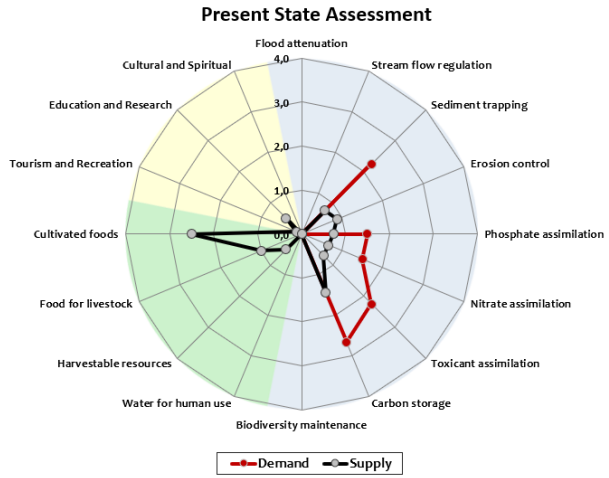




Figure C: Representative photographs of the wetland flat located within the study area.

PES discussion	**PES: Moderately Modified (Category D)** The wetland flat was ascertained to be in a largely modified ecological condition at the time of the assessment. The historical disturbances within the study area have resulted in changes in the ecological integrity of the wetlands through activities such as clearing of vegetation, groundbreaking activities, which have impacted on runoff and water retention and distribution patterns within the wetland and within the wetland. Over these disturbances have led to the formation of areas that pond within the site and consist of vegetation response that is indicative of freshwater habitat, although anthropogenically driven.	**Ecoservice provision**	**Ecoservices category: Low to Moderate** The ecoservice provision by the wetland flat was assessed to be very low to low. The wetland system is located in a largely industrial area, and as such the demand for provision of important ecological services such as sediment trapping, nitrate assimilation, toxicant assimilation and toxicant assimilation is considered moderate, although the supply is limited to a degree due to current and historical activities which have impacted the ecological integrity of the system. The wetland is located within an access-controlled site, and as such, its ability to provide socio-cultural services, including the provision of harvestable resources for crafts, is considered very limited. Access restrictions further constrain opportunities for direct community interaction and utilisation of these ecosystem services.

EIS discussion	**EIS Category: Moderate** The wetland flats were assessed to have moderate ecological importance and sensitivity (EIS) at the time of the assessment, primarily due to their hydro-functional role and the provision of key regulating and supporting services within the landscape. Ongoing catchment-level activities further elevate the importance of services such as nitrate and phosphate assimilation, as well as flood attenuation. Although the system is not hydrologically connected to other freshwater ecosystems, these functions remain important for maintaining local water quality and regulating on-site hydrological conditions.	**REC, RMO & BAS Category**	**REC: D** **BAS: C/D** **RMO: Maintain** Given that the proposed infrastructure will result in the complete loss of the seep wetlands since the wetlands are going to be infilled, a recommended management objective (RMO) cannot be specified for the wetland.
Wetland drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):			
Construction of infrastructure within the study area has altered the natural hydraulic regime of the wetlands. This has resulted in the fragmentation of the wetland with surrounding road and industrial infrastructure impacting on how water reports to the wetland. The wetland flat have been subjected to disturbance from vegetation clearing, excavations, infilling, and sediment deposition associated with historical land-use activities in the broader catchment. These activities have modified natural water distribution and retention patterns, increasing concentrated and directional flow and ponding of water. No surface water was present at the time of the assessment and therefore, no in-situ water quality measurements were recorded. However, given the surrounding land uses, it is likely that water quality may be influenced by nutrient and contaminant inputs (e.g., nitrates and phosphates) from upstream and adjacent activities. In terms of habitat and biota, vegetation composition within the wetlands has been impacted by partial clearing and ongoing disturbance, with evidence of woody encroachment and the proliferation of alien and invasive species. As with the seep wetland, the vegetation within the wetland is dominated by grasses, sedges, and hydrophilic herbaceous species such as *Cyperus*, *Juncus*, *Phragmites australis*, *Typha capensis*, and *Leersia hexandra*, forming dense cover in less disturbed areas. The AIPs dominating the wetland include *Gomphocarpus physocarpus*, *Chromolaena odorata* and *Bidens pilosa* occur primarily in disturbed sections associated with anthropogenic impacts but remain limited in more intact areas where indigenous vegetation and ecological functioning are better preserved (Scientific Terrestrial Services, 2026).		
Extent of modification anticipated	**High** The extent of modification to the seep wetland was considered to be high given that the seep wetland within the study area will be completely lost due to infilling. This will result in a complete loss of ecological functioning for these wetlands. According to the scoping report (Nemai Consulting, 2026), an overarching Environmental Authorisation (EA) (Ref: 14/12/16/3/3/2/665) was issued for the RBIDZ, which permits the infilling of certain wetlands within the development area. Furthermore, wetland offset measures were incorporated as part of the IDZ EIA process to support the principle of no net loss of wetland function and biodiversity. While the loss of wetlands within the authorised development footprint is therefore acknowledged, it remains essential that construction activities are undertaken in accordance with best practice and environmental management measures to minimise further impacts. This includes the implementation of appropriate housekeeping measures, such as erosion and sediment control, prevention of pollution, and careful management of stormwater, to ensure that adjacent and remaining aquatic features are protected and that the broader ecological integrity of the area is maintained.		

5 LEGISLATIVE REQUIREMENTS, NATIONAL AND PROVINCIAL GUIDELINES PERTAINING TO THE APPLICATION OF BUFFER ZONES

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone. However, in summary, it is considered to be "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted, however, that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

The definition and motivation for a regulated zone of activity for the protection of the freshwater ecosystems can be summarised as follows (Table 5):

Table 5: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use Authorisation Application in terms of the National Water Act, 1998 (Act No. 36 of 1998) as amended. **Department of Water and Sanitation (DWS).**	Government Notice 4167 as published in the Government Gazette 49833 of December 2023 as it relates to the National Water Act, 1998 (Act No.36 of 1998) as amended. In accordance with GN4167 of December 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21(c) and 21(i) is defined as: • **the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake, or dam;** • in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • **a 500 m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.**
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended must be taken into consideration if any activities (for example,	**Activity 12** of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA regulations, 2014 (as amended) states that: *The development of:* *(xii) Infrastructure or structures with a physical footprint of 100 square meters or more;*

Regulatory authorisation required	Zone of applicability
access roads) are to take place within the applicable zone of regulation. This must be determined by the EAP in consultation with the relevant authorities.	*Where such development occurs—* *a) Within a watercourse;* *b) In front of a development setback; or* *c) If no development setback has been adopted, within **32 meters of a watercourse**, measured from the edge of a watercourse.*
Biodiversity Impact Assessment Handbook for KwaZulu-Natal (Draft) (Ezemvelo KZN Wildlife, 2010)	The biodiversity assessment must comply with the minimum requirements as stipulated by Ezemvelo Biodiversity Guidelines (2010) and must contain the following information: ➢ Rules for buffer zone widths are as follows: • 30 m from the outer edge of the temporary zone of the wetland.

In terms of GN 4167 of 2023, published under the National Water Act, 1998 (Act No. 36 of 1998), a 500 m zone of regulation is typically applied to aquatic features for the purposes of risk assessment. A 32 m regulated area in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) is also generally applicable to wetlands. In addition, the Biodiversity Impact Assessment Guidelines (Ezemvelo KZN Wildlife, 2010) recommend a 30 m buffer from the outer edge of the temporary wetland zone within the province.

However, as previously discussed an Environmental Authorisation (EA) has been granted for the development, including the infilling of wetlands within the study area. As such, the standard zones of regulation and buffer requirements are not considered applicable within the authorised development footprint where wetland infilling has been approved. Notwithstanding this, a net-positive impact (NPI) approach to biodiversity management remains applicable, whereby impacts associated with authorised activities should be balanced through appropriate mitigation, rehabilitation, and offset measures to maintain or enhance overall ecological function.

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6 RISK ASSESSMENT

An Environmental Authorisation (EA) (Ref: 14/12/16/3/3/2/665) and associated Water Use Authorisation (WUA) were previously granted for RBIDZ Phase 1F, which included the infilling of wetlands and the development of service infrastructure to support industrial development within the study area. As these activities have already been authorised and are not being reapplied for as part of the current application, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was not applied as no additional significant quantum of risk to the adjacent wetlands is deemed likely as a result of the proposed development.

6.1 Risk Assessment Statement

In addition to the direct impacts associated with wetland infilling, it is important to consider the potential indirect impacts on adjacent wetlands which have the potential to arise from the operation of the proposed Mabasa gas project. During the operation phase, activities including combustion processes, may result in atmospheric emissions and particulate (dust) fallout, which have the potential to deposit particulate within surrounding wetland areas. This has the potential to alter water quality, while the deposition of particulates may also potentially change soil characteristics and contribute to changes in nutrient dynamics.

In terms of habitat and biota, the settling of dust may alter the vegetation composition particularly to the surrounding wetlands. While these impacts are expected to be localised and of low in magnitude relative to the direct loss of wetlands within the development footprint, they must be managed accordingly given that they represent indirect influences the project may have on the ecological integrity and functioning of adjacent freshwater systems which are not directly impacted by the proposed project.

It therefore recommended that monitoring measures be implemented, including dust monitoring, and dust suppression (where applicable) in line with relevant standards, and periodic (three yearly) monitoring of adjacent wetland condition to ensure that indirect impacts remain low. should any changes in wetland structure and function be observed that are attributable to Mabasa, appropriate adaptive management should be initiated.

6.2 Cumulative Impacts

Cumulative impacts refer to the combined effects of past, present, and reasonably foreseeable future activities on freshwater ecosystems, considered both spatially and temporally alongside the impacts identified for the proposed development.

Freshwater ecosystems within the region are already under sustained pressure from ongoing residential expansion, agricultural activities, and mining operations (including sand and coal extraction), which have collectively contributed to the progressive degradation of ecological integrity and functioning. These pressures have resulted in the ongoing loss, fragmentation, and modification of freshwater habitats, particularly wetlands.

Within the broader Richards Bay Industrial Development Zone (RBIDZ) and surrounding areas, the expansion of industrial infrastructure has intensified these pressures, with significant cumulative losses of inter-dunal wetlands and swamp forest systems. These systems are groundwater-dependent and are therefore highly sensitive to changes in hydrological processes, particularly reductions in recharge and alterations to diffuse flow regimes. The proposed development will result in the complete infilling of wetlands within the study area, and as such, avoidance of impacts to these systems has not been achieved. This represents a direct and permanent loss of wetland habitat and associated ecological functions and will contribute to the existing cumulative trajectory of wetland transformation within the region. Furthermore, these impacts must be considered in the context of not only wetlands within the immediate study area, but also the wetlands within the surrounding landscape, which collectively contribute to catchment-scale hydrological functioning and ecological resilience.

The cumulative loss of wetlands and vegetated areas within the catchment increases the risk of flooding, particularly during high rainfall events, due to reduced attenuation capacity and increased impervious surfaces associated with development. Given that impacts to wetlands will not be avoided, and that the loss is permanent and irreversible, the proposed development is expected to contribute to high cumulative impacts within the region, particularly in relation to groundwater-driven wetland systems.

7 CONCLUSION

A freshwater assessment was conducted as part of the Environmental Authorisation (EA) process for the proposed Mabasa 750MW Combined Cycle Gas Turbine (CCGT) power plant in the city of uMhlathuze Local Municipality and the King Cetshwayo District Municipality, KwaZulu-Natal Province. During the assessment which took place in June 2024, two wetlands were identified within the study area, namely a seep wetland and wetland flat. The results from the assessment are summarised in the table below (Table 6).

Table 6: Summary of results of the field assessment as discussed in Section 4.

Freshwater Ecosystem	Present Ecological State (PES) / Ecostatus	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category / Recommended Management Objective / Best Attainable State
Seep Wetland	Category C (Moderately Modified)	Moderate	Intermediate	REC Category: C BAS Category: C RMO: Maintain
Wetland flat	Category C (Moderately Modified)	Moderate	Intermediate	REC Category: C BAS Category: C RMO: Maintain
Extent of modification anticipated to the seep wetland and wetland flat	**High** The extent of modification to the seep wetland was considered to be high given that the seep wetland within the study area will be completely lost due to infilling. This will result in a complete loss of ecological functioning for these wetlands.			

An Environmental Authorisation (EA) (Ref: 14/12/16/3/3/2/665) and associated Water Use Authorisation (WUA) were previously granted for RBIDZ Phase 1F, which included the infilling of wetlands and the development of service infrastructure to support industrial development within the study area. As these activities have already been authorised and are not being reapplied for as part of the current application, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was not applied as no additional significant quantum of risk to the adjacent wetlands is deemed likely as a result of the proposed development.

While the loss of wetlands within the authorised development footprint is therefore acknowledged, it remains essential that construction activities are undertaken in accordance with best practice and environmental management measures to minimise further impacts. This includes the implementation of appropriate housekeeping measures, such as erosion and sediment control, prevention of pollution, and careful management of stormwater, to ensure that adjacent and remaining aquatic features are protected and that the broader ecological integrity of the area is maintained.

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APPENDIX A – Terms of Use and Indemnity

INDEMNITY AND TERMS OF USE OF THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as the available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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APPENDIX B – Legislation

LEGISLATIVE REQUIREMENTS

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act (NEMA) (Act No. 107 of 1998)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
The National Water Act (NWA) (Act No. 36 of 1998)	The National Water Act (NWA) (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).
National Environmental Management: Biodiversity Act (2004) (Act 10 of 2004) (NEMBA)	**Ecosystems that are threatened or in need of protection** (1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection. *(b)* An MEC for environmental affairs in a province may, by notice in *the Gazette,* publish a provincial list of ecosystems in the province that are threatened and in need of protection. (2) The following categories of ecosystems may be listed in terms of subsection (1): *(a)* critically endangered ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation; *(b)* endangered ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems; (c) vulnerable ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and *(d)* protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs *(a), (b)* or (c).
Government Notice 598 Alien and Invasive Species Regulations (2014), including the Government Notice 864 Alien Invasive Species List as published in the Government Gazette	NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. This act in terms of alien and invasive species aims to: ➢ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➢ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and

40166 of 2016, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004)	➢ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. Alien species are defined, in terms of the NEMBA as: (a) A species that is not an indigenous species; or (b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. Categories according to NEMBA (Alien and Invasive Species Regulations, 2017): ➢ **Category 1a:** Invasive species that require compulsory control; ➢ **Category 1b:** Invasive species that require control by means of an invasive species management programme; ➢ **Category 2:** Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and ➢ **Category 3:** Ornamentally used plants that may no longer be planted.
Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the NWA (Act 36 of 1998) as amended	GN 4167 outlines the parameters and process of a General Authorisation (GA), which replaces the need to apply for a license in terms of Section 40 of the NWA, provided that the water use is within the limits and conditions of the GA. The notice **replaces GN 509 of 2016.** The GA sets out the need to determine the regulated area of a watercourse, as well as the degree of risk posed by an activity/ies related to a particular water use. In accordance with GN 4167 of December 2023, the regulated area of a watercourse for Section 21c and 21i of the NWA, 1998 is defined as: a) the outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake, or dam; b) in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or c) In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans. The GA only applies to the use of water in terms of Section 21(c) and (i) of the NWA where the risk class is **LOW** as determined through the application of the Risk Matrix as prescribed in the Notice. The GA also does not apply where other Section 21 water uses are triggered, does not apply for most sewage infrastructure and pipelines carrying hazardous materials, water uses associated with hazardous materials, water uses associated with water and wastewater treatment works, and for most mining-related water uses. The GA may be exercised as follows: i) Section 21(c) or (i) water use activities that are determined to pose a LOW Risk as determined through the application of the Risk Matrix as prescribed in the Notice can be undertaken subject to the general conditions of the GA; ii) Section 21(c) or (i) water use activities set out in Appendix D1 of the Notice can be undertaken *without* being subject to the requirement of a risk assessment and subject to the general conditions of the GA. Such water use activities in Appendix D1 include *inter alia* emergency river crossings, fence erection, solar renewable infrastructure that has no direct impact on watercourses and mini-scale hydropower developments; iii) Prescribed water use activities undertaken by certain State Owned Entities as detailed in Appendix D2 of the Notice can be undertaken *without* being subject to the requirement of a risk assessment and subject to the general conditions of the GA;

	iv) Maintenance work associated with an existing lawful water use in terms of Section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix can be undertaken ; v) River and stormwater management activities including maintenance of infrastructure as contained in a river management plan or similar management plan, may be conducted subject to the approval of such a plan by the relevant DWS regional office or catchment management agency; vi) Rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix can be conducted; and vii) Emergency work arising from an emergency situation and or incident associated with the persons' existing lawful water use entitlement can be undertaken, provided that all work is executed and reported in the manner prescribed in the Emergency protocol contained in Appendix C of the Notice. A GA issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence with the water use as contemplated in the GA.
National Environmental Management: Waste Act, No 59 of 2008 (NEMWA)	NEMWA, which reforms the law regulating waste management in order to protect the health and the environment by providing reasonable measures for the prevention of pollution; provides for national norms and standards for regulating the management of waste by all spheres of government, and provides for the licensing and control of waste management activities.

APPENDIX C – Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and ecostatus of the larger aquatic system within which the watercourses present or in close proximity of the study area are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater Ecosystem Priority Areas (NFEPA, 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland features present in the vicinity of or within the study area.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa

The watercourses encountered within the study area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013), hereafter referred to as the "Classification System". A summary of Levels 1 to 4 of the classification system are presented in Table C1 and C2, below.

Table C1: Proposed classification structure for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Unit for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the Classification System, Inland Systems are defined as aquatic ecosystems that have no existing connection to the ocean[4] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but which are inundated or saturated with water, either permanently or periodically. It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

[4] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) group's vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the National Freshwater Ecosystem Priority Areas (NFEPA) project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting

At Level 3 of the Classification System, for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units

Seven primary HGM Types are recognised for Inland Systems at Level 4A of the Classification System (Table C2), on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa.

Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et al*., 2009).

3. Watercourse Function Assessment

“The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class”.[5] The assessment of the ecosystem services supplied by the identified watercourses was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the watercourses. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the watercourses.

Table C5: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

4. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purposed of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).
In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse

[5] Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999

types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C6) of the wetland system being assessed.

Table C6: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

5. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure" (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the watercourse (sections above), with the objective of either maintaining, or improving the ecological integrity of the watercourse in order to ensure continued ecological functionality.

Table C7: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

PES			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unnacceptable (Malan and Day, 2012) and therefore, should a watercourse fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A watercourse may receive the same class for the REC as the PES if the watercourse is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the watercourse.

Table C8: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

6. General Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans *et al.* 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in Table C8 below.

Table C9: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans *et al.* 2008]

Class	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60 - 79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40 – 59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 – 39
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.	0 - 19

7. The Riparian Vegetation Response Assessment Index (VEGRAI)

VEGRAI is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results (Kleynhans *et al.*, 2007a). Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

Riparian vegetation is described in the National Water Act (NWA; Act 36 of 1998) as follows: 'riparian habitat' includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soil, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

Table C10: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic 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	0-19

8. Freshwater ecosystem delineation

The freshwater ecosystem delineation took place according to the method presented in the “Updated manual for the identification and delineation of wetland and riparian resources” published by DWAF in 2008. The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

According to the DWA (2005) like wetlands, riparian areas have their own unique set of indicators. It is possible to delineate riparian areas by checking for the presence of these indicators. Some areas may display both wetland and riparian indicators and can accordingly be classified as both. If you are adjacent to a watercourse, it is important to check for the presence of the riparian indicators described below, in addition to checking for wetland indicators, to detect riparian areas that do not qualify as wetlands. The delineation process requires that the following be taken into account:

- topography associated with the watercourse;
- vegetation; and
- alluvial soils and deposited material.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWA, 2005).

APPENDIX D – Freshwater Results

PRESENT ECOLOGICAL STATE (PES) AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table E1: Presentation of the results of the Ecoservices assessment applied to the wetland flat.

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0,0	0,0	0,0	Very Low
	Stream flow regulation	0,0	0,0	0,0	Very Low
	Sediment trapping	0,8	2,3	0,4	Very Low
	Erosion control	0,9	0,0	0,0	Very Low
	Phosphate assimilation	0,7	1,5	0,0	Very Low
	Nitrate assimilation	0,7	1,5	0,0	Very Low
	Toxicant assimilation	0,7	2,3	0,3	Very Low
	Carbon storage	1,4	2,7	1,3	Low
	Biodiversity maintenance	0,0	0,0	0,0	Very Low
PROVISIONING SERVICES	Water for human use	0,0	0,0	0,0	Very Low
	Harvestable resources	0,5	0,0	0,0	Very Low
	Food for livestock	1,0	0,0	0,0	Very Low
	Cultivated foods	2,5	0,0	1,0	Low
CULTURAL SERVICES	Tourism and Recreation	0,1	0,0	0,0	Very Low
	Education and Research	0,5	0,0	0,0	Very Low
	Cultural and Spiritual	0,0	0,0	0,0	Very Low

Table E2: Presentation of the results of the Ecoservices assessment applied to the seep wetland.

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0,0	0,0	0,0	Very Low
	Stream flow regulation	0,0	0,0	0,0	Very Low
	Sediment trapping	0,8	2,3	0,4	Very Low
	Erosion control	1,9	0,2	0,5	Very Low
	Phosphate assimilation	0,6	1,5	0,0	Very Low
	Nitrate assimilation	0,7	1,5	0,0	Very Low
	Toxicant assimilation	0,7	2,3	0,4	Very Low
	Carbon storage	1,7	2,7	1,5	Moderately Low
	Biodiversity maintenance	1,7	0,0	0,2	Very Low
PROVISIONING SERVICES	Water for human use	0,0	0,0	0,0	Very Low
	Harvestable resources	2,0	0,0	0,5	Very Low
	Food for livestock	1,5	0,0	0,0	Very Low
	Cultivated foods	2,3	0,0	0,8	Very Low
CULTURAL SERVICES	Tourism and Recreation	0,4	0,0	0,0	Very Low
	Education and Research	0,5	0,0	0,0	Very Low
	Cultural and Spiritual	0,0	0,0	0,0	Very Low

Table E3: Presentation of the results of the EIS results of the seep wetland and flat.

FRESHWATER FEATURE:			Seep Wetland	Flat Wetland	Confidence
Ecological Importance and Sensitivity			Score (0-4)	Score (0-4)	Confidence (1-5)
Biodiversity support			Average	Average	Average
			0.33	0.33	4.00
Presence of Red Data species			0	0	4
Populations of unique species			0	0	4
Migration/breeding/feeding sites			1	1	4
Landscape scale			B (Average)	B (Average)	Confidence (1-5)
			1.00	1.00	
Protection status of the wetland			1	1	4
Protection status of the vegetation type			0	0	4
Regional context of the ecological integrity			1	1	4
Size and rarity of the wetland type/s present			1	1	4
Diversity of habitat types			2	2	4
Sensitivity of the wetland			C (Average)	C (Average)	Confidence (1-5)
			1.33	1.00	4.00
Sensitivity to changes in floods			1	0	4
Sensitivity to changes in low flows/dry season			2	2	4
Sensitivity to changes in water quality			1	1	4
ECOLOGICAL IMPORTANCE & SENSITIVITY			Max of (A, B or C)	Max of (A, B or C)	
Fill in highest score			B (1.10)	B (1.10)	
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.					
Hydro-Functional Importance			Score (0-4)	Score (0-4)	Score (0-4)
Regulating & supporting benefits	Flood attenuation		2	2	4
	Streamflow regulation		0	1	4
	Water Quality Enhancement	*Sediment trapping*	2	2	4
		Phosphate assimilation	1	1	4
		Nitrate assimilation	2	2	4
		Toxicant assimilation	1	1	4
		Erosion control	1	1	4
	Carbon storage		1	1	4
HYDRO-FUNCTIONAL IMPORTANCE (average score)			1.25	1.38	4.00
Direct Human Benefits			Score (0 – 4)	Score (0 – 4)	Confidence (1-5)
Subsistence benefits	*Water for human use*		0	0	4
	Harvestable resources		0	0	4
	Cultivated foods		0	0	4
Cultural benefits	*Cultural heritage*		0	0	4
	Tourism and recreation		0	0	4
	Education and research		1	1	4
DIRECT HUMAN BENEFITS (average score)			0.17	0.17	4.00

Table E5: Presentation of the results of the results of the present ecological state (PES) (WET-Health) wetland flat.

Wetlands	Hydrology		Geomorphology		Vegetation		Combined Impact Score and PES Category
	Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score	
Seep Wetland	13.5	-1	5.7	-1	7.0	-1	3.8 Moderately Modified
Wetland Flat	13.5	-1	3.9	-1	6.8	-1	3.5 Largely Modified

APPENDIX E – Risk Analysis and Mitigation Measures

General construction management and good housekeeping practices

Given that authorisation has been granted for the infilling of the identified wetlands within the development footprint, the implementation of avoidance and minimisation mitigation measures within these specific areas is not applicable. However, general environmental management and good construction practices remain applicable to ensure that impacts are contained within the authorised footprint and do not extend to adjacent areas. These measures are therefore focused on preventing secondary impacts, such as sedimentation, pollution, and unnecessary disturbance to surrounding environments.

Development footprint

- All development footprint areas must be minimised as far as practicable, with disturbance limited strictly to the authorised wetland infilling areas and associated infrastructure footprint;
- The boundaries of all footprint areas, including construction and laydown areas, must be clearly demarcated prior to construction, and all activities must remain within these defined areas to prevent unnecessary disturbance to adjacent, non-impacted portions of the wetland and surrounding environment. Edge effects must be carefully managed and contained;
- Appropriate sanitary facilities must be provided for the duration of the construction phase, with all waste collected and disposed of at a licensed waste disposal facility;
- All hazardous substances and stockpiles must be stored on bunded surfaces, with adequate measures implemented to contain and control runoff from these areas;
- All hazardous storage containers and storage areas must comply with relevant SANS standards to prevent leaks and spills;
- No open fires shall be permitted within or in close proximity to the construction area; and
- Sufficient waste receptacles and spill kits must be provided on-site to ensure effective waste management and rapid response to accidental spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- The proliferation of alien and invasive plant species is anticipated within disturbed areas associated with the proposed development. Although current levels of invasion are not considered severe, the vegetation within the freshwater ecosystem is already transformed, creating conditions conducive to further invasion. Alien invasive species are highly opportunistic and are likely to establish and spread in response to disturbance; therefore, these species must be actively controlled and eradicated to prevent their spread beyond the authorised project footprint. In addition, the potential for seed dispersal from the upper soil layers within disturbed footprint areas must be managed, as this may negatively affect future rehabilitation success;
- The removal and control of alien and weed species must be undertaken in compliance with applicable legislation, including the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), and the duty of care provisions outlined in Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998); and
- Eradication efforts must be implemented in a manner that minimises additional disturbance, with footprint areas kept as small as practicable during clearing activities. Furthermore, access by vehicles within designated sensitive freshwater ecosystem areas must be strictly prohibited

during alien and weed eradication to prevent further degradation and the spread of invasive species.

Soils

- The establishment and maintenance of indigenous vegetation within and adjacent to disturbed areas should be promoted as far as practicable, in order to stabilise soils, reduce erosion, and minimise runoff and sediment transport into adjacent freshwater systems.; and
- Furthermore, regular monitoring of the development footprint must be undertaken to assess the extent of soil disturbance and sedimentation, enabling the implementation of appropriate adaptive management measures where required.

APPENDIX F – Specialist information

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1. (a) (i) Details of the specialist who prepared the report

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

Nqobile Lushozi MSc (Geoinformatics) (Stellenbosch University)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Physical address:	29 Arterial Road West, Oriel		
Postal code:	2007	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	Stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, declare that -

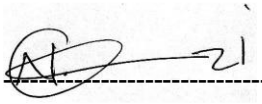
- I act as the independent specialist (**report reviewer**) in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise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



Signature of the Specialist

I, Nqobile Lushozi, 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 relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, 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



Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)

3. Minerals beneficiation
4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use License Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF NQOBILE LUSHOZI

PERSONAL DETAILS

Position in Company	Freshwater Ecologist Wetland and Aquatic Ecology
Joined SAS Environmental Group of Companies	April 2019

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa
Member of the South African Wetland Society (SAWS)
Member of the South African Council for Natural Scientific Professions (SACNASP Reg No - 124679)

EDUCATION

Qualifications

MSc Geoinformatics (Cum laude) (Stellenbosch University)	2019
BSc (Hons) Environmental Sciences (University of KwaZulu-Natal)	2015
BSc Environmental Sciences (University of KwaZulu-Natal)	2014

Short courses

Tools for Wetland Assessment (Rhodes University)	2020
Grass Identification Course (Africa Land-Use Training)	2021

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Free State

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans

Aquatic Ecological Assessment and Water Quality Studies

- Toxicological Analysis
- Surface and groundwater quality Monitoring
- Screening Test
- Mass and salt balance determination