



Wetland Functional and Impact Assessment for the proposed D3 Energy Production Right Application

**Matjhabeng and Masilonyana Local Municipalities,
Lejweleputswa District Municipality, Free State
Province, South Africa**

8/12/2026

Prepared by:

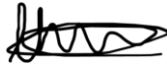
The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

Report Name	Wetland Functional and Impact Assessment for the proposed D3 Energy Production Right Application	
Specialist Theme	Aquatic Biodiversity Theme	
Project Reference	D3 Energy Production Right	
Report Version	8/12/2026	
Environmental Assessment Practitioner		
Technical Support	Dawid Coetsee (Can. Sci. Nat. 152512) ¹	
	Celine Klinkert (Can. Sci. Nat. 165111)	
Responsible Specialist	Rian Pienaar (Pr. Sci. Nat. 135544)	
Declaration	The Biodiversity Company and its associates act as independent consultants in accordance with the requirements of the South African Council for Natural Scientific Professions. We confirm that we have no affiliation with, or vested financial interest in, the proponent, other than remuneration for professional services rendered in terms of the Environmental Impact Assessment Regulations. We have no conflicting interest in the proposed activity or any secondary developments arising from the authorisation of the project, and our work has been undertaken objectively and in accordance with accepted scientific principles.	

¹ All work was undertaken under the guidance and supervision of a registered professional Rian Pienaar (Pr. Sci. Nat. 135544)

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1 Introduction

1.1 Background

The Biodiversity Company (TBC) was appointed by Environmental Impact Management Services (Pty) Ltd (EIMS) on behalf of D3 Energy South Africa (Pty) Ltd to undertake a freshwater impact assessment for the D3 Energy Production Right Area located near Virginia and Henneman, in the Free State Province (Figure 1-1). A 500 m area has been demarcated for the project to facilitate the identification of wetlands within the regulatory zone; this area is referred to as the Project Area of Influence (PAOI).

This assessment has been completed in accordance with the requirements of the published Government Notice (GN) 4167 by the Department of Water and Sanitation (DWS) (previously GN 509 of 2016 and GN 3139 of 2023). The said notice was published in the Government Gazette (no. 49833) under Section 39 of the National Water Act (Act no. 36 of 1998) in December 2023, for a Water Use Authorisation (WUA) in terms of Section 21(c) & (i) water uses. The GN 4167 process provides an allowance to apply for a WUA for Section 21(c) & (i) under a General Authorisation (GA), as opposed to a full Water Use Licence (WUL). A water use (or potential) qualifies for a GA under GN 4167 when the proposed water use/activity is subjected to analysis using the DWS Risk Assessment Matrix (RAM), provided the identified risks are all considered a low risk, and the applicant is listed under Appendix D1 or Appendix D2 of the same notice. This assessment will implement the RAM and provide a specialist opinion on the appropriate water use authorisation.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations, 2014 as amended of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices (GN) 320 (20 March 2020) and GN 1150 (30 October 2020) in terms of NEMA, dated 20 March and 30 October 2020: "Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation" (Reporting Criteria).

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making with regards to the ecological viability of the proposed development and related activities.

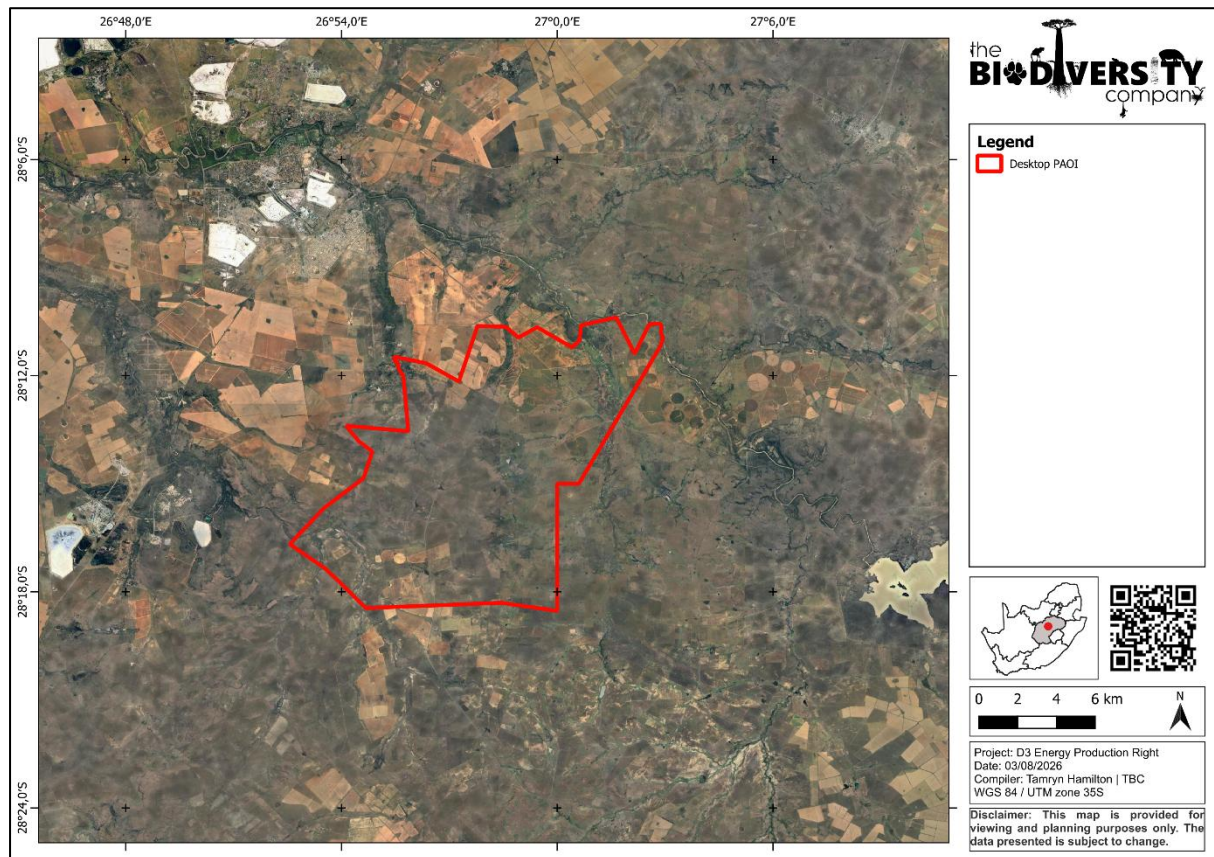


Figure 1-1 **Location of the proposed project**

1.2 Scope of Work

The following tasks were completed in fulfilment of the terms of reference for this assessment:

- A desktop assessment of available and related datasets to provide context of the freshwater biodiversity of the project area and to indicate potential wetland areas;
- A field survey to identify wetland areas;
- The delineation, classification and assessment of wetlands within the 500 m PAOI;
- Delineation and classification of wetlands within the Desktop PAOI;
- The provision of recommendations relevant to associated potential impacts; and
- Report compilation detailing the findings.

1.3 Project Description and Technical Information

The following information has been received from EIMS regarding the undertaking of an Environmental Impact Assessment (EIA) for the planned Motuoane Production Right Area.

D3 Energy proposes the undertaking of exploration and production activities within the planned new Production Right Area.

The proposed Production Right makes provision for ongoing exploration and production drilling and the undertaking of seismic activities within preliminary identified seismic transects. Existing wells within the area may be worked over and possibly included as production sites.

Drilling and production are proposed from approximately 30 to 50 production wells located within four identified well production corridors. The intention is to assess these corridors in detail through the EIA process in order to allow for drilling and production to occur within these areas.

The development further includes the installation of trenched, and sub-surface gas gathering pipelines aligned along the routes. The pipeline network will transport gas to a local production plant. At the production plant, the gas will initially be compressed to deliver compressed Helium and Methane as a first phase of development. This will be followed by a second phase during which the gas will be liquefied to produce LNG.

The proposed project layout is presented in Figure 1-2.

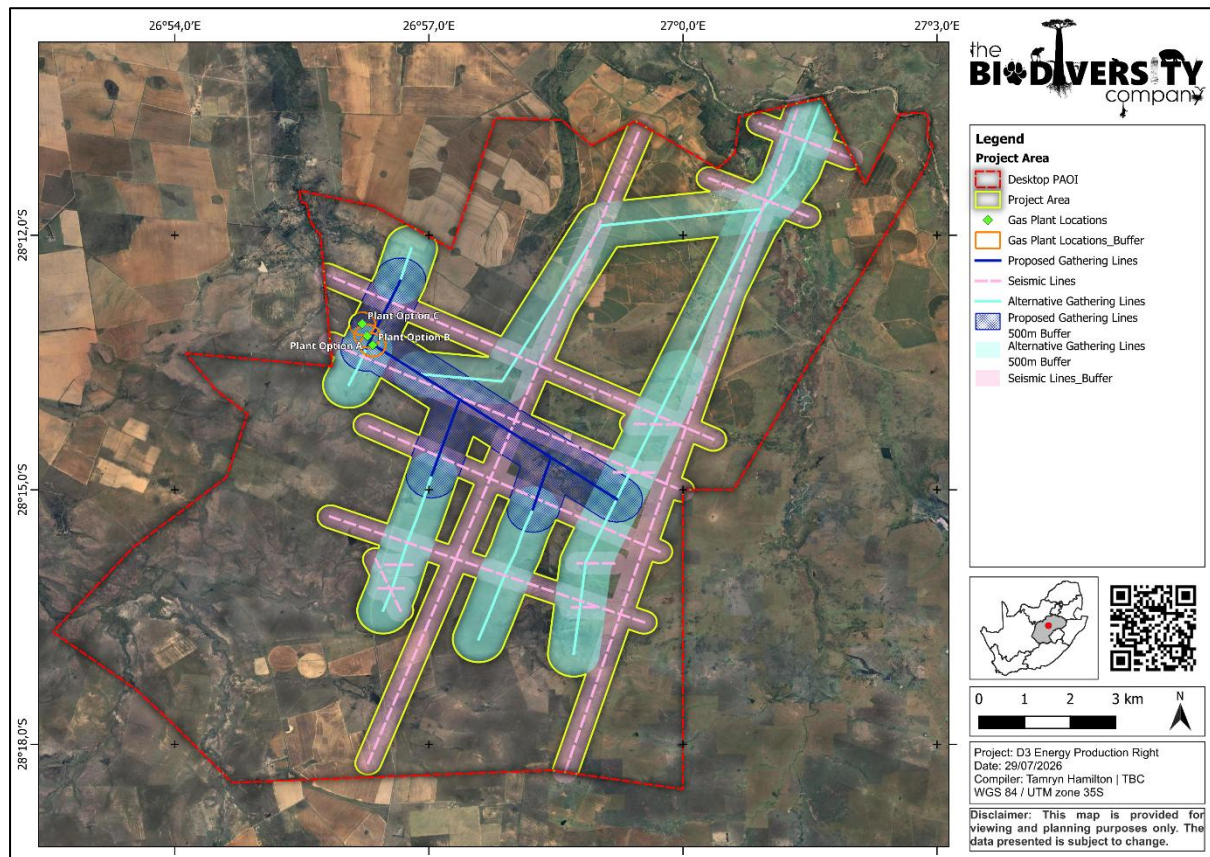


Figure 1-2 Proposed project layout components and project area of influence

1.4 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- It has been assumed that the spatial files provided to the specialist are accurate;
- Apart from the infrastructure locations as indicated in the layout map, no other relevant spatial information in terms of the structure design was provided in relation to the proposed development at the time report preparation;
- Representative sampling for the different wetland areas was conducted and is considered to be sufficient for the purpose of this report;
- Only the Gathering Lines, Alternative Gathering Lines and Gas Plant Locations were ground-truthed for freshwater systems during the survey;
- The 500 m buffer around the Gathering Lines, Gas Plant and Seismic Lines was delineated on a high-level desktop basis. The broader PAOI (Desktop PAOI) was included only for desktop assessment, and no detailed field-based delineations or findings are available for this area due to access constraints;
- The seasonality of the surveys is not considered to be a limiting factor with regard to the identification and delineation of wetlands, the only limitation in this regard would be the identification of certain plant species. The results of the assessment are considered sufficient for the purposes of this assessment in the opinion of the specialist;
- Only natural features were considered for the ecological components of this assessment; and

- The GPS used for water resource delineations is accurate to within five metres; therefore, the wetland delineation plotted digitally may be offset by a maximum of five metres to either side.

1.5 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 1-1 are applicable to the current project. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Table 1-1 A list of key legislative requirements

Region	Legislation / Guideline	Comment
National	National Environmental Management Act (Act No. 107 of 1998) (NEMA)	To provide for the effective protection and controlled utilisation of the environment and for matters incidental thereto.
	NEMA: Environmental Impact Assessment Regulations (2014) (GNR 326, 7 April 2017), Appendix 6 requirements	Minimum content for specialist reports.
	NEMA: Government Notices (GN) 320 (20 March 2020) and GN 1150 (30 October 2020)	The minimum criteria for reporting. Protocol for the specialist assessment and minimum report content requirements.
	The National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA), Threatened or Protected Species Regulations	The protection of species and ecosystems that warrant protection.
	National Environmental Management: Waste Act (Act No. 59 of 2008)	The regulation of waste management to protect the environment.
	National Water Act (Act No. 36 of 1998) (NWA)	To provide for the regulation of water uses.
	NWA: Government Notice (GN) 4167 (previously GN 509 of 2016 and GN 3139 of 2023)	Water Use Licence (WUL) in terms of Section 21 (c) & (i) water uses and the provision to apply for a General Authorisation subject to usage and outcome of the Risk Assessment Matrix.
	NEMBA: Alien and Invasive Species Regulations (2014) (GN R598, 1 August 2014)	The regulation and management of alien and invasive species.
Provincial	National Environmental Management Act (Act No. 107 of 1998) (NEMA)	To provide for the effective protection and controlled utilisation of the environment and for matters incidental thereto.
	Free State Province Biodiversity Plan: Technical Report v1.0 (2016)	A spatial tool comprising of a set of maps of biodiversity priority areas accompanied by contextual information and land-use guidelines for use in land-use and development planning, environmental assessment and regulation, and natural resource management.

1.6 National Water Act (NWA, 1998)

The DWS is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (Act No. 36 of 1998) (NWA) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam 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.

The NWA recognises that the entire ecosystem and not just the water 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 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) and (i).

1.7 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 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.

1.8 Legislative Framework

In line with the protocol for the specialist assessment and minimum report content requirements for environmental impacts on freshwater biodiversity, as per Government Notice 320 published in terms of NEMA, dated 20 March 2020: “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation” – the following has been assumed:

- An applicant intending to undertake an activity identified in the scope of this protocol on a site identified on the screening tool as being of:
 - “very high sensitivity” for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Assessment;
 - “low sensitivity” for aquatic biodiversity, must submit an Aquatic Biodiversity Compliance Statement;
- Where the information gathered from the site sensitivity verification differs from the screening tool designation of “very high” aquatic biodiversity sensitivity, and it is found to be of a “low” sensitivity, an Aquatic Biodiversity Compliance Statement must be submitted;
- Similarly, where the information gathered from the site sensitivity verification differs from the screening tool designation of “low” aquatic biodiversity sensitivity, and it is found to be of a “very high” sensitivity, an Aquatic Biodiversity Specialist Assessment must be submitted.

Even though areas of “very high” aquatic biodiversity sensitivity were identified by the national screening tool, the reporting of a Compliance Statement has been followed based on the following reasoning:

- Low Impact Nature of Activities: The proposed exploration activities are of a low-impact nature, with careful planning to minimise disturbance to freshwater ecosystems; and
- Wetland Avoidance: It is expected that all target areas and planned activities will be sited to avoid direct impacts on wetlands.

Despite this, an impact assessment was still conducted for the proposed seismic surveys and drilling wells to ensure that any potential risks to aquatic biodiversity are thoroughly evaluated and appropriately managed.

An Aquatic / Freshwater Biodiversity Specialist Assessment Report must contain the information as presented in Table 1-2 below.

Table 1-2 *Aquatic Biodiversity Specialist Assessment information requirements as per the relevant protocol, including the location of the information within this report*

Information to be Included (as per GN 320, 20 March 2020)	Report Section
The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of aquatic sciences	7.4
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae	7.4
A signed statement of independence by the specialist(s)	7.3
The assessment must be undertaken on the preferred site and within the proposed development footprint	1.3
A baseline description of the aquatic biodiversity and ecosystems on the site, including: aquatic ecosystem types; presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns.	3.1.4
The threat status of the ecosystem and species as identified by the screening tool	3.1.4
An indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free-flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area)	3.1.4
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.); and (b) the historic ecological condition (reference) as well as present ecological state of rivers (in- stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater)	N/A
The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate	3.2.1
Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal? Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present? How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include: (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) will the proposed development change the sediment regime of the aquatic ecosystem and its sub-catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns); (c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and (d) to what extent will the risks associated with water uses and related activities change.	4
How will the proposed development impact on the functioning of the aquatic feature? This must include: (a) base flows (e.g., too little or too much water in terms of characteristics and requirements of the 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); (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); (e) fragmentation (e.g., road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and	N/A

(f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g., waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.)	
How will the proposed development impact on key ecosystems regulating and supporting services especially:	
(a) flood attenuation;	
(b) streamflow regulation;	
(c) sediment trapping;	
(d) phosphate assimilation;	3.3
(e) nitrate assimilation;	
(f) toxicant assimilation;	
(g) erosion control; and	
(h) carbon storage?	
How will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	-
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment	2.1
The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant	7.1
A description of the assumptions made, any uncertainties or gaps in knowledge or data	1.4
The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant	3.4
Additional environmental impacts expected from the proposed development	N/A
Any direct, indirect and cumulative impacts of the proposed development on site	4
The degree to which impacts and risks can be mitigated	4
The degree to which the impacts and risks can be reversed	4
The degree to which the impacts and risks can cause loss of irreplaceable resources	4
A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies	3.4
Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr)	4.3
A motivation must be provided if there were development footprints identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate	3.5.2
A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	5.2
Any conditions to which this statement is subjected	5.2

A signed copy of the assessment must be appended to the Environmental Impact Assessment Report.

2 Fieldwork

2.1 Freshwater Biodiversity Field Assessment

A field survey for the area was undertaken on the 16th to the 19th of March 2026 (summer), which constitutes a wet season survey in line with the requirements of GN 320, 20 March 2020, to identify the presence of freshwater features (wetlands) and to delineate their spatial extents. An additional field survey was undertaken on the 15th to the 16th of July following a proposed layout alternation. The seasonality is not considered to be a limiting factor to the assessment of which the results are conclusive.

3 Results & Discussion

3.1 Desktop Dataset Assessment

3.1.1 Climate

The climate of the region, as inferred from the Central Free State Grassland, Bloemfontein Karroid Shrubland, and Vaal-Vet Sandy Grassland, is characterised by a warm-temperate, summer rainfall regime. The Mean Annual Precipitation (MAP) across the region averages approximately 530–560 mm,

with rainfall predominantly occurring during the summer months, peaking between December and January. Rainfall events are largely convectional in nature.

The Mean Annual Temperature (MAT) is approximately 15°C, with high summer temperatures typical of the region. Winters are cold, and the area experiences a high frequency of frost, averaging between 37 and 40 frost days per year. These climatic conditions strongly influence vegetation structure, soil development, and land-use potential across the region (Mucina & Rutherford, 2006).

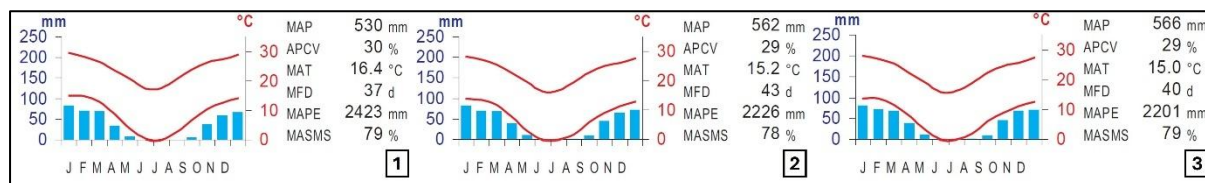


Figure 3-1 Climate for the project area based on the Vaal-Vet Sandy Grassland (1); Central Free State Grassland (2); Bloemfontein Karroid Shrubland (3) (Mucina & Rutherford, 2006)

3.1.2 Soils and Geology

The geology of the region is primarily associated with the Karoo Supergroup, including mudstone, sandstone, shale, and sedimentary mudstone of the Adelaide Subgroup, with localized occurrence of Ecca Group lithologies. In addition, the landscape is intruded by Jurassic dolerite sills, particularly within the Bloemfontein Karroid Shrubland, while older Ventersdorp Supergroup basement rocks (gneiss and andesite) occur toward the northern extent of the region.

Unconsolidated aeolian and colluvial sands are widespread, frequently overlying Karoo sediments or dolerite intrusions. These geological conditions give rise to a variety of soil forms, including melanic, vertic, red structured, prismaeutanic, and pedocutanic soils, as well as plinthic catenas in some landscape positions.

The dominant land types across the region include Dc, Bd, Ae, Ea, Bc, Ba, and Fa, reflecting variations in soil depth, texture, drainage, and parent material. Collectively, these soils support grass-dominated systems with karroid elements on shallower or more degraded substrates and influence grazing capacity, erosion potential, and vegetation resilience (Mucina & Rutherford, 2006; Land Type Survey Staff, 1972–2006).

3.1.3 Hydrological Characteristics

The PAOI falls within the Highveld Ecoregion, within the Vaal-Orange Water Management Area (WMA). At a finer scale, within the C42H, C42G and C42K quaternary catchments. The fine scale hydrological features are presented in the following section.

3.1.3.1 Topographical River Lines and Inland Water Areas

The topographical inland and river line data for the “2826” and “2827” quarter degree indicated multiple perennial and non-perennial streams within the 500 m PAOI. Multiple inland water areas were also identified within the PAOI (Figure 3-2), including:

- Dams
- Large Reservoir
- March Vlei
- Non-perennial Pan

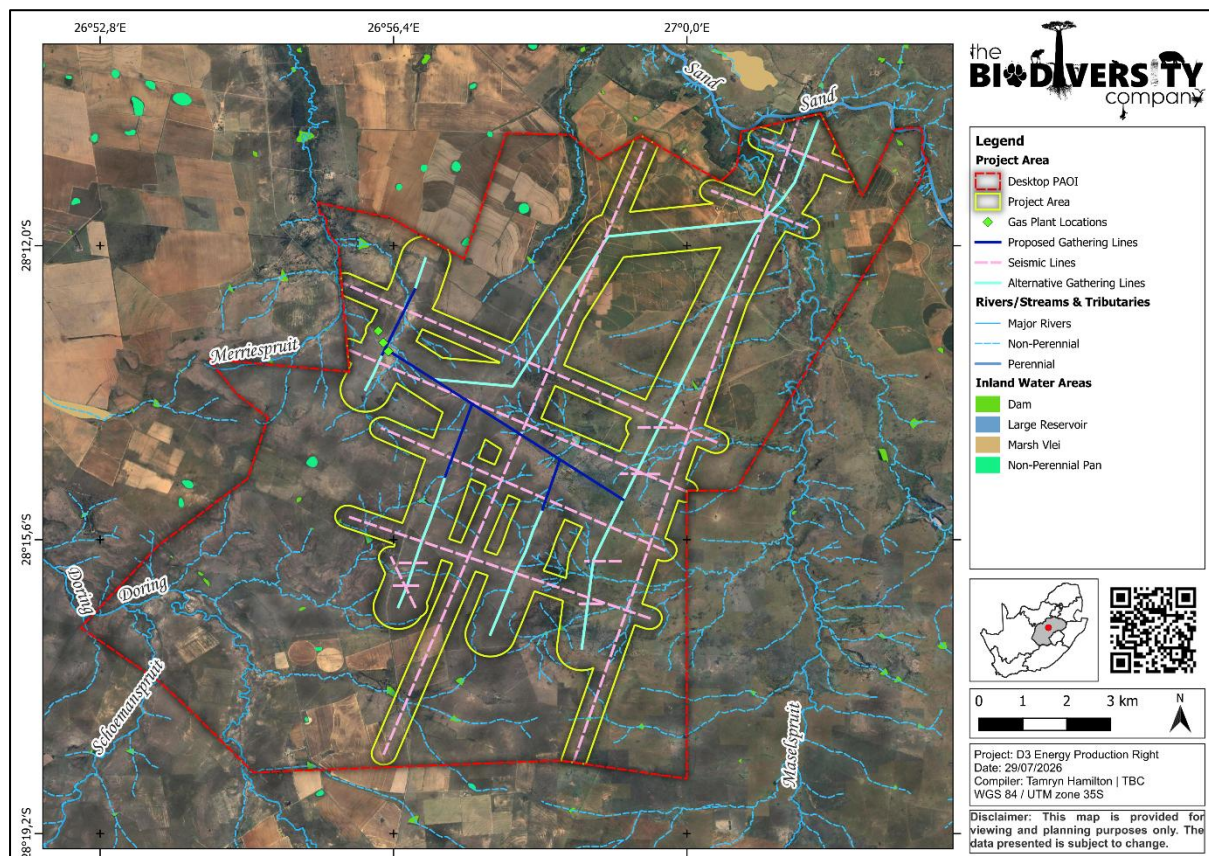


Figure 3-2 Topographical inland water areas and river lines that intersect the project area of influence

3.1.4 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed project to ecologically important landscape features is summarised in Table 3-1. Only features that were identified to be relevant to the proposed project were further discussed.

Table 3-1 Summary of relevance of the proposed project to ecologically important landscape features

Desktop Information Considered	Relevant/Irrelevant	Section
South African Inventory of Inland Aquatic Ecosystems (SIIAE)	Relevant – PAOI overlaps with SIIAE wetlands and Rivers.	3.1.4.1
National Freshwater Ecosystem Priority Area	Relevant – PAOI overlaps with NFEPA wetlands and Rivers.	3.1.4.2
Provincial Conservation Plan	Relevant – PAOI overlaps with Terrestrial CBAs and ESAs	3.1.4.3
Strategic Water Source Areas	Irrelevant – PAOI does not overlap with a SWSA or GWSWSA.	-

3.1.4.1 South African Inventory of Inland Aquatic Ecosystems

Multiple wetland types were identified within the Desktop PAOI, consisting of isolated depressions, a seep, and the Maselspruit to the North of the Desktop PAOI, Doring and Schoemanspruit to the South of the Desktop PAOI and the Merriespruit to the West of the Desktop PAOI (Figure 3-3).

The depressions were listed as “Least Concern” and “Poorly Protected” and classified as ranging between “A/B – Natural/Largely Natural” to “C – Moderately Modified”. The seep was listed as “Critically Endangered” and “Not Protected” and classified as “A/B – Natural/Largely Natural”.

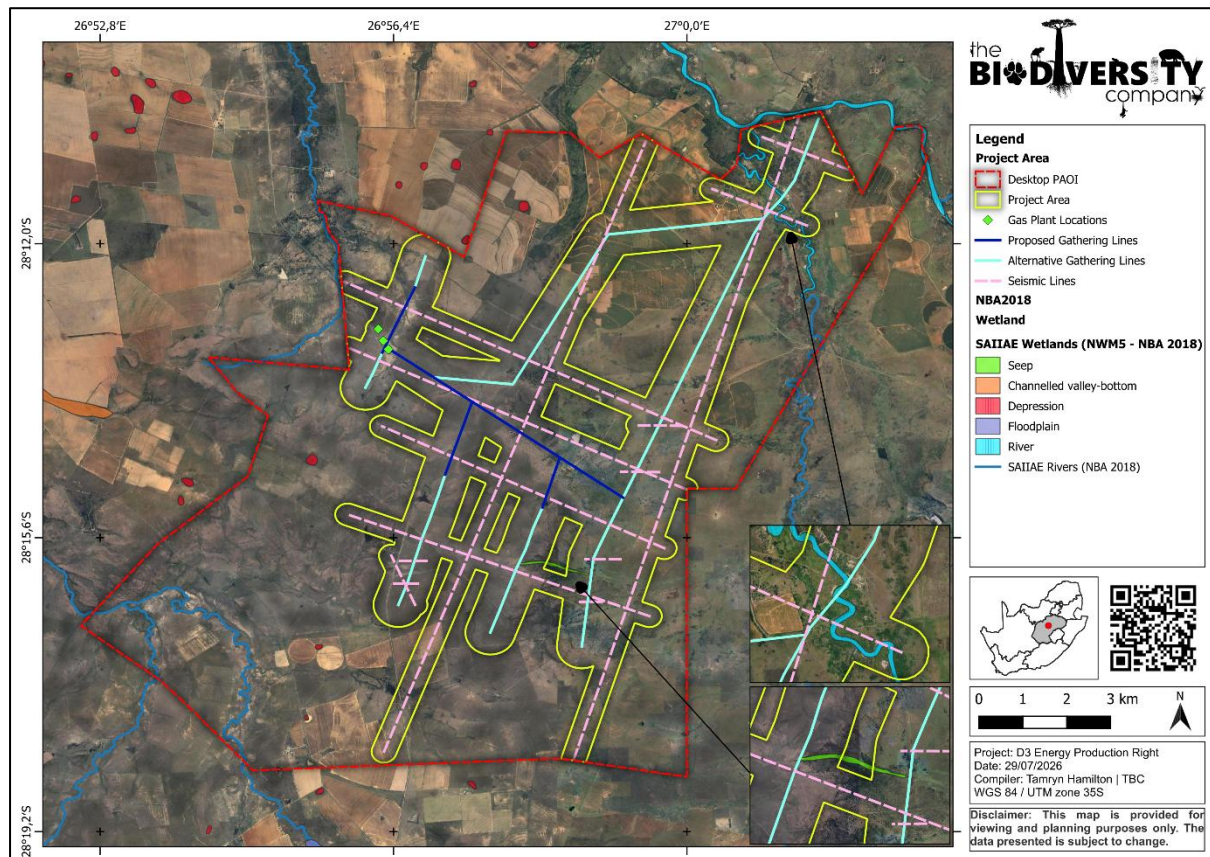


Figure 3-3 Wetland features identified within the project area of influence according to the South African Inventory of Aquatic Ecosystems dataset

3.1.4.2 National Freshwater Ecosystem Priority Areas

As with the SAIIE dataset, several wetlands were identified within the Desktop PAOI, consisting of seeps, depressions, flats, channelled-valley bottoms, unchannelled valley-bottoms, and a floodplain (Figure 3-4). Furthermore, several rivers were identified which coincide with the identified features from the SAIIE dataset. According to the dataset, all of the identified wetlands have been classified as “Non-Priority” ecosystems.

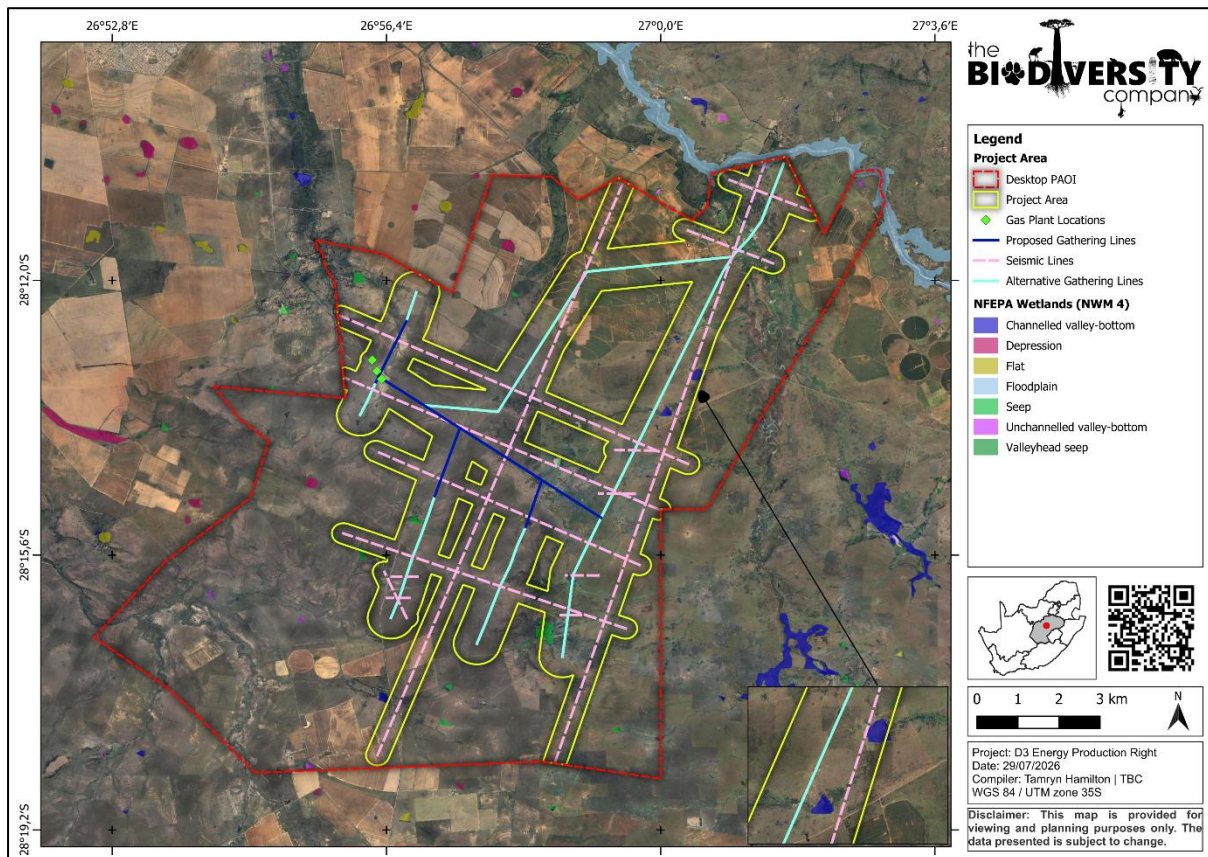


Figure 3-4 Wetland features identified within the project area of influence according to the National Freshwater Ecosystem Priority Areas dataset

3.1.4.3 Free State Terrestrial Biodiversity Sector Plan

The Free State Conservation Plan (version 4) classifies areas within the province according to their importance in achieving provincial conservation targets. Areas identified as priorities for biodiversity conservation are designated as Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs), with the objective of ensuring long-term ecological sustainability. CBAs are further categorised as either Irreplaceable, which must be conserved, or Important, which are required to meet biodiversity targets. It should be noted that the conservation plan does not differentiate between terrestrial and aquatic (freshwater) ecosystems. Consequently, while the dataset is primarily applicable to terrestrial biodiversity, it has been included to provide a comprehensive overview of conservation priorities within the study area.

Figure 3-5 indicates the Desktop PAOI overlayed on the Free State Critical Biodiversity Areas dataset. The PAOI overlaps with Ecological Support Areas (ESAs 1 & 2), Critical Biodiversity Areas (CBAs 1 & 2), Degraded Areas, and Other Natural Areas (ONAs)

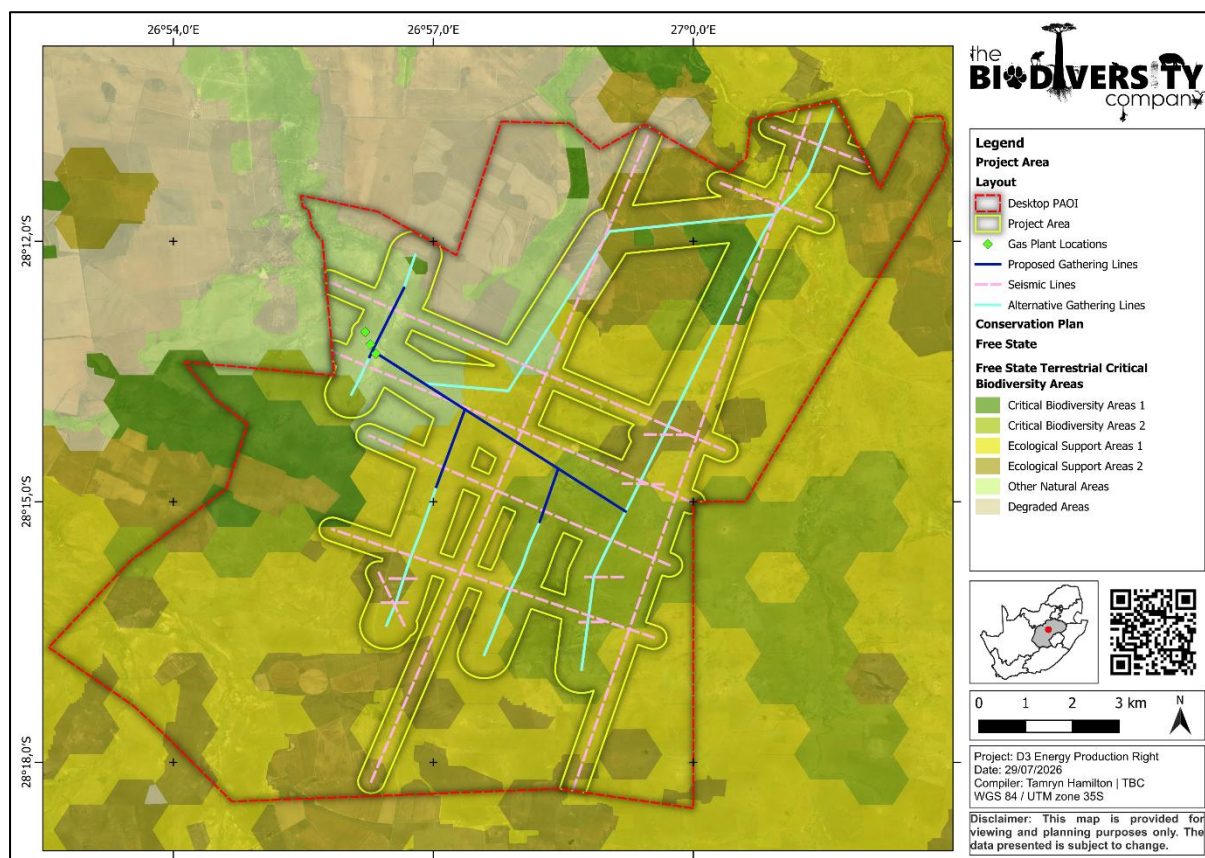


Figure 3-5 Free State Terrestrial Biodiversity Sector Plan overlay for the project area of influence

3.2 Wetland Field Survey

3.2.1 Delineation

The delineated wetlands were grouped into Hydrogeomorphic (HGM) units based on their topographic similarity, shared exposure to comparable threats, and the expectation that they provide similar ecological benefits. This approach ensures that wetlands with analogous landscape positions, hydrological regimes, and vulnerability to anthropogenic pressures are assessed collectively.

Forty-two (42) HGM units were identified and delineated within the Desktop PAOI (Figure 3-6). These features were classified as channelled valley-bottoms, unchannelled valley-bottoms, seeps, depressions, and floodplain systems. In addition, three riparian systems and several non-perennial drainage features and dams were identified. Furthermore, several artificial wet areas were delineated, which have resulted from stormwater management and land-use practices such as agricultural activities.

The buffer requirements for the wetlands were calculated using the Site-Based Tool: Determination of buffer zone requirements for wetland ecosystems (Macfarlane *et al.*, 2014). The recommended post-mitigation buffers were calculated to be 15 m.

A summary of the wetland area and percentage covers of wetland within the PAOI is provided in Table 3-2.

Table 3-2 Summary of wetland area within the project area of influence

Feature	Area (Ha)	Area (%)
HGM 1 – Unchannelled Valley-Bottom	49.19	11.40
HGM 2 – Seep	7.67	1.78

D3 Energy Production Right

HGM 3 – Channelled Valley-Bottom	39.32	9.11
HGM 4 – Depression	3.41	0.79
HGM 5 – Seep	4.63	1.07
HGM 6 – Unchannelled Valley-Bottom	1.39	0.32
HGM 7 – Unchannelled Valley-Bottom	15.10	3.50
HGM 8 – Channelled Valley-Bottom	2.13	0.49
HGM 9 – Unchannelled Valley-Bottom	5.78	1.34
HGM 10 – Depression	36.98	8.57
HGM 11 – Unchannelled Valley-Bottom	52.43	12.15
HGM 12 – Depression	2.14	0.50
HGM 13 – Channelled Valley-Bottom	36.0	8.34
HGM 14 – Seep	1.29	0.30
HGM 15 – Channelled Valley-Bottom	15.23	3.53
HGM 16 – Unchannelled Valley-Bottom	9.56	2.22
HGM 17 – Seep	4.36	1.01
HGM 18 – Depression	3.60	0.83
HGM 19 – Depression	2.59	0.60
HGM 20 – Floodplain	11.05	2.56
HGM 21 – Seep	6.47	1.50
HGM 22 – Unchannelled Valley-Bottom	0.5	0.12
HGM 23 – Depression	1.64	0.38
HGM 24 – Channelled Valley-Bottom	7.46	1.73
HGM 25 – Seep	2.80	0.65
HGM 26 – Depression	0.6	0.14
HGM 27 – Seep	5.39	1.25
HGM 28 – Depression	2.80	0.65
HGM 29 – Unchannelled Valley-Bottom	4.12	0.95
HGM 30 – Seep	11.53	2.67
HGM 31 – Unchannelled Valley-Bottom	6.04	1.40
HGM 32 – Floodplain	11.01	2.55
HGM 33 – Seep	3.70	0.86
HGM 34 – Unchannelled Valley-Bottom	14.64	3.39
HGM 35 – Seep	32.12	7.44
HGM 36 – Seep	12.27	2.84
HGM 37 – Depression	2.88	0.67
HGM 38 – Seep	0.27	0.06
HGM 39 – Depression	0.75	0.17
HGM 40 – Depression	0.07	0.02
HGM 41 – Depression	0.11	0.03
HGM 42 – Channelled Valley-Bottom	0.54	0.12

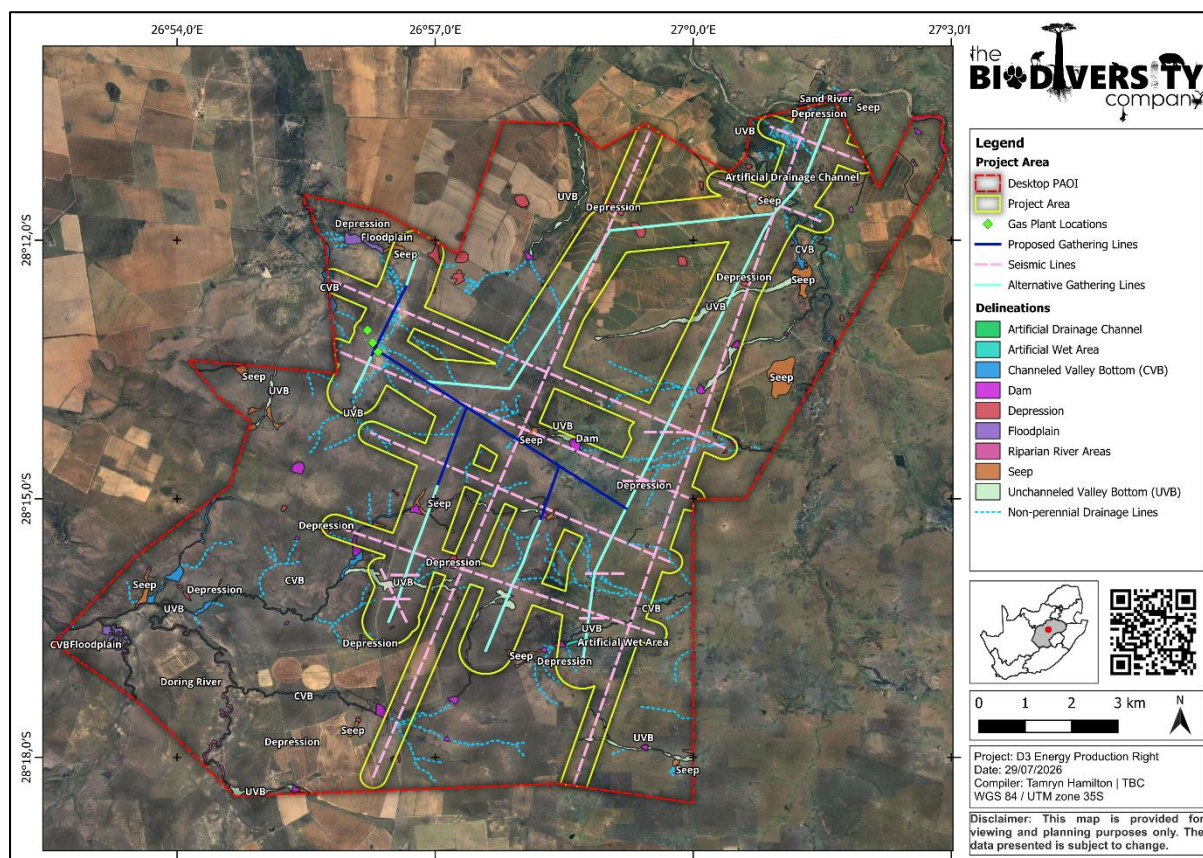


Figure 3-6 Delineation of water resources within the desktop project area of influence

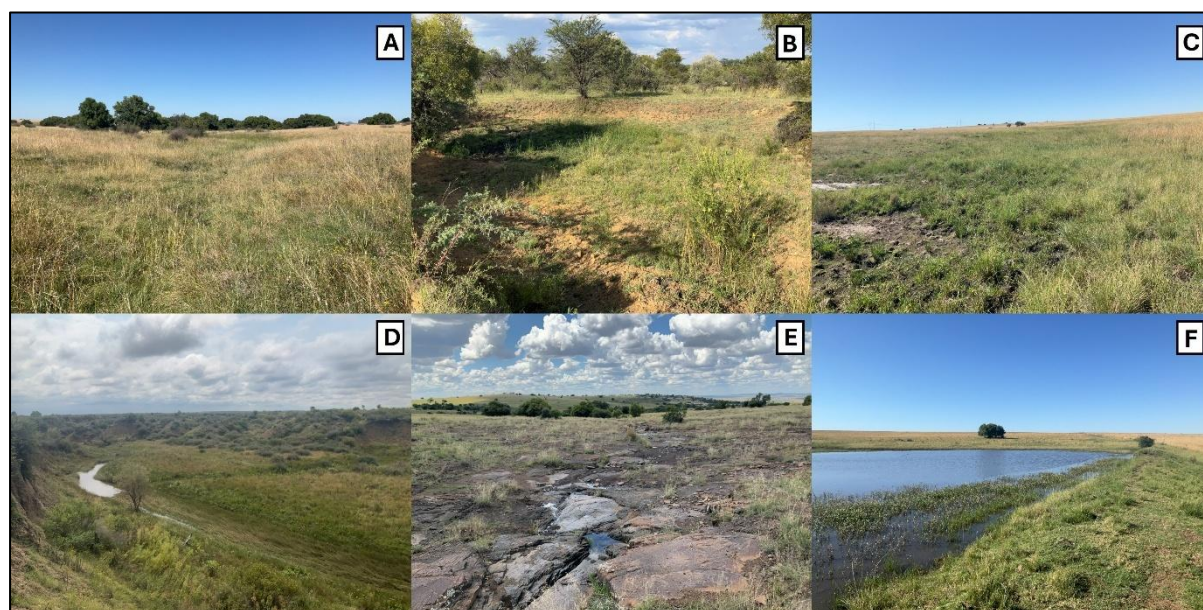


Figure 3-7 Representative photographs of the different water features within the project area of interest. A) Seep; B) Depression; C) UVB; D) CVB; E) Non-perennial Drainage Line; F) Dam

3.2.2 Risk Screening

Table 3-3 provides the results of risk screening for the delineated wetlands and provides motivation for each of the determined categories. Most of delineated wetlands were identified to be “At-Risk”. This is attributed to the proximity of the activities to the watercourses in conjunction with the interconnectivity of some of the watercourses.

Table 3-3 Risk status of the delineated wetlands

HGM unit	Risk Status	Rationale
Unchannelled Valley-Bottom (HGM 1; HGM 6; HGM 7; HGM 9; HGM 11) Channelled Valley-Bottom (HGM 3; HGM 8; HGM 13; HGM 15) Seep (HGM 2; HGM 5; HGM 14) Depression (HGM 4; HGM 10; HGM 12)	At Risk	These HGM units were located either within proximity of the proposed activities or downslope of the activities and, have therefore been determined as "At Risk". It is anticipated that direct and / or indirect impacts to the wetland systems are potential.
HGM 16 – 42	Not at Risk	These HGM units were located outside of the PAOI and/or upslope of the proposed activities and have therefore been determined as "Not at Risk".
Artificial Wet Areas Artificial Drainage Channels Dams	Not applicable	Artificial Wet Areas, Artificial Drainage Channels, and Dams, are predominantly man-made or anthropogenically induced systems/areas that are dependent on one or more induced drivers (e.g., engineered flow conveyance, altered runoff regimes, seepage, damming, discharge, or land-use-driven concentration of flows) for their initiation and ongoing persistence. Their ability to provide ecological services is therefore contingent on the long-term persistence and management of these drivers. As such, standard wetland risk assessment approaches are generally not directly applicable to these features, because their ecological processes, values, and sensitivities may be substantially different from those of natural wetlands and can change rapidly if the inducing drivers are modified, removed, or fail.

3.2.3 Classification and Description

The wetland classification as per SANBI guidelines (Ollis *et al.*, 2013) is presented in Table 3-4.

Table 3-4 Wetland classification as per SANBI guideline (Ollis *et al.*, 2013)

Wetland Type	Level 1	Level 2		Level 3	Level 4		
	System	DWS Ecoregion/s	NFEPA Wet Veg Group/s	Landscape Unit	4A (HGM)	4B	4C
Unchannelled Valley-Bottom Wetland	Inland	Highveld	Dry Highveld Grassland Group 3 / Dry Highveld Grassland Group 4	Valley Bottom	UVB	N/A	N/A
Seep Wetland				Slope	Seep	Without channelled outflow	N/A
Channelled Valley-Bottom Wetland				Valley Bottom	CVB	N/A	N/A
Depression Wetland				Plain	Depression	Endorheic	Without channelled inflow
Floodplain Wetland				Valley Bottom	Floodplain	Floodplain Flat	N/A

An unchannelled valley-bottom wetland, is a wetland located on a valley floor, characterised by the absence of a distinct river channel (Ollis *et al.*, 2013). These wetlands are defined by their diffuse water flows, which are not confined within channel banks, allowing water to spread across the valley floor. The primary water inputs for unchannelled valley-bottom wetlands include diffuse surface and subsurface flows from upstream channels that lose confinement, as well as seepage from adjacent valley side-slopes. The hydrodynamics of these wetlands are dominated by horizontal, unidirectional, diffuse surface flow, although infiltration and evapotranspiration can also be significant. This setting allows unchannelled valley-bottom wetlands to function as important sites for sediment deposition, water filtration, and habitat provision, supporting a diverse range of plant and animal species. Their unique hydrological and geomorphological characteristics make them vital components of the landscape, contributing to the overall ecological health of the valley systems in which they occur. Figure

3-8 presents a diagram of a typical unchannelled valley-bottom wetland, showing the dominant movement of water into, through and out of the system.

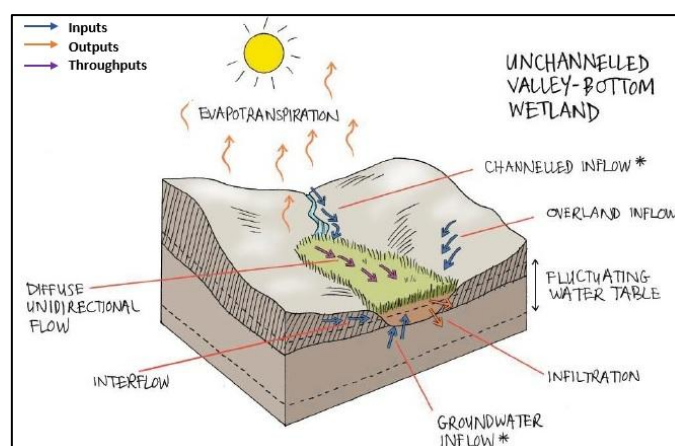


Figure 3-8 Amalgamated diagram of a typical unchannelled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

A seep wetland is typically located on gently to steeply sloping land and is characterised by the colluvial, unidirectional movement of water and material down-slope (Ollis et al., 2013). Seeps are often found on the side-slopes of a valley but do not usually extend onto the valley floor. The primary water inputs for seeps are subsurface flows from an up-slope direction, with water movement through the seep mainly occurring as interflow. During and after rainfall events, diffuse overland flow, known as sheetwash, can also be significant. Seeps are associated with geological formations and topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to seep down-slope as subsurface interflow. This unique hydrological setting allows seeps to support specific vegetation adapted to these conditions, contributing to their ecological significance in the landscape. Figure 3-9 illustrates a diagram of the hillslope seeps, showing the dominant movement of water into, through and out of the system.

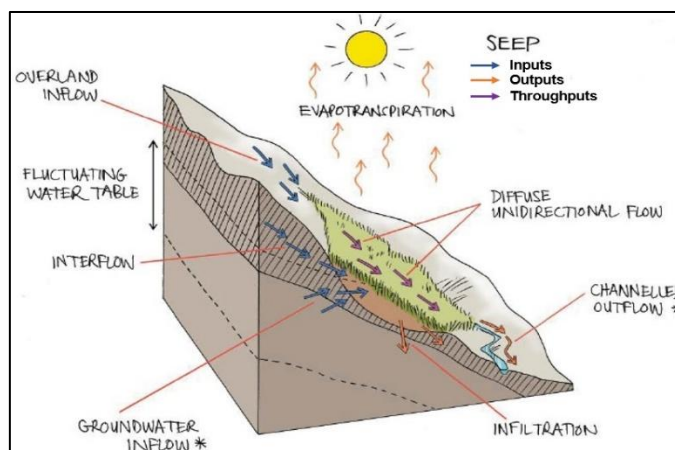


Figure 3-9 Amalgamated diagram of a typical hillslope seep, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

A channelled valley-bottom wetland, is a wetland ecosystem located along a valley floor, characterised by the presence of a river channel running through it (Ollis et al., 2013). These wetlands are distinct from floodplain wetlands due to the absence of characteristic floodplain features and the presence of a defined river channel. The landscape setting of a channelled valley-bottom wetland typically involves a valley floor where the wetland receives water inputs from the river channel, either as surface flow during flooding or as subsurface flow, and from adjacent valley side-slopes through overland flow or interflow. The hydrodynamics of these wetlands are influenced by the river channel, which provides a

concentrated flow of water, contributing to the wetland's ecological functions such as sediment trapping, nutrient cycling, and habitat provision. This setting makes channelled valley-bottom wetlands crucial for maintaining the ecological integrity of riverine systems and supporting biodiversity. Figure 3-10 presents a diagram of a typical channelled valley bottom, showing the dominant movement of water into, through and out of the system.

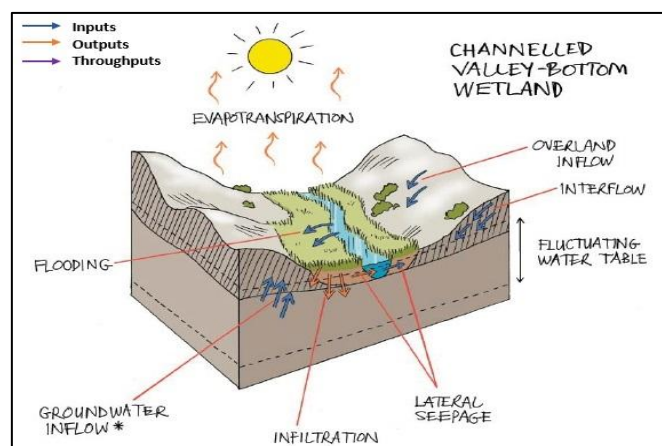


Figure 3-10 Amalgamated diagram of a typical channelled valley-bottom wetland, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

A depression wetland is characterised by its distinct geomorphological features (Ollis et al., 2013). These wetlands are defined by closed or near-closed elevation contours, which increase in depth from the perimeter to a central area of greatest depth, where water typically accumulates. Depressions may be flat-bottomed, often referred to as pans, or round-bottomed, and can have various combinations of inlets and outlets or lack them entirely. The hydrodynamics of a depression are typically dominated by vertical water level fluctuations, with water inputs primarily from precipitation, groundwater discharge, interflow, and diffuse or concentrated overland flow. The classification system further categorizes depressions based on their outflow drainage characteristics as exorheic (outward-draining), endorheic (inward-draining), or dammed, and by their inflow drainage characteristics as with or without channelled inflow. This detailed classification helps in understanding the ecological functions and management needs of depression wetlands in South Africa. Figure 3-11 presents a diagram of a typical depression wetland, showing the dominant movement of water into, through and out of the system.

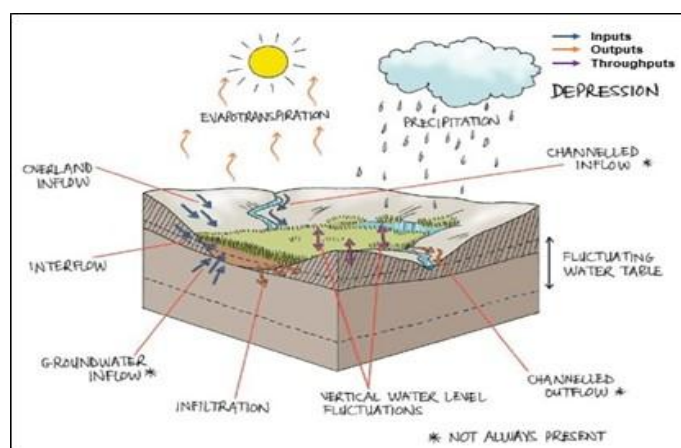


Figure 3-11 Amalgamated diagram of a typical depression wetland, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

A floodplain is a wetland area situated on the mostly flat or gently-sloping land adjacent to and formed by an alluvial river channel (Ollis et al., 2013). These areas are subject to periodic inundation by the

overtopping of the channel bank, which contributes to their dynamic nature. Floodplains are typically characterised by a suite of geomorphological features associated with river-derived depositional processes, such as point bars, scroll bars, oxbow lakes, and levees. The floodplain is formed under the current climate and sediment load, distinguishing it from terraces, which are remnants of previous climatic conditions. Water and sediment enter floodplain wetlands mainly as overspill from a major river channel during flooding, with water movement through the wetland being predominantly horizontal and bidirectional. This setting allows floodplains to play crucial roles in sediment deposition, nutrient cycling, and providing diverse habitats for various species, making them vital components of the riverine landscape. Figure 3-12 presents a diagram of the delineated floodplain, showing the dominant movement of water into, through and out of the system.

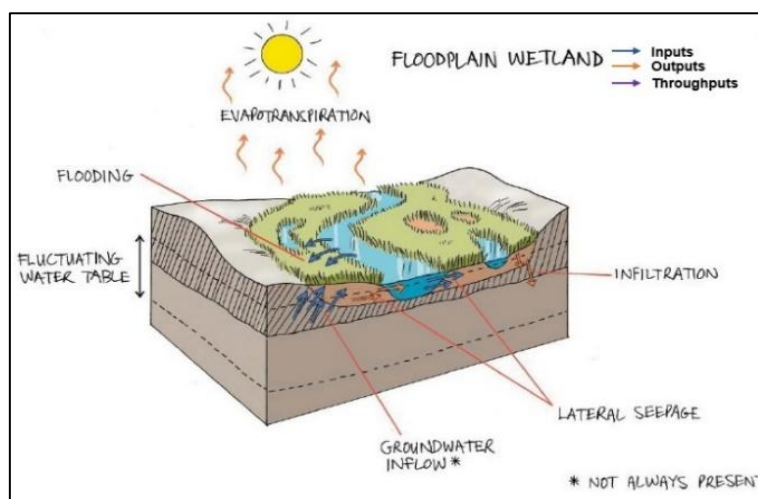


Figure 3-12 Amalgamated diagram of a typical floodplain system, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

The DWAF (2005) manual separates the classification of watercourses into three (3) separate types of channels or sections defined by their position relative to the zone of saturation in the riparian area (Figure 3-13). The classification system separates channels into:

- those that do not have baseflow ('A' Sections);
- those that sometimes have baseflow ('B' Sections) or non-perennial; or
- those that always have baseflow ('C' Sections) or perennial.

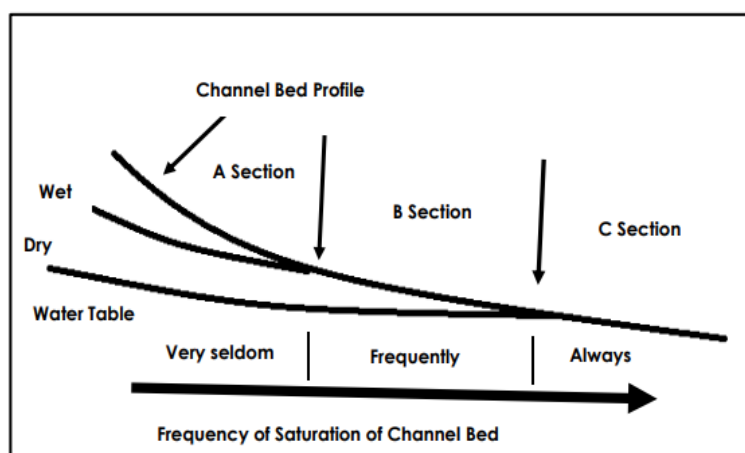


Figure 3-13 The watercourse classifications (DWAF, 2005)

3.3 Wetland Functional and Ecological Assessment

3.3.1 Functional Assessment

Only natural features perceived to be “At – Risk” from the proposed activities were assessed further in terms of their ecological features.

3.3.2 General Functional Description

Unchannelled valley-bottom wetlands are characterised by their location in valley bottoms without a distinct stream channel, resulting in diffuse water flow across the wetland. These wetlands are highly effective in sediment trapping due to their gentle gradients and the extensive areas that remain permanently saturated, which promote the deposition of sediments carried by runoff waters. The high levels of soil organic matter in these wetlands enhance their capacity for nitrate and toxicant removal, as the prolonged contact with runoff waters facilitates these processes. However, phosphate retention may be lower compared to other wetland types due to potential remobilisation under prolonged anaerobic conditions. Unchannelled valley-bottom wetlands also contribute to streamflow regulation to some extent, although this is influenced by factors such as vegetation transpiration and soil characteristics. These wetlands play a crucial role in maintaining water quality and providing habitat for diverse species, making them vital components of the landscape (Kotze *et al.*, 2009).

Hillslope seep wetlands are typically found on hillsides where water emerges from subsurface flows, creating a diffuse downslope movement. These wetlands are primarily fed by groundwater discharges, although surface water contributions can also supplement flows. Hillslope seeps are particularly effective in water quality enhancement, notably in the removal of excess nutrients and pollutants such as nitrates, through processes like denitrification. This is facilitated by the wetland's vegetation, which provides organic carbon necessary for microbial processes that assimilate these nutrients. The vegetation also plays a critical role in stabilising the soil, thereby reducing erosion risks, although the generally steep slopes of hillslope seeps can increase erosion susceptibility if vegetation cover is compromised. Additionally, these wetlands contribute to streamflow regulation by slowing down subsurface water movement, which prolongs water contribution to stream systems during low flow periods, although their flood attenuation capacity is limited once the soils are saturated (Kotze *et al.*, 2009).

Channelled valley-bottom wetlands are characterised by their location in valley bottoms with a well-defined stream channel. These wetlands play a crucial role in hydrological processes, particularly in flood attenuation and sediment trapping. The presence of a channel allows for the movement of water, which can contribute to the regulation of streamflow, especially during periods of low flow. The vegetation in these wetlands provides resistance to water flow, thereby slowing down the movement of water and allowing for the deposition of sediments. This process not only helps in maintaining water quality by trapping sediments and associated nutrients but also supports the wetland's role in flood attenuation by spreading out and slowing down floodwaters. Additionally, channelled valley-bottom wetlands can contribute to the removal of nitrates and toxicants from the water, enhancing the overall water quality in the catchment area. These wetlands are integral to maintaining the ecological balance and providing essential ecosystem services, such as water purification and habitat provision for various species (Kotze *et al.*, 2009).

Depression wetlands are characterised by their basin-shaped areas with closed elevation contours, allowing for the accumulation of surface water. These wetlands are typically isolated from stream channels, which limits their role in streamflow regulation. However, they play a crucial role in capturing runoff, thereby reducing the volume of surface water that would otherwise contribute to downstream flooding. The inward-draining nature of depressions, combined with their generally impermeable underlying layers, means they are not significant contributors to streamflow regulation. Instead, they are more effective in nutrient cycling, particularly nitrogen, through processes such as denitrification and volatilisation. The water quality in depression wetlands is influenced by local pedology, geology, and climate, which also affects their response to nutrient inputs. These wetlands can also serve as

important sites for the precipitation of minerals, including phosphate minerals, due to the concentrating effects of evaporation (Kotze *et al.*, 2009).

Floodplains are vital wetland ecosystems located in valley bottom areas with well-defined stream channels. They are characterised by their ability to receive water primarily during high flow events when riverbanks overflow. Floodplains play a crucial role in flood attenuation due to their vegetation and topographic setting, which allow them to spread out and slow down floodwaters, thereby reducing the severity of floods downstream. This flood attenuation capacity is typically higher early in the season until the floodplain soils become saturated. Additionally, floodplains are significant in sediment trapping, as the decreased velocity of floodwaters allows for the deposition of sediment particles, effectively retaining phosphorous bound to these sediments. While floodplains may not significantly contribute to streamflow regulation due to the retention of water in their generally clayey soils, they can enhance groundwater recharge in areas with coarser sediments. Overall, floodplains are essential for maintaining water quality and providing diverse habitats, supporting a wide range of ecological functions and services (Kotze *et al.*, 2009).

Non-perennial drainages, as documented by Kotze *et al.*, (2009), are characterised by their intermittent flow patterns, which are not sustained throughout the year. These systems are crucial for flood attenuation, particularly during periods of flow, as their channels allow for the temporary storage and slow release of water. This attenuation is most effective when the channel-bed and surrounding soils are not fully saturated. The deposition of sediments and organic material within these systems contributes to the retention of water, thereby enhancing the capacity to moderate flow variability. Non-perennial drainages also play a role in nutrient cycling, particularly in the assimilation of nitrates through processes such as denitrification, facilitated by the organic matter present. These features improve water quality by trapping sediments and assimilating excess nutrients and pollutants from agricultural and industrial sources. Although their capacity for erosion control is limited due to their intermittent nature, non-perennial systems provide ecosystem services by connecting various aquatic habitats and supporting biodiversity during wet periods.

It should be noted that these characteristics are representative of ideal river or wetland features and may not necessarily represent the characteristics of all rivers or wetlands. The functionality of the features and the provision of benefits is largely dependent on the river or wetland size and influence from abiotic drivers.

3.3.3 Ecosystem Services

The ecosystem services provided by the relevant HGM units on site were assessed and rated using the WET-EcoServices method (Kotze *et al.*, 2009). The results of the assessments are presented in Table 3-5. The ecosystem services scores of the delineated wetlands ranges from “Moderately Low” to “Moderately High”. The delineated wetlands within the project area provide a range of regulating and supporting ecosystem services despite varying levels of modification. These include attenuation of surface runoff, temporary water storage, maintenance of local hydrological connectivity, sediment trapping, erosion reduction, and enhancement of water quality through the retention and filtration of suspended material and contaminants. Seepage wetlands additionally reflect groundwater-driven processes and contribute to the maintenance of local soil moisture regimes. Collectively, the wetland systems also provide habitat and movement corridors for wetland-associated flora and fauna, thereby supporting ecological functioning within the surrounding landscape.

Table 3-5 Summary of the average ecosystem scores of the assessed wetland units

Moderately High	Intermediate	Moderately Low
Channelled Valley-Bottoms (HGM 1; HGM 6; HGM 7; HGM 9; HGM 11) Unchannelled Valley-Bottoms (HGM 3; HGM 8; HGM 13; HGM 15)	Seeps (HGM 2; HGM 5; HGM 14)	Depressions (HGM 4; HGM 10; HGM 12)
	-	-

3.3.4 Present Ecological State

The wetlands identified within the project area have exhibited a limited degree of modification resulting from natural physical changes, as well as anthropogenically induced impacts at both the local and catchment level. Resultingly, the wetlands scored average Present Ecological State (PES) scores within the “C – Moderately Modified” and “D – Largely Modified” PES classes. The results of the wetland health and integrity assessment is provided in Table 3-6.

Table 3-6 Average Present Ecological State scores for the assessed wetland units

C – Moderately Modified	D – Largely Modified
Channelled Valley-Bottoms (HGM 1; HGM 6; HGM 7; HGM 9; HGM 11)	Unchannelled Valley-Bottoms (HGM 3; HGM 8; HGM 13; HGM 15)
Seeps (HGM 2; HGM 5; HGM 14)	Depressions (HGM 4; HGM 10; HGM 12)

The list below refers to the present-day local impacts observed within the assessed wetland areas:

- Agricultural disturbance and associated edge effects;
- Localised soil compaction in and around wetland areas;
- Erosion and sediment deposition from disturbed surfaces and access routes;
- Altered runoff pathways caused by existing roads, tracks, and crossings;
- Disturbance of wetland-edge vegetation and reduced buffer integrity;
- Alien and invasive and disturbance-associated plant encroachment;
- Habitat fragmentation and reduced ecological connectivity; and
- Localised disturbance associated with existing access and exploration activities.

3.3.5 Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) assessment was applied to the HGM units in conjunction with the ecosystem service scores in the preceding sections, to assess the levels of sensitivity and ecological importance of the wetland. Various components pertaining to the protection status of a wetland is considered for the EIS, including Strategic Water Source Areas (SWSA), the NFEPA Wetveg protection status and the protection status of the wetland itself considering the NBA wetland dataset. The results of the assessment are shown in the subsequent sections. The wetlands average EIS scores present within the “B – High”, and “C – Moderate” classes.

Table 3-7 Aspects considered in the Ecological Importance and Sensitivity assessment

HGM Type.	NFEPA Wet Veg			Wetland Condition (Field Survey)	NBA Wetlands		SWSA (Y/N)	CBA / ESA (Y/N)	EIS Class
	Type	Ecosystem Threat Status	Ecosystem Protection Level		Ecosystem Threat Status 2018	Ecosystem Protection Level			
Unchannelled Valley-Bottoms (HGM 3; HGM 8; HGM 13; HGM 15)		Least Threatened / Critically Endangered		D – Largely Modified	Critically Endangered	Not Protected		Y (CBA, ESA)	B – High
Seeps (HGM 2; HGM 5; HGM 14)	Dry Highveld Grassland Group 3	Endangered / Critically Endangered	Not Protected	C – Moderately Modified	Critically Endangered	Not Protected	N	Y (CBA, ESA)	B - High
Channelled Valley-Bottoms (HGM 1; HGM 6; HGM 7; HGM 9; HGM 11)	/Dry Highveld Grassland Group 4	Least Threatened / Critically Endangered		C – Moderately Modified	Critically Endangered	Not Protected		Y (CBA, ESA)	B – High
Depressions (HGM 4; HGM 10; HGM 12)		Least Threatened		D – Largely Modified	Least Threatened	Poorly Protected		Y (CBA, ESA)	C – Moderate

3.3.6 Recommended Ecological Category and Recommended Management Objective

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) for the wetland areas was determined from the results of the PES and EIS assessments. These assessments indicated that all wetland features within the site, had to an extent, underwent transformation as a result of historical and current impacts. Nevertheless, despite the altered ecological integrity of these systems, they are considered to provide ecological services. The appropriate REC and RMO estimated for the wetland areas are presented in tables below.

Table 3-8 Summary of the REC and RMO categories assigned to the relevant wetlands

B/C – Improve	C/D – Improve	D – Maintain
Seeps (HGM 2; HGM 5; HGM 14)	Unchannelled Valley-Bottoms (HGM 3; HGM 8; HGM 13; HGM 15)	Depressions (HGM 4; HGM 10; HGM 12)
Channelled Valley-Bottoms (HGM 1; HGM 6; HGM 7; HGM 9; HGM 11)	-	-

3.4 Buffer Requirements

The buffer requirements for the wetlands were calculated using the Site-Based Tool: Determination of buffer zone requirements for wetland ecosystems (Macfarlane *et al.*, 2014). The recommended buffer zones are presented in Table 3-9 and Figure 3-14. The post-mitigation buffers for the freshwater features in relation to the proposed project area were calculated to be 15 m. Provided that all recommended mitigation measures are diligently implemented, these buffers are considered sufficient to maintain the resilience and ecosystem services of the wetlands and drainage features. Areas where the proposed infrastructure does not avoid the required buffers the risk of the wetland's and drainage features ability to maintain the resilience and ecosystem services are expected to be impacted and are discussed in subsequent sections of the report.

Table 3-9 Buffer requirements for the relevant wetland features

Aspect	Recommended Buffer
Freshwater Buffer	15 m

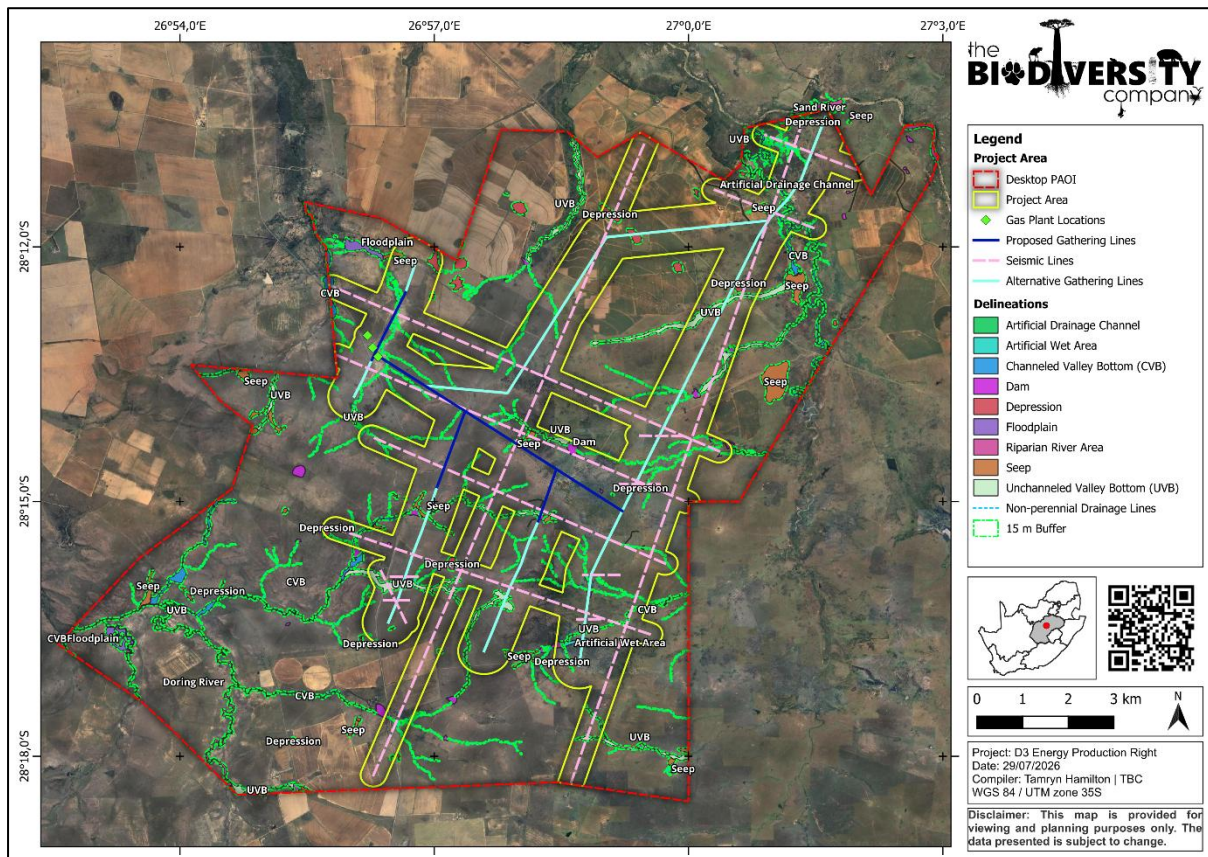


Figure 3-14 Recommended buffers for the identified freshwater features in relation to the proposed development

3.4.1 Regulation Zones

Table 3-10 presents the legislated zones of regulation that would be applicable to the watercourse areas.

In accordance with Government Notice (GN) 4167 of 2023 and GN 509 of 2016, as it relates to the NWA (1998), water uses as defined in Section 21 (c) and 21 (i) of the NWA must be considered if the proposed activities fall within the regulated zones of a watercourse as defined in the Act.

Listed activities in terms of the NEMA (1998), (Act 107 of 1998) EIA Regulations as amended in April 2017 must be taken into consideration if any infrastructure is to be placed within the applicable zone of regulation.

Both types of authorisations (NEMA and NWA) are applicable given that the proposed development occurs within the relevant regulated zones (Figure 3-15).

Table 3-10 **Legislated zones of regulation**

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). GN 4167 as published in the Government Gazette 49833 of 2023. GN 509 as published in the Government Gazette 40229 of 2016.	In accordance with GN 4167 of 2023 and GN 509 of 2016, as it relates to the National Water Act, 1998 (Act 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21c and 21i 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.
Environmental Authorisation in terms of the Listed activities of the National Environmental Management Act, 1998 (Act No. 107 of 1998). EIA Regulations (2014), as amended.	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 metres or more; 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 metres of a watercourse, measured from the edge of a watercourse. excluding – (dd) where such development occurs within an urban area; or (ee) where such development occurs within existing roads or road reserves. Activity 19 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 infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.”

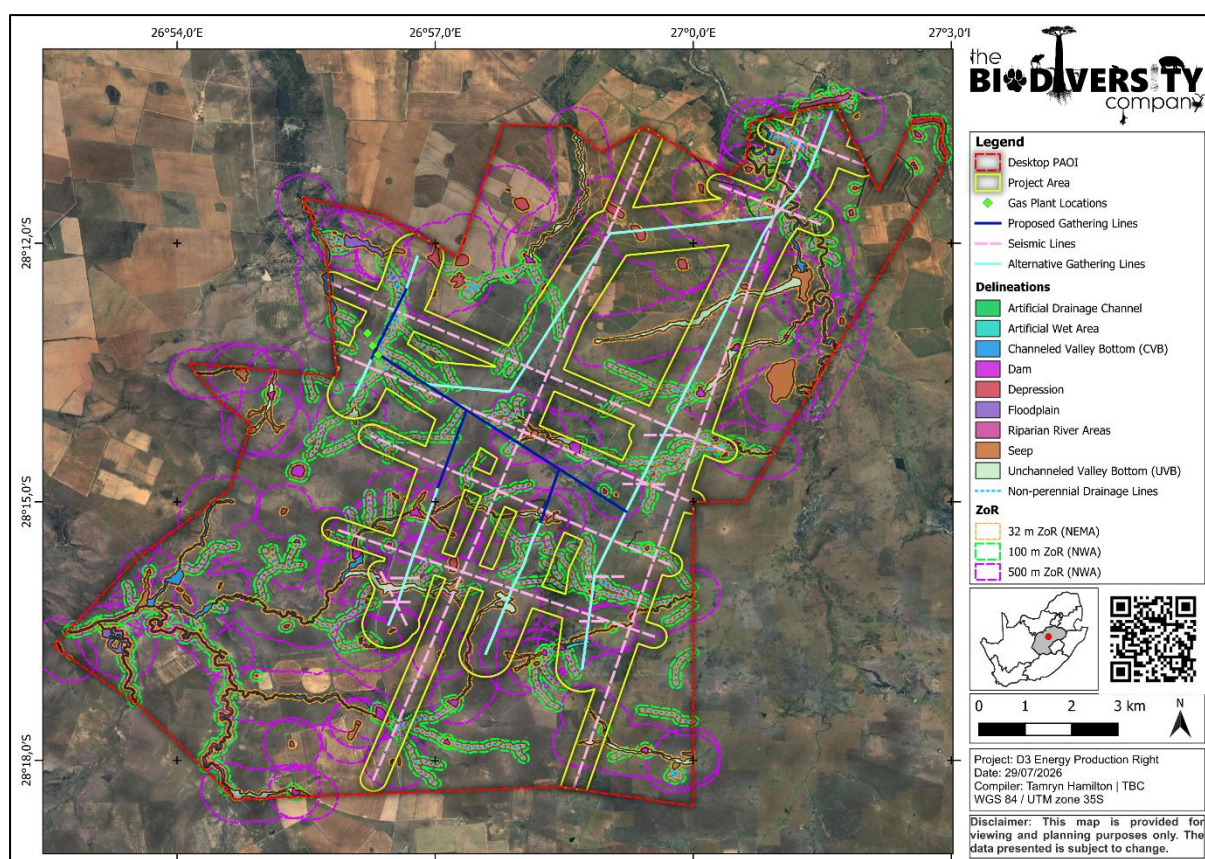


Figure 3-15 Zones of Regulation in relation to the identified freshwater systems within the project area of influence

3.5 Site Sensitivity Verification

3.5.1 Desktop Ecological Sensitivity

The following is deduced from the National Web-based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended):

- Aquatic Biodiversity Theme sensitivity as “Low” for the majority of the project footprint with areas of “Very High” sensitivity assigned for the presence of wetlands (Depression; Seep; River), rivers, and FEPA Subcatchment (Figure 3-16).

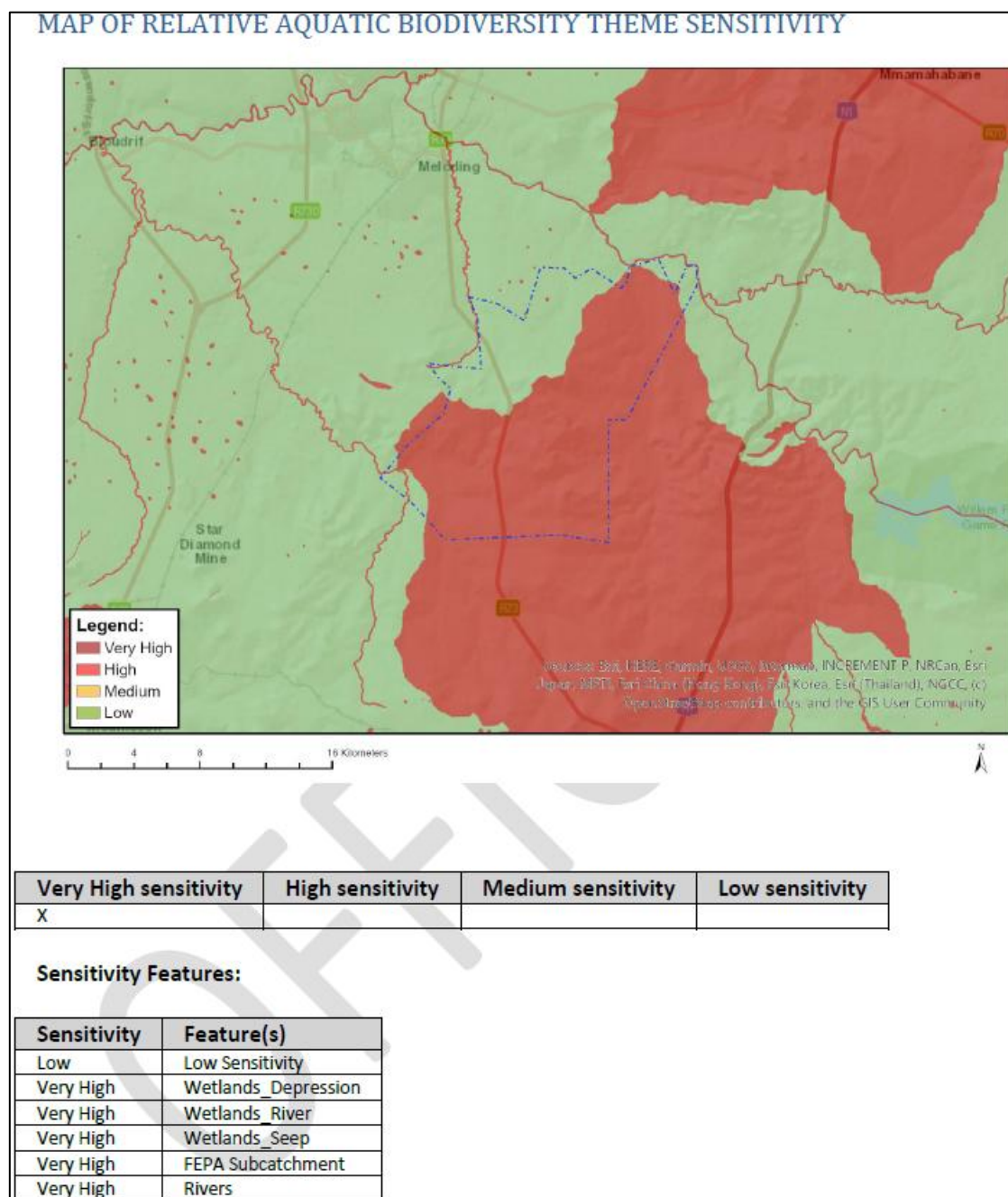


Figure 3-16 Aquatic Biodiversity Theme Sensitivity for the project area of influence

3.5.2 Screening Tool Comparison

The allocated sensitivities for each of the relevant themes are either disputed or validated for the assessed areas in Table 3-11 below. A summative explanation for each result is provided as relevant. It should be noted that the National Web-based Environmental Screening Tool allocates sensitivities to freshwater resources identified through the available national freshwater datasets based on their presence (very high) or absence (low). The specialist-assigned sensitivity ratings presented herein for the natural and assessed wetlands have considered the ecological characteristics of the delineated features.

The specialist-assigned sensitivity ratings are informed by desktop screening and field verification, including observed wetland indicators and habitat characteristics, and consideration is given to any observed or likely presence of sensitive fauna and flora. The sensitivities are displayed in Figure 3-17.

Table 3-11 Summary of the screening tool vs specialist assigned sensitivities

Features	Screening Tool Theme	Environmental Screening Tool Sensitivity	Specialist Sensitivity	Tool Validated or Disputed by Specialist - Reasoning
HGM 1, 2; HGM 5 – 9; HGM 11; HGM 14, 15	Aquatic Biodiversity Theme	Low	High	Disputed – These wetlands are important for maintaining ecological processes and supporting biodiversity but have experienced some degree of modification resulting in some change of ecological process and benefit provision.
		Very High		
HGM 3, 13		Low	Very High	Disputed – These are larger intact valley-bottom systems which retain good residual function and sensitivity by providing important ecological services. These wetlands also have direct hydrological and ecological connectivity within the valley-floor network and downstream perennial systems.
		Very High	Very High	Validated - These are larger intact valley-bottom systems which retain good residual function and sensitivity by providing important ecological services. These wetlands also have direct hydrological and ecological connectivity within the valley-floor network and downstream perennial systems.
HGM 4, HGM 10, HGM 12		Low	Medium	Disputed - These wetlands are the smaller systems with reduced connectivity and have reduced ecological function and service provision resulting from modification.
		Very High		
15 m Buffer		Low	Medium	Disputed – Buffers play a role in protecting adjacent wetlands from edge effects and supporting ecological connectivity and their sensitivity is therefore determined by the features they encompass.
		Very High		
Non-perennial Drainage		Low	Medium	Disputed – These features provide limited habitat and are minor hydrological sources to the downstream wetlands they have connectivity with. However, can be clearly differentiated from the surrounding terrestrial environment.
Artificial Wet Areas Artificial Drainage Channels Dams		Low	Low	Validated – These are artificial features which were constructed by human intervention and are therefore reliant on human induced drivers for long-term persistence which if removed, altered or stopped will result in the features not being present. The features do not provide naturally supported ecological services.
		Very High	Low	Disputed – These are artificial features which were constructed by human intervention and are therefore reliant on human induced drivers for long-term persistence which if removed, altered or stopped will result in the features not being present. The features do not provide naturally supported ecological services.
Remaining Area			Low	Low

Very High

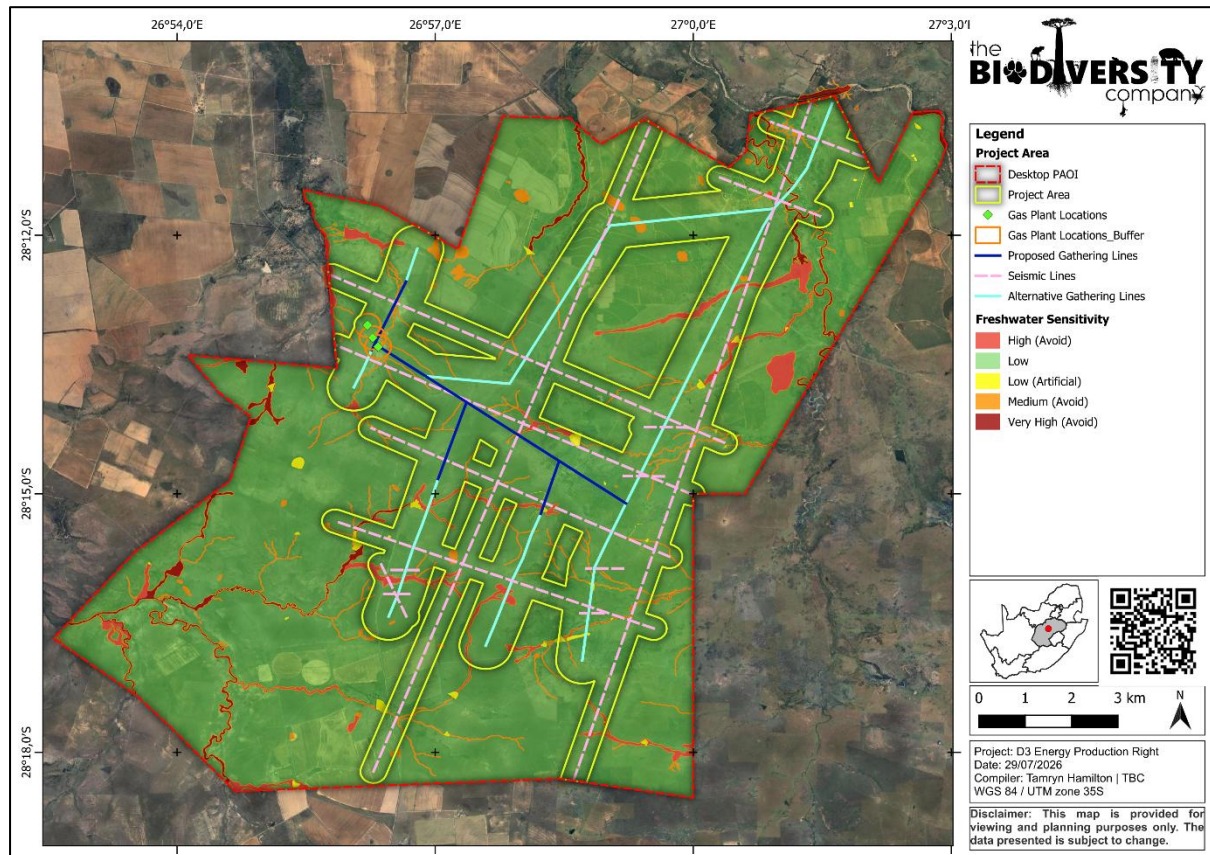


Figure 3-17 Freshwater Sensitivity for the project area of influence

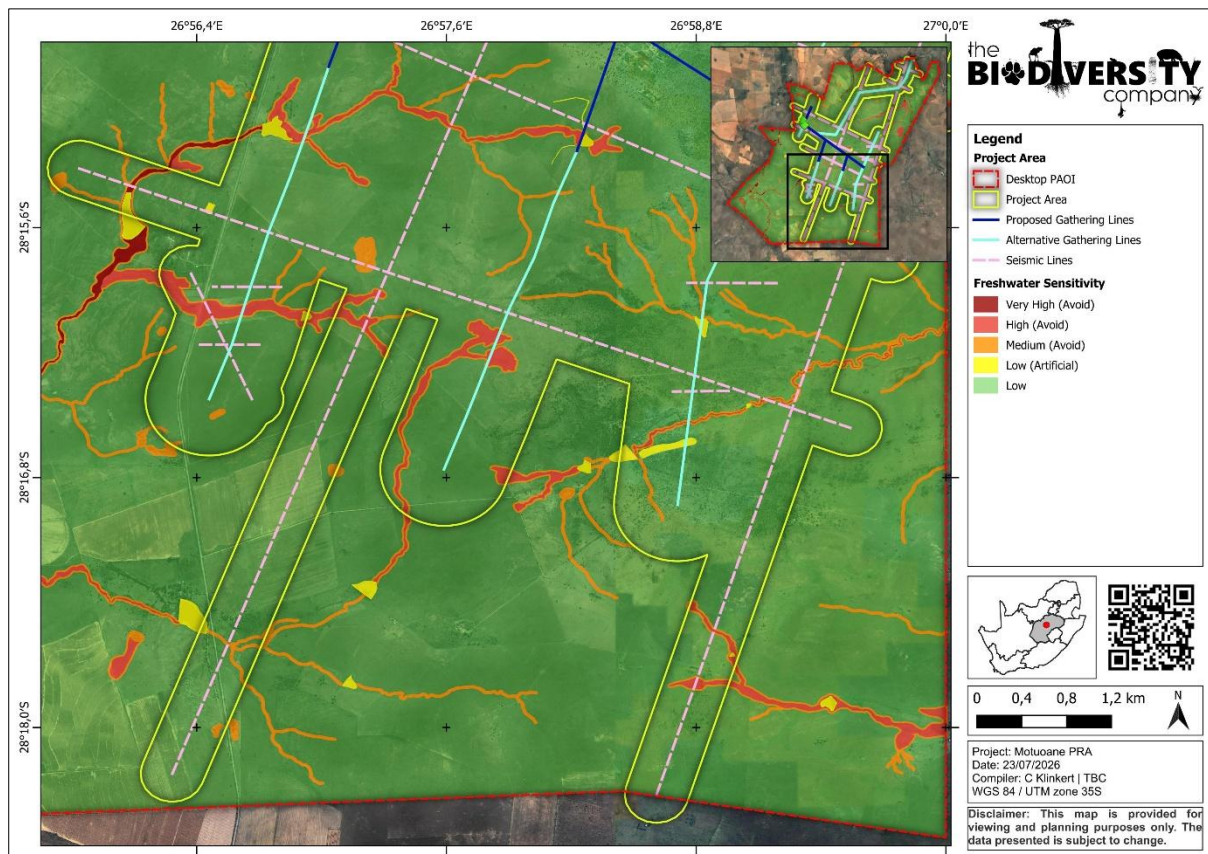


Figure 3-18 Freshwater Sensitivity for the southern portion of the project area of influence

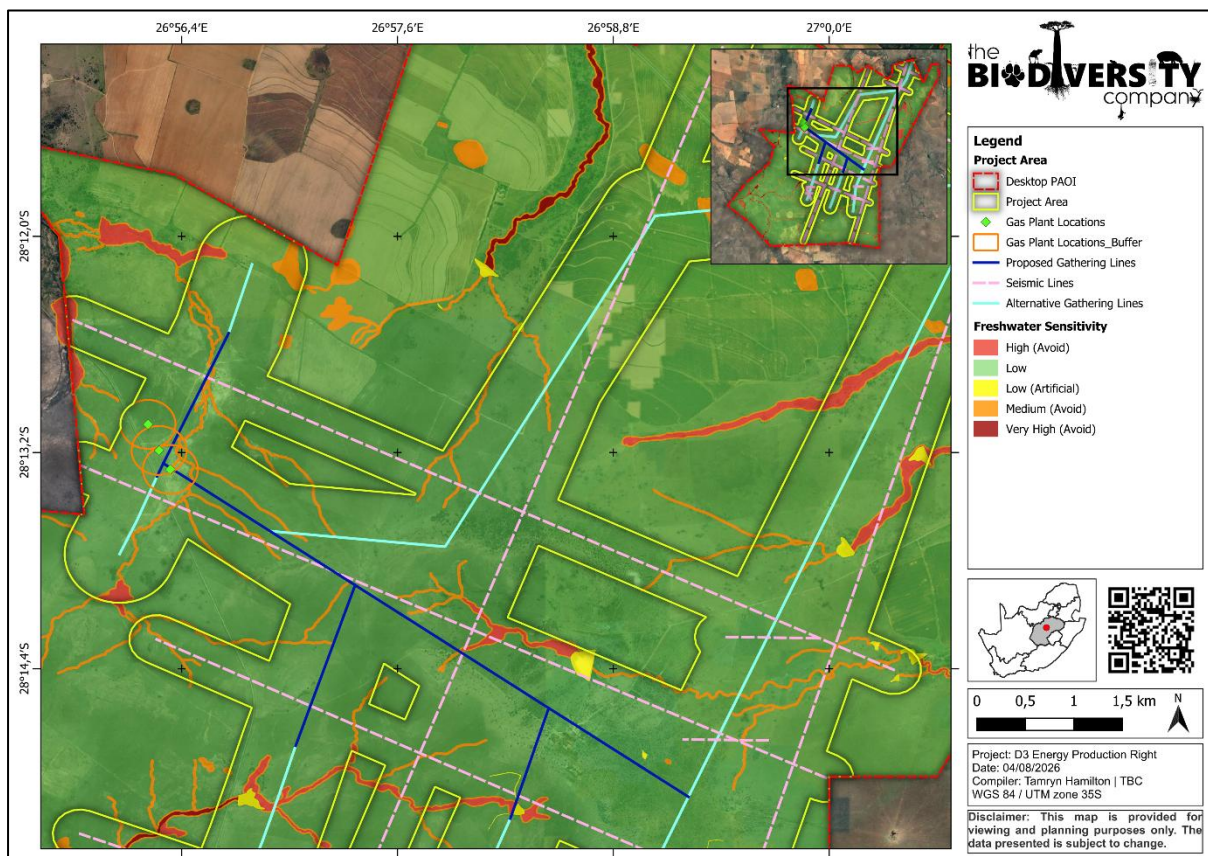


Figure 3-19 Freshwater Sensitivity for the central portion of the project area of influence

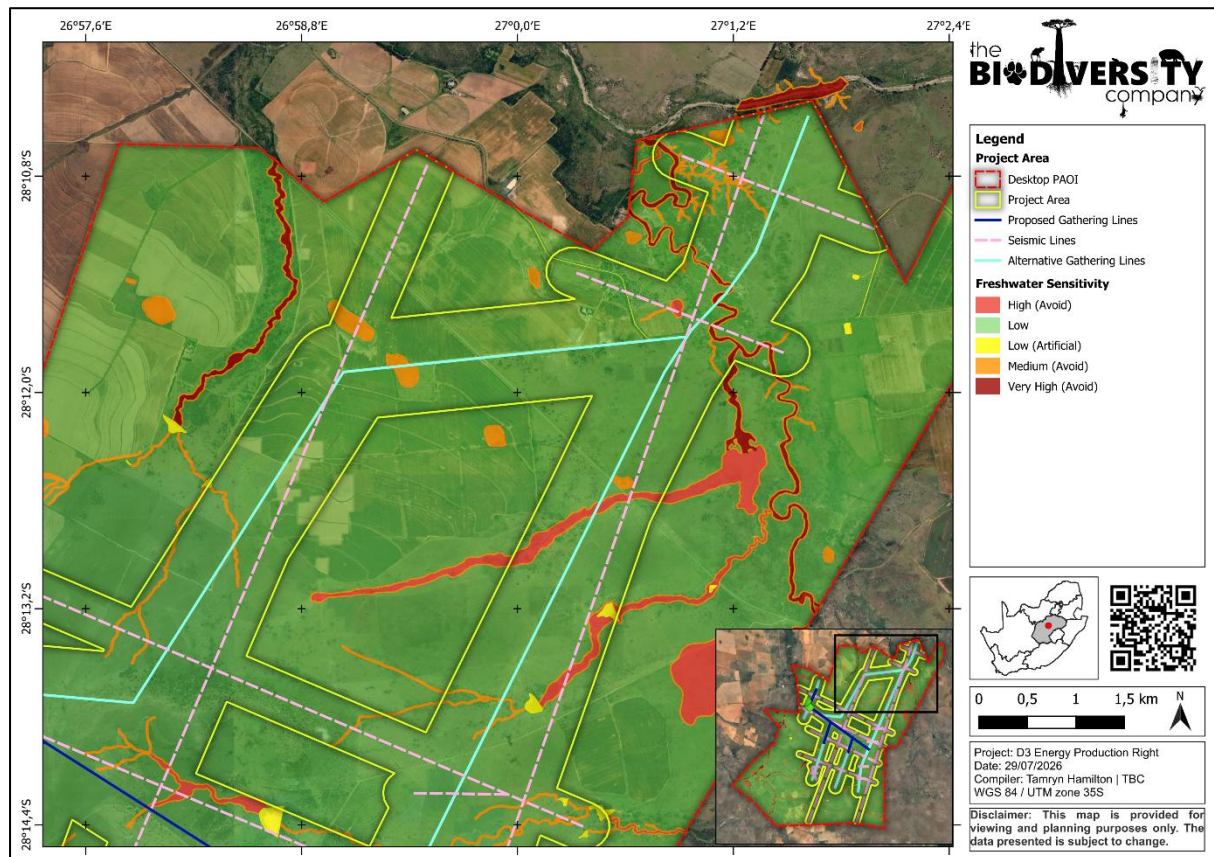


Figure 3-20 Freshwater Sensitivity for the northern portion of the project area of influence

4 Risk and Impact Assessment

4.1 Quantitative Risk and Impact Assessment

The proposed project is anticipated to result in localised, predominantly temporary disturbance within the assessment footprint, primarily associated with vehicle movement along the planned seismic lines and drilling activities associated with the proposed areas for the drilling wells, and the excavation activities for the gathering pipelines situated between the drilling well localities. The principal freshwater-related risk is that ground disturbance (particularly under wet conditions) may lead to rutting/compaction, vegetation disturbance and the development of localised erosion hotspots, with the potential for increased sediment and contaminant mobilisation toward wetlands and drainage features. The focus for mitigation was thus placed on minimising potential impacts.

It is anticipated that the project will pose “Low” and “Moderate” post-mitigation risks, this considers that the suggested mitigations are implemented and that wetlands will not be fully avoided. The impact of the proposed development can be mitigated to a large degree through the designing of the proposed facilities outside of the wetlands and their associated buffers. Although the proposed mitigation measures significantly reduce the severity of most anticipated impacts, several activities particularly those intersecting wetlands continue to exhibit moderate post-mitigation risks. These residual risks remain because certain impacts, such as hydrological alteration, habitat loss within wetland footprints, fragmentation, and long-term changes to flow pathways at crossings, cannot be fully eliminated. Conversely, risks relating to water quality impairment, alien and invasive plant encroachment, sedimentation, and vegetation clearance can be effectively mitigated to low provided the recommended buffer avoidance, stormwater management measures, rehabilitation provisions and operational controls are implemented.

Table 4-1 *Summative results of the Risk Assessment conducted for the proposed development*

Phase	Activity	Impact	Potentially affected watercourses	Significance (max = 100)	Risk Rating
			Name/s		
Construction	Construction of Drill Pad / Well Sites (Intersecting Wetlands) Site clearing and preparation Earthworks and vehicle movement Civil works Storage and use of hazardous substances and equipment	Increased runoff and sedimentation from exposed areas	Unchannelled Valley-Bottom (HGM 1, 6, 11)	32	M
			Seep (HGM 2)	32	M
			Channelled Valley-Bottom (HGM 13)	32	M
			Non-perennial Drainage Lines	12	L
		Edge effects associated with proliferation of alien species from vegetation clearance	Unchannelled Valley-Bottom (HGM 1, 6, 11)	25.6	L
			Seep (HGM 2)	25.6	L
			Channelled Valley-Bottom (HGM 13)	25.6	L
			Non-perennial Drainage Lines	9.6	L
		Impaired water quality from contaminated runoff (accidental chemical and oil spills from machinery and equipment)	Unchannelled Valley-Bottom (HGM 1, 6, 11)	32	M
			Seep (HGM 2)	32	M
			Channelled Valley-Bottom (HGM 13)	32	M
			Non-perennial Drainage Lines	12.8	L

	Construction of Drill Pad / Well Sites (Within 500m of Wetlands and 100 m From Drainage Features) Site clearing and preparation Earthworks and vehicle movement Civil works Storage and use of hazardous substances and equipment	Increased runoff and sedimentation from exposed areas	Seep (HGM 5, 14)	8	L
			Channelled Valley-Bottom (HGM 3, 8)	8	L
			Depression (HGM 4, 10, 12)	6	L
			Non-perennial Drainage Lines	4	L
		Edge effects associated with proliferation of alien species from vegetation clearance	Seep (HGM 5, 14)	8	L
			Channelled Valley-Bottom (HGM 3, 8)	8	L
			Depression (HGM 4, 10, 12)	6	L
			Non-perennial Drainage Lines	4	L
		Impaired water quality from contaminated runoff (accidental chemical and oil spills from machinery and equipment)	Seep (HGM 5, 14)	5.6	L
			Channelled Valley-Bottom (HGM 3, 8)	5.6	L
			Depression (HGM 4, 10, 12)	4.2	L
			Non-perennial Drainage Lines	2.8	L
	Construction of Gas Pipeline (Intersecting Wetlands and Drainage Features) Site clearing and preparation. Earthworks including the excavation, reshaping and compacting of project trench area for pipeline installation. Operation of machinery and equipment and vehicle movement. Stripping, soil stockpiling and building material stockpiles. Storage and use of hazardous substances associated with accidental spills. Waste and ablution facilities. Final reshaping, retaining, and landscaping.	Loss of native vegetation and habitat fragmentation (direct and indirect loss of wetland) with proliferation of alien species from vegetation clearance	Unchannelled Valley-Bottom (HGM 1, 6, 11)	32	M
			Seep (HGM 2)	32	M
			Channelled Valley-Bottom (HGM 13)	32	M
			Non-perennial Drainage Lines	12.8	L
		Altered Hydrology and induced erosion and sedimentation from soil compaction	Unchannelled Valley-Bottom (HGM 1, 6, 11)	32	M
			Seep (HGM 2)	32	M
			Channelled Valley-Bottom (HGM 13)	32	M
			Non-perennial Drainage Lines	12.8	L
		Water quality impairment from contaminated runoff	Unchannelled Valley-Bottom (HGM 1, 6, 11)	19.2	L
			Seep (HGM 2)	19.2	L
			Channelled Valley-Bottom (HGM 13)	19.2	L
			Non-perennial Drainage Lines	9.6	L
		Storage of chemicals, mixes, and fuels with associated accident spills	Unchannelled Valley-Bottom (HGM 1, 6, 11)	12.8	L
			Seep (HGM 2)	12.8	L
			Channelled Valley-Bottom (HGM 13)	12.8	L
			Non-perennial Drainage Lines	6.4	L
		Altering surface hydrology due to soil stripping, soil	Unchannelled Valley-Bottom (HGM 1, 6, 11)	32	M
			Seep (HGM 2)	32	M
			Channelled Valley-Bottom (HGM 13)	32	M

		stockpiling and building material stockpiles	Non-perennial Drainage Lines	12.8	L
		Final reshaping, retaining, and landscaping	Unchannelled Valley-Bottom (HGM 1, 6, 11)	14.4	L
			Seep (HGM 2)	14.4	L
			Channelled Valley-Bottom (HGM 13)	14.4	L
			Non-perennial Drainage Lines	7.2	L
Construction of Gas Pipeline (Within 500 m of Wetlands and 100 m from Drainage Features) Site clearing and preparation. Earthworks including the excavation, reshaping and compacting of project trench area for pipeline installation. Operation of machinery and equipment and vehicle movement. Stripping, soil stockpiling and building material stockpiles. Storage and use of hazardous substances associated with accidental spills. Waste and ablation facilities. Final reshaping, retaining, and landscaping.	Loss of native vegetation and habitat fragmentation (direct and indirect loss of wetland) with proliferation of alien species from vegetation clearance		Seep (HGM 5, 14)	12.8	L
			Channelled Valley-Bottom (HGM 3, 8)	12.8	L
			Depression (HGM 4, 10, 12)	9.6	L
			Non-perennial Drainage Lines	4	L
		Altered Hydrology and induced erosion and sedimentation from soil compaction	Seep (HGM 5, 14)	21.6	L
			Channelled Valley-Bottom (HGM 3, 8)	21.6	L
			Depression (HGM 4, 10, 12)	16.2	L
			Non-perennial Drainage Lines	8.4	L
		Water quality impairment from contaminated runoff	Seep (HGM 5, 14)	12.8	L
			Channelled Valley-Bottom (HGM 3, 8)	12.8	L
			Depression (HGM 4, 10, 12)	9.6	L
			Non-perennial Drainage Lines	5.6	L
		Storage of chemicals, mixes, and fuels with associated accident spills	Seep (HGM 5, 14)	11.2	L
			Channelled Valley-Bottom (HGM 3, 8)	11.2	L
			Depression (HGM 4, 10, 12)	8.4	L
			Non-perennial Drainage Lines	5.6	L
		Altering surface hydrology due to soil stripping, soil stockpiling and building material stockpiles	Seep (HGM 5, 14)	11.2	L
			Channelled Valley-Bottom (HGM 3, 8)	11.2	L
			Depression (HGM 4, 10, 12)	8.4	L
			Non-perennial Drainage Lines	4	L
		Final reshaping, retaining, and landscaping	Seep (HGM 5, 14)	11.2	L
			Channelled Valley-Bottom (HGM 3, 8)	11.2	L
			Depression (HGM 4, 10, 12)	8.4	L
			Non-perennial Drainage Lines	4	L
	Construction of Gas Plant (Within 100 m of Drainage Features) Site clearing and preparation. Earthworks.	Loss of native vegetation and habitat fragmentation (direct and indirect loss of wetland) with	Non-perennial Drainage Lines	6.4	L

	Civil works. Storage and handling of hazardous substances. Operation and maintenance	proliferation of alien species from vegetation clearance			
		Altered Hydrology and induced erosion and sedimentation from soil compaction	Non-perennial Drainage Lines	6.4	L
		Water quality impairment from contaminated runoff	Non-perennial Drainage Lines	8	L
	Surveying of Seismic Transects (Intersecting Wetlands and Drainage Features)	Localised soil compaction altering overland flow patterns and reduce infiltration	Unchannelled Valley-Bottom (HGM 1, 7, 9, 11)	8	L
			Seep (HGM 5, 14)	8	L
			Channelled Valley-Bottom (HGM 3, 8, 13, 15)	8	L
			Depression (HGM 4, 10)	6	L
			Non-perennial Drainage Lines	2	L
		Impaired water quality from accidental hydrocarbon leaks or spills	Unchannelled Valley-Bottom (HGM 1, 7, 9, 11)	5.6	L
			Seep (HGM 5, 14)	5.6	L
			Channelled Valley-Bottom (HGM 3, 8, 13, 15)	5.6	L
			Depression (HGM 4, 10)	4.2	L
			Non-perennial Drainage Lines	2.8	L
		Disturbance to wetland-edge vegetation from repeated traversing of sensitive areas	Unchannelled Valley-Bottom (HGM 1, 7, 9, 11)	5.6	L
			Seep (HGM 5, 14)	5.6	L
			Channelled Valley-Bottom (HGM 3, 8, 13, 15)	5.6	L
			Depression (HGM 4, 10)	4.2	L
			Non-perennial Drainage Lines	2	L
	Operation of Drill Pad / Well Site (Intersecting Wetlands and Drainage Features) Drilling operations. Temporary handling and storage of materials and waste. Sample collection and management. Management of drilling fluids and cores/chips/cuttings. Maintenance of drill rig and support vehicles.	Increased runoff and sedimentation from cleared areas and drill pad	Unchannelled Valley-Bottom (HGM 1, 6, 11)	21.6	L
			Seep (HGM 2)	21.6	L
			Channelled Valley-Bottom (HGM 13)	21.6	L
			Non-perennial Drainage Lines	8.4	L
		Water quality impairment from contaminated runoff (spills/leaks and waste management)	Unchannelled Valley-Bottom (HGM 1, 6, 11)	21.6	L
			Seep (HGM 2)	21.6	L
			Channelled Valley-Bottom (HGM 13)	21.6	L
			Non-perennial Drainage Lines	10.8	L
		Edge effects from continued proliferation of	Unchannelled Valley-Bottom (HGM 1, 6, 11)	21.6	L
			Seep (HGM 2)	21.6	L
			Channelled Valley-Bottom (HGM 13)	21.6	L

		alien invasive vegetation	Non-perennial Drainage Lines	5.6	L
Operation of Drill Pad / Well Sites (Within 500 m of Wetlands and 100 m from Drainage Features) Drilling operations. Temporary handling and storage of materials and waste. Sample collection and management. Management of drilling fluids and cores/chips/cuttings. Maintenance of drill rig and support vehicles.	Increased runoff and sedimentation from cleared areas and drill pad	Seep (HGM 5, 14)	11.2	L	
		Channelled Valley-Bottom (HGM 3, 8)	11.2	L	
		Depression (HGM 4, 10, 12)	8.4	L	
		Non-perennial Drainage Lines	2.8	L	
	Water quality impairment from contaminated runoff (spills/leaks and waste management)	Seep (HGM 5, 14)	14.4	L	
		Channelled Valley-Bottom (HGM 3, 8)	14.4	L	
		Depression (HGM 4, 10, 12)	10.8	L	
		Non-perennial Drainage Lines	3.6	L	
	Edge effects from continued proliferation of alien invasive vegetation	Seep (HGM 5, 14)	14.4	L	
		Channelled Valley-Bottom (HGM 3, 8)	14.4	L	
		Depression (HGM 4, 10, 12)	10.8	L	
		Non-perennial Drainage Lines	5.6	L	
	Operation of Gas Pipeline (Intersecting Wetlands and Drainage Features) Pipeline Routine Access and Maintenance	Altered overland flows from hardened surfaces	Unchannelled Valley-Bottom (HGM 1, 6, 11)	6.4	L
			Seep (HGM 2)	12.8	L
			Channelled Valley-Bottom (HGM 13)	12.8	L
			Non-perennial Drainage Lines	3.2	L
Loss of native vegetation and habitat fragmentation (direct and indirect loss of wetland) with proliferation of alien species from vegetation clearance		Unchannelled Valley-Bottom (HGM 1, 6, 11)	12.8	L	
		Seep (HGM 2)	12.8	L	
		Channelled Valley-Bottom (HGM 13)	12.8	L	
		Non-perennial Drainage Lines	3.2	L	
Water quality impairment from contaminated leakage		Unchannelled Valley-Bottom (HGM 1, 6, 11)	16	L	
		Seep (HGM 2)	16	L	
		Channelled Valley-Bottom (HGM 13)	16	L	
		Non-perennial Drainage Lines	4	L	
Operation of Gas Plant (Within 100 m of Drainage Features) Operation and maintenance of gas processing infrastructure. Vehicle movement. Storage and handling of hydrocarbons and equipment. Management of stormwater, dirty water, and waste.		Altered overland flows from hardened surfaces	Non-perennial Drainage Lines	5.6	L
		Water quality impairment from contaminated runoff (spills/leaks and waste management)	Non-perennial Drainage Lines	7.2	L

4.2 Impact Assessment

The impacts associated with the proposed activities, was assessed in the impact matrix provided by EIMS and the results are given in Table 4-2 – Table 4-5 for the activities relating to the Seismic Transects, Drilling Wells, Gathering Lines and Gas Plant.

The proposed Seismic Transect survey is anticipated to result in localised, predominantly temporary disturbance within the project footprint, primarily associated with vehicle movement along the planned transect lines and related field activities. The principal freshwater-related risk is that ground disturbance, particularly under wet conditions, may lead to rutting, soil compaction, vegetation disturbance and the development of localised erosion hotspots, with the potential for increased sediment and contaminant mobilisation towards wetlands and drainage features. Although direct impacts to wetlands are not anticipated based on an avoidance approach, inappropriate routing, wet-weather access or uncontrolled driving could result in incidental encroachment into sensitive wetland areas. The only phases assessed for the Seismic Transect survey are the Construction (Exploration Phase) and Post-Exploration (Rehab and Closure Phase), as the nature of seismic surveys is such that all significant activities and associated impacts occur during the initial data acquisition period.

The proposed exploration drilling wells are expected to cause localised and largely temporary disturbance within the designated drilling sites and their immediate surroundings. The primary freshwater-related risks are associated with site clearance and earthworks required for the drilling pads, drilling operations themselves, and the movement of vehicles and equipment to and from the well locations during the Construction Phase. These activities may result in soil compaction, vegetation removal, and the generation of drill cuttings and fluids which, if not properly managed, could lead to increased sedimentation, hydrocarbon or chemical contamination, and altered surface drainage patterns. In addition to construction-related impacts, the operational phase of the drilling wells has been assessed under two scenarios, namely normal operations and abnormal operations. Normal operations include routine well operation, site maintenance and associated vehicle access, which may result in ongoing disturbance, erosion, contaminated runoff and the spread of alien and invasive vegetation. Abnormal operations refer to unplanned but credible incidents, including blowouts during drilling or production, major hydrocarbon or chemical spills, releases of contaminated water, fires or explosions, and infrastructure or waste management failures, all of which may result in acute or chronic impacts on wetlands, drainage features and associated freshwater habitat.

The proposed gathering lines are expected to result in localised, linear disturbance along the pipeline servitudes, primarily associated with trench excavation, pipe installation, backfilling, and associated vehicle and machinery movement during the Construction Phase. The principal freshwater-related risks are linked to the excavation and reinstatement of trenches, particularly where gathering lines intersect or occur in close proximity to wetlands and drainage features. These activities may alter local surface and shallow subsurface flow patterns, disturb wetland soils and vegetation, and create erosion-prone disturbed surfaces, with the potential for increased sediment mobilisation to adjacent freshwater features. Additional risks include impaired water quality resulting from sediment-laden runoff, trench water, and accidental spills or leaks of fuels, oils, and other hazardous substances associated with construction machinery and materials handling. If not appropriately managed, soil stripping, spoil stockpiling, trench backfilling, and poor reinstatement of the trench corridor may result in temporary obstruction or diversion of natural overland flow, localised ponding, settlement, persistent erosion, and reduced wetland habitat quality. In addition, disturbance along the pipeline corridor may facilitate the establishment and spread of alien and invasive plant species in disturbed wetland and buffer areas. Although the gathering lines are anticipated to be rehabilitated following installation, inadequate rehabilitation and poor re-establishment of pre-disturbance contours and vegetation cover may prolong impacts into the Rehab and Closure Phase. The phases assessed for the gathering lines therefore include the Construction Phase, the Operational Phase, and the Rehab and Closure Phase. For the Operational Phase, impacts are assessed for both **normal operations**, such as maintenance access and routine infrastructure management, and **abnormal operations**, including pipeline rupture, chronic leakage, accidental major spills, stormwater control failure and emergency incident response, which

may result in contamination, soil disturbance and degradation of adjacent wetlands and drainage features.

The proposed Gas Plant and associated production infrastructure are expected to result in localised but potentially persistent disturbance within the plant footprint and immediate surroundings. Freshwater-related risks are primarily associated with site establishment and earthworks during construction, the creation of hardened surfaces, stormwater generation, storage and handling of hydrocarbons, condensate and other hazardous substances, and the operation of process infrastructure. During the Operational Phase, the Gas Plant has similarly been assessed for both **normal operations** and **abnormal operations**. Normal operations may result in altered runoff patterns, increased stormwater volumes, contaminated runoff, habitat disturbance and ongoing risks associated with routine maintenance and vehicle activity. Abnormal operations may include major hydrocarbon or chemical releases, produced water or process water containment failure, fire or explosion, stormwater containment failure, and sewage or waste system failure, all of which could cause acute or chronic impacts on nearby wetlands, drainage features, wetland soils and vegetation if not effectively contained and managed. The Gas Plant assessment therefore considers impacts during the Construction Phase, the Operational Phase under both normal and abnormal scenarios, and the Rehab and Closure Phase where relevant.

The impact assessment indicates that the risks associated with the proposed activities are generally of Medium to Low significance prior to mitigation, with gathering lines presenting the highest pre-mitigation risk where interactions with wetlands and drainage features are unavoidable or difficult to manage. With the implementation of appropriate avoidance, management and mitigation measures, impacts are generally reduced to Medium to Low or Low significance, indicating that the identified risks can be effectively managed. The findings indicate that, provided that wetland avoidance is maintained where possible and that both routine operational controls and emergency response measures are effectively implemented, the long-term impacts on wetland and freshwater ecosystem health and functionality are expected to remain limited.

Table 4-2 *Summative results of the Impact Assessment conducted for the proposed activities in relation to the Seismic Transects*

ID: WetA1	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Altered surface flows from soil compaction and creation of preferential flow paths leading to erosion and sedimentation	Construction	Medium to Low	Low	Low
Mitigation Measures				
• Pre-survey and mark transects to follow natural contours and avoid low-lying, saturated, or visibly sensitive areas. • No activities are to be permitted within on wetlands or watercourses (32 m prelitigation and a 15 m post-mitigation buffer). • Minimise physical footprint of construction. Construction / exploration impacts associated with the proposed project must be contained within the footprint of the assessed areas. • Areas rated as High sensitivity outside of the direct construction / exploration areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery				
ID: WetA2	Construction	Medium to Low	Low	Low
Impact: Soil compaction leading to increased risk of erosion and sedimentation				
Mitigation Measures				
• Compacting of soil must be avoided as far as possible, and the use of heavy machinery must be restricted in areas outside of the seismic transects to reduce the compaction of soils. • No activities are to be permitted within on wetlands or watercourses (32 m prelitigation and a 15 m post-mitigation buffer). • Areas rated as High sensitivity outside of the direct construction / exploration areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery • Minimise physical footprint of construction.				
ID: WetA3	Construction	Medium to Low	Low	Low
Impact: Disturbance to wetland vegetation and soil leading to proliferation of alien invasive plants				
Mitigation Measures				
• Stockpile removed vegetation for use in site rehabilitation. • Re-cover disturbed soil with native vegetation or mulch. • Re-seed or plant with locally sourced indigenous wetland species where natural recovery is slow. • Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site. • Ongoing identification of risks and impacts. • Areas outside the direct project footprint, should under no circumstances be disturbed. • No activities are to be permitted within on wetlands or watercourses (32 m prelitigation and a 15 m post-mitigation buffer). • Areas rated as High sensitivity outside of the direct construction / exploration areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery.				
ID: WetA4	Construction	Medium to Low	Low	Low
Impact: Impaired water quality from hydrocarbon spills and leaks and associated contaminated runoff				
Mitigation Measures				

• Designate refuelling and maintenance areas at least 50 m from any wetland or watercourse. • Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. • Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. • All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. • Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. • Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. • Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. • Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. • Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.				
ID: WetA5	Rehab and Closure	Medium to Low	Low	Low
Impact: Impaired water quality from hydrocarbon spills and leaks and associated contaminated runoff from rehabilitation activities				
Mitigation Measures				
• Designate refuelling and maintenance areas at least 50 m from any wetland or watercourse. • All debris and contaminated soils must be removed and suitably disposed of. • Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. • Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. • All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. • Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. • Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. • Drip trays must be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. • Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. • Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.				
ID: WetA6	Rehab and Closure	Medium to Low	Low	Low
Impact: Continued degradation of wetlands from improper post-exploration rehabilitation				

Mitigation Measures				
- Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities. - All debris and contaminated soils must be removed and suitably disposed of. - Contours and natural surrounding must be reformed. - All equipment, fencing and other infrastructure must be removed from site upon completion of activities. - Natural drainage patterns must be restored. - The stockpiled topsoil must be returned to the surface of the reinstated areas. For topsoil's with highly enriched seedbanks, additional seeding may not be required, but this would need to be monitored over time. If necessary, seed from the surrounding areas should be used to augment the topsoil seedbank. - During and after rehabilitation, ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment. - Temporary access routes/roads must be suitably rehabilitated. - Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved.				
ID: WetA7	Rehab and Closure	Low+	Low to Medium +	Medium to low +
Impact: Improvement in wetland functionality from successful rehabilitation				
Mitigation Measures				
- Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site. - Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-construction survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities. - The stockpiled topsoil must be returned to the surface of the reinstated areas. For topsoil's with highly enriched seedbanks, additional seeding may not be required, but this would need to be monitored over time. If necessary, seed from the surrounding areas should be used to augment the topsoil seedbank. - During and after rehabilitation, ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment. - Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved.				
*Mitigation listed in red are new additional measures while those in black are mitigation measures which have been previously approved from similar activities within the same region undertaken by the same applicant.				

Table 4-3 *Summative results of the Impact Assessment conducted for the proposed activities in relation to locations identified for drilling of wells*

ID: WetB1	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Altered surface flows from soil compaction and creation of preferential flow paths leading to erosion and sedimentation	Construction	Medium to Low	Low	Low
Mitigation Measures				

- No drilling / production activities are to be permitted within on wetlands or watercourses (32 m pre-mitigation and a 15 m post-mitigation buffer). - Minimise physical footprint of construction. Construction / production impacts associated with the proposed project must be contained within the footprint of the assessed areas; - Minimise vegetation clearance. Existing gravel roads must be used as far as possible, and the closest disturbed areas must be considered for drill pads. Clearance of vegetation must be kept to the required footprint (i.e. 50 x 50 m drill pad and ~1.5ha for gas plant). Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed. - Soils in drilling areas where disturbances will be encountered must be stripped and stockpiled outside affected areas for use after completion of the drilling program. Topsoil must be adequately stripped to the correct depth and stored separately from subsoils - Cut of trench and berm must be constructed around the drill pad to prevent contaminated surface runoff from entering shallow aquifers and surrounding water resources. - A liner should be placed over the drill pad and drip trays must be used in all areas where hydrocarbons are handled.				
ID: WetB2	Constru	Mediu	Low	Low
Impact: Soil compaction leading to increased risk of erosion and sedimentation	m to	Low		
Mitigation Measures				
- Compacting of soil must be avoided as far as possible, and the use of heavy machinery must be restricted in areas outside of the proposed production sites to reduce the compaction of soils. - No drilling/ production activities are to be permitted within on wetlands or watercourses (32 m premitigation and a 15 m post-mitigation buffer). - Areas rated as High sensitivity outside of the direct construction / production areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery. - Minimise physical footprint of construction.				
ID: WetB3	Constru	Mediu	Low	Low
Impact: Disturbance to wetland vegetation and soil leading to proliferation of alien invasive plants	m to	Low		
Mitigation Measures				
- Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site. - Ongoing identification of risks and impacts. - Areas outside the direct project footprint, should under no circumstances be disturbed; - Areas rated as High sensitivity outside of the direct construction / production areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery.				
ID: WetB4	Constru	Mediu	Low	Low
Impact: Impaired water quality from hydrocarbon spills and leaks and associated contaminated runoff	m to	Low		
Mitigation Measures				
Designate refuelling and maintenance areas at least 50 m from wetlands and watercourses. - Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall.				

D3 Energy Production Right

- Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimize the potential for leakage and to prevent spillage onto the soil. - Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. - Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. - Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.				
ID: WetB5	Construction (unplanned)	Medium to Low	Low	Low
Impact: Altered surface flows from soil compaction and creation of preferential flow paths leading to erosion and sedimentation				
Mitigation Measures				
- Immediately halt work in the event of unplanned disturbance and assess the extent of impact. - Monitor the area for signs of altered flow or erosion and implement additional controls if needed. - No drilling / production activities are to be permitted within on wetlands or watercourses (32 m premitigation and a 15 m post-mitigation buffer). - Minimise physical footprint of construction. Construction / production impacts associated with the proposed project must be contained within the footprint of the assessed areas; - Minimise vegetation clearance. Existing gravel roads must be used as far as possible, and the closest disturbed areas must be considered for drill pads. Clearance of vegetation must be kept to the required footprint (i.e. 50 x 50 m drill pad and ~1.5ha for gas plant). Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed. - Soils in drilling areas where disturbances will be encountered must be stripped and stockpiled outside affected areas for use after completion of the drilling program. Topsoil must be adequately stripped to the correct depth and stored separately from subsoils - Cut of trench and berm must be constructed around the drill pad to prevent contaminated surface runoff from entering shallow aquifers and surrounding water resources. - A liner should be placed over the drill pad, and drip trays must be used in all areas where hydrocarbons are handled.				
ID: WetB6	Construction (unplanned)	Medium to Low	Low	Low
Impact: Soil compaction leading to increased risk of erosion and sedimentation				
Mitigation Measures				
- Compacting of soil must be avoided as far as possible, and the use of heavy machinery must be restricted in areas outside of the proposed production sites to reduce the compaction of soils. - No drilling / production activities are to be permitted within on wetlands or watercourses (32 m premitigation and a 15 m post-mitigation buffer). - Areas rated as High sensitivity outside of the direct construction / production areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery. - Minimise physical footprint of construction.				
ID: WetB7	Construction (unplanned)	Medium to Low	Low	Low
Impact: Disturbance to wetland vegetation and soil leading to proliferation of alien invasive plants				
Mitigation Measures				

• Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site. • Ongoing identification of risks and impacts. • Areas outside the direct project footprint, should under no circumstances be disturbed; • Areas rated as High sensitivity outside of the direct construction / production areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery.				
ID: WetB8	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Impaired water quality from hydrocarbon spills and leaks and associated contaminated runoff	Construction (unplanned)	Medium to Low	Low	Low
Mitigation Measures				
• Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. • Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. • All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. • Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. • Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimize the potential for leakage and to prevent spillage onto the soil. • Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. • Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. • Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.				
ID: WetB9	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Routine operation of the drilling wells may result in localised contaminated runoff, minor hydrocarbon leaks, and ongoing disturbance within the operational footprint, which may reduce water quality and habitat condition in nearby wetlands and drainage features if not appropriately managed	Operations	Medium to Low	Low	Low
Mitigation Measures				
• Routine inspection and maintenance of well infrastructure must be undertaken to prevent leaks and surface contamination.				

- All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. - Spill kits must be available on site at all times. - Any minor leaks or spills must be contained and cleaned immediately. - Stormwater runoff from operational areas must be managed to prevent discharge to wetlands and drainage features. - Operational areas must be kept tidy and free of waste and debris.				
ID: WetB10	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Routine maintenance access and associated vehicle movement may result in localised soil compaction, vegetation disturbance and erosion along access routes, with the potential to affect nearby wetland habitat and drainage patterns.	Operations	Medium to Low	Low	Low
Mitigation Measures				
- Maintenance access must be restricted to designated routes and existing disturbed areas as far as possible. - No off-road driving may occur within wetland areas or buffers unless absolutely necessary. - Access roads and disturbed areas must be maintained to prevent erosion. - Activities must be avoided during very wet conditions where possible. - Any disturbed areas showing signs of erosion or degradation must be rehabilitated promptly.				
ID: WetB11	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Continued disturbance within and around the well pad and associated access areas may facilitate the establishment and spread of alien and invasive plant species, resulting in reduced habitat quality in adjacent wetland and buffer areas..	Operations	Medium to Low	Low	Low
Mitigation Measures				
- An alien invasive plant monitoring and control programme must be implemented for all disturbed operational areas. - Disturbance to surrounding natural vegetation must be minimised. - Existing infestations must be treated promptly and follow-up control undertaken where necessary. - Disturbed areas not required for ongoing operations should be stabilised and revegetated where feasible.				
ID: WetB12	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance

Impact: An uncontrolled blowout during drilling or production could result in the release of hydrocarbons, drilling fluids and/or formation fluids into adjacent wetland areas, causing acute contamination of wetland soils and surface water, destruction of vegetation, and long-term degradation of wetland ecological integrity and functioning.	Operati ons (Abnor mal or Unplann ed)	Mediu m to High	Mediu m to Low	Mediu m to Low
Mitigation Measures				
• Appropriate blowout prevention and well control systems must be installed, tested and maintained throughout drilling and production activities. • Well design, casing installation and pressure management must comply with applicable industry standards and best practice. • A site-specific emergency response procedure for blowout incidents must be implemented and all relevant personnel must be trained in its application. • Spill response equipment and containment materials must be available on site at all times. • Wetlands and associated buffer areas must be clearly demarcated as no-go areas for routine activities and emergency response access, as far as reasonably possible. • In the event of a blowout, the source of the release must be controlled as soon as safely possible and all contaminated areas must be contained, assessed and rehabilitated under specialist supervision. • Post-incident monitoring of affected wetland areas must be undertaken.				
ID: WetB13	Phase	Pre- Mitigat ion Signifi cance	Post- Mitigati on Signific ance	Final Signifi cance
Impact: An accidental major spill of fuel, hydrocarbons, lubricants, drilling additives or other hazardous substances during abnormal operations may result in contamination of wetland soils and water resources, loss of habitat quality, and impairment of wetland ecological processes.	Operati ons (Abnor mal or Unplann ed)	Mediu m to Low	Mediu m to Low	Mediu m to Low
Mitigation Measures				
• All fuels, oils, chemicals and hazardous substances must be stored in bunded and secured areas outside wetlands and their buffers, where possible. • Refuelling and chemical handling must only take place in designated, controlled areas. • Spill kits suitable for the volumes and substances handled on site must be available at all times. • Personnel must be trained in spill prevention, containment and clean-up procedures. • Any spill must be contained immediately, and contaminated material must be removed and disposed of at a suitably licensed facility. • Where wetland contamination has occurred, remediation must be undertaken under the guidance of a qualified specialist. • Impacted wetland areas must be monitored following clean-up.				
ID: WetB14	Phase	Pre- Mitigat ion Signifi cance	Post- Mitigati on Signific ance	Final Signifi cance

Impact: The accidental release of produced water, contaminated process water or drilling wastewater during abnormal operations could result in increased salinity and pollutant loading in wetland soils and surface water, adversely affecting vegetation, habitat quality and wetland functioning.	Operati ons (Abnor mal or Unplann ed)	Mediu m to High	Mediu m to Low	Mediu m to Low
Mitigation Measures				
- All produced water and contaminated water must be stored in lined, contained and appropriately bundled systems. - Storage tanks, pipes, valves and transfer systems must be inspected regularly for leaks or structural failure. - Emergency containment measures must be available for rapid deployment in the event of a release. - No discharge of contaminated water to wetlands, drainage lines or surrounding natural areas may be permitted. - In the event of a release, contaminated water must be recovered where possible and affected soils/water must be assessed. - Water and soil quality monitoring must be implemented following any incident. - Rehabilitation measures must be implemented in impacted wetland areas under specialist guidance.				
ID: WetB15	Phase	Pre- Mitigat ion Signifi cance	Post- Mitigati on Signific ance	Final Signifi cance
Impact: A fire or explosion associated with drilling or production infrastructure may result in direct damage to wetland vegetation and soils, while emergency response actions may cause secondary impacts through trampling, soil compaction, disturbance of wetland habitat and the release of firefighting agents.	Operati ons (Abnor mal or Unplann ed)	Mediu m to Low	Low	Mediu m to Low
Mitigation Measures				
- Fire prevention, detection and suppression systems must be installed and maintained. - Emergency response procedures must identify routes and methods that avoid wetlands and wetland buffers wherever possible. - Emergency personnel must be made aware of environmentally sensitive no-go areas. - Environmentally appropriate firefighting methods and suppression agents should be used where feasible. - Any temporary access created for emergency response must be minimised and rehabilitated immediately after the event. - A post-incident ecological assessment must be undertaken where wetland areas may have been affected.				
ID: WetB16	Phase	Pre- Mitigat ion Signifi cance	Post- Mitigati on Signific ance	Final Signifi cance
Impact: Failure of sewage, sanitation or waste management systems during drilling operations may result in the discharge of untreated effluent or waste materials into wetland areas, causing nutrient enrichment, contamination, odour impacts and a decline in habitat quality.	Operati ons (Abnor	Mediu m to High	Mediu m to Low	Mediu m to Low

	mal or Unplanned)			
Mitigation Measures				
- Sewage and sanitation facilities must be maintained in good working order and serviced regularly. - Waste storage areas must be secure, clearly designated and located outside wetlands and their buffers. - No waste disposal or temporary stockpiling may occur within wetland areas. - Emergency procedures must be in place to contain and clean up any sewage or waste release. - Any contaminated material must be removed promptly and disposed of at an authorised facility. - Affected wetland areas must be rehabilitated and monitored where contamination has occurred.				
ID: WetB17	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Failure of stormwater control or erosion management structures during extreme rainfall events may result in uncontrolled runoff, erosion, sediment deposition and transport of contaminants into wetlands, thereby altering hydrological functioning and reducing habitat quality.	Operations (Abnormal or Unplanned)	Medium to High	Medium to Low	Medium to Low
Mitigation Measures				
- Stormwater controls must be designed to accommodate high-intensity rainfall events. - Berms, drains, silt traps and other stormwater structures must be inspected and maintained regularly. - Disturbed areas must be stabilised as soon as possible to reduce erosion risk. - Emergency erosion and runoff control measures must be available for rapid deployment. - Following major rainfall events, wetland areas downstream of the site must be inspected for evidence of erosion, sedimentation or contamination. - Any erosion or sedimentation impacts must be rehabilitated promptly.				
ID: WetB18	Rehab and Closure	Medium to Low	Low	Low
Impact: Impaired water quality from hydrocarbon spills and leaks and associated contaminated runoff				
Mitigation Measures				
- Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall.				

- Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimize the potential for leakage and to prevent spillage onto the soil. - Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. - Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. - All debris and contaminated soils must be removed and suitably disposed of. - Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.				
ID: WetB19	Rehab and Closure	Medium to Low	Low	Low
Continued degradation of wetlands from improper post-exploration rehabilitation				
Mitigation Measures				
- Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities. - All debris and contaminated soils must be removed and suitably disposed of. - Contours and natural surrounding must be reformed. - All equipment, fencing and other infrastructure will be removed from site. - Natural drainage patterns must be restored. - The stockpiled topsoil must be returned to the surface of the reinstated areas. For topsoil's with highly enriched seedbanks, additional seeding may not be required, but this would need to be monitored over time. If necessary, seed from the surrounding areas should be used to augment the topsoil seedbank. - During and after rehabilitation, ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment. - All surface infrastructure on site must be removed upon completion of activities. - Temporary access routes/roads must be suitably rehabilitated. - Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved.				
ID: WetB20	Rehab and Closure	Low+	Low to Medium +	Medium to low +
Improvement in wetland functionality from successful rehabilitation				
Mitigation Measures				
- Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site. - Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities. - The stockpiled topsoil must be returned to the surface of the reinstated areas. For topsoil's with highly enriched seedbanks, additional seeding may not be required, but this would need to be monitored over time. If necessary, seed from the surrounding areas should be used to augment the topsoil seedbank. - During and after rehabilitation, ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment. - Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved.				
*Mitigation listed in red are new additional measures while those in black are mitigation measures which have been previously approved from similar activities within the same region undertaken by the same applicant.				

Table 4-4 *Summative results of the Impact Assessment conducted for the proposed activities in relation to excavations for gathering lines*

ID: WetC1	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Altered surface and shallow subsurface flow patterns from trench excavation, backfilling, and compaction, leading to erosion and sedimentation	Construction	Medium to High	Medium to Low	Medium to Low
- Align gathering lines to avoid wetlands and drainage features where possible, while where unavoidable, cross such features at the narrowest feasible point and as close to perpendicular to flow as practicable. - Minimise physical footprint of construction. Construction / exploration impacts associated with the proposed project must be contained within the footprint of the assessed areas. - No exploration / production activities are to be permitted within on wetlands or watercourses (32 m prelitigation and a 15 m post-mitigation buffer). - Soils in drilling areas where disturbances will be encountered must be stripped and stockpiled outside affected areas for use after completion of the drilling program. Topsoil must be adequately stripped to the correct depth and stored separately from subsoils. - Backfill trenches and remove excess spoil as soon as practicable. Re-profile disturbed areas to match surrounding contours and restore natural drainage patterns. - Minimise removal of vegetation as far as possible.				
Mitigation Measures				
ID: WetC2	Construction	Medium to High	Medium to Low	Medium to Low
Impact: Soil disturbance and compaction along the trench corridor leading to increased erosion and sedimentation risk				
- On-site vehicles must be limited to approved access routes and areas on the site so as to minimise excessive environmental disturbance to the soil and vegetation on site, and to minimise disruption of traffic (where relevant) - Compacting of soil must be avoided as far as possible, and the use of heavy machinery must be restricted in areas outside of the proposed exploration sites to reduce the compaction of soils. - No exploration / production activities are to be permitted within on wetlands or watercourses (32 m prelitigation and a 15 m post-mitigation buffer). - Areas rated as High sensitivity outside of the direct construction / exploration areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery - Minimise physical footprint of construction.				
Mitigation Measures				
ID: WetC3	Construction	Medium to High	Medium to Low	Medium to Low
Impact: Disturbance to wetland vegetation and soils within the pipeline corridor leading to habitat degradation and proliferation of alien invasive plants				
- Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site. - No exploration / production activities are to be permitted within on wetlands or watercourses (32 m prelitigation and a 15 m post-mitigation buffer). - Ongoing identification of risks and impacts. - Areas outside the direct project footprint, should under no circumstances be disturbed. - Areas rated as High sensitivity outside of the direct construction / exploration areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery.				
Mitigation Measures				
ID: WetC4	Construction			

Impact: Impaired water quality from sediment-laden runoff, trench water, and contaminated runoff associated with construction activities			Medium to High	Medium to Low	Medium to Low
- Prevent trench water from discharging directly into wetlands, drainage lines, or other watercourses. - Pump or decant trench water to stable, vegetated upland areas only where sediment can settle and no runoff to wetlands will occur. - Backfill trenches and remove excess spoil as soon as practicable. Re-profile disturbed areas to match surrounding contours and restore natural drainage patterns. - Minimise removal of vegetation as far as possible. - No exploration / production activities are to be permitted within on wetlands or watercourses (32 m prelitigation and a 15 m post-mitigation buffer). - Minimise physical footprint of construction. Construction / exploration impacts associated with the proposed project must be contained within the footprint of the assessed areas.					
Mitigation Measures					
ID: WetC5		Construction	Medium to High	Medium to Low	Medium to Low
Impact: Impaired water quality from accidental spills and leaks of fuels, oils, and other hazardous substances associated with machinery and construction activities					
- Designate refuelling and maintenance areas at least 50 m from wetlands and watercourses. - Keep spill kits (absorbent pads, booms, disposal bags) at trenching work fronts and train staff in their use. - Develop and implement a site-specific spill response plan; immediately remediate any spills and remove contaminated soil for proper disposal. - Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. - Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. - Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. - Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. - Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.					
Mitigation Measures					
ID: WetC6		Construction	Medium to High	Medium to Low	Medium to Low
Impact: Temporary obstruction or diversion of overland flow due to topsoil stripping, spoil stockpiling, and placement of construction materials					
- Place topsoil, spoil, and construction material stockpiles outside wetlands, drainage lines, and natural flow paths. - Keep stockpiles to the minimum required size and duration, and stabilise them where erosion risk is evident. - Do not place excavated material on the downslope side of wetlands or drainage features where it may obstruct or redirect flow. - Inspect stockpile and trench areas regularly, especially after rainfall, and correct any flow diversion or erosion immediately. - Minimise physical footprint of construction. Construction / exploration impacts associated with the proposed project must be contained within the footprint of the assessed areas.					

- No seismic activities nor drilling activities are to be permitted within on wetlands or watercourses (32 m prelitigation and a 15 m post-mitigation buffer). - Soils in drilling areas where disturbances will be encountered must be stripped and stockpiled outside affected areas for use after completion of the drilling program. Topsoil must be adequately stripped to the correct depth and stored separately from subsoils - Backfill trenches and remove excess spoil as soon as practicable. Re-profile disturbed areas to match surrounding contours and restore natural drainage patterns. - Natural drainage patterns must be restored.				
Mitigation Measures				
ID: WetC7	Construction (unplanned)	Medium to Low	Medium to Low	Medium to Low
Impact: Altered surface and shallow subsurface flow patterns from poorly managed trenching, collapse, or storm-related failure of trench sections leading to erosion and sedimentation				
- Immediately halt work in the event of unplanned disturbance and assess the extent of impact. - Install temporary berms, silt socks, or other controls to prevent further runoff and sediment transport. - Monitor the affected area for signs of altered flow, trench instability, or erosion and implement additional controls if needed. - Minimise physical footprint of construction. Construction / exploration impacts associated with the proposed project must be contained within the footprint of the assessed areas. - Backfill trenches and remove excess spoil as soon as practicable. Re-profile disturbed areas to match surrounding contours and restore natural drainage patterns.				
Mitigation Measures				
ID: WetC8	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Severe erosion and sedimentation resulting from intense rainfall on open trenches, exposed soils, and stockpiles	Construction (unplanned)	Medium to Low	Medium to Low	Medium to Low
- Monitor weather forecasts and avoid opening trench sections where heavy rainfall is forecast. - Stabilise exposed soils and stockpiles using mulch, brush packing, sheeting, or similar temporary measures where heavy rainfall risk exists. - Install temporary sediment barriers downslope of exposed trenching areas and stockpiles. - Inspect all affected areas after rainfall and repair erosion, sediment controls, and disturbed surfaces immediately. - Minimise removal of vegetation as far as possible. - Minimise physical footprint of construction. Construction / exploration impacts associated with the proposed project must be contained within the footprint of the assessed areas. - Backfill trenches and remove excess spoil as soon as practicable. Re-profile disturbed areas to match surrounding contours and restore natural drainage patterns.				
Mitigation Measures				
ID: WetC9	Construction (unplanned)	Medium to Low	Medium to Low	Medium to Low
Impact: Disturbance to wetland vegetation and soils leading to accelerated alien invasive plant establishment following failed rehabilitation or excessive disturbance				
- Immediately remove and properly dispose of any invasive plant material found in the disturbed area. - Re-seed or plant with locally sourced indigenous wetland species if natural recovery is slow. - Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site - Ongoing identification of risks and impacts.				
Mitigation Measures				
ID: WetC10	Construction			

Impact: Significant water quality deterioration from major hydrocarbon spills, chemical leaks, or contaminated runoff entering wetlands or drainage features	(unplanned)	Medium Low	to	Medium to Low	Medium to Low
- Stop all work and contain the spill using absorbent materials and booms. - Prevent spilled material or contaminated runoff from entering wetlands, drainage lines, or trench water. - Undertake confirmatory inspection of the affected area after cleanup. - Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. - Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimize the potential for leakage and to prevent spillage onto the soil. - Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. - Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. - Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.					
Mitigation Measures					
ID: WetC11	Operation	Low	Low	Low	
Impact: Altered overland flow and localised erosion at poorly reinstated pipeline crossings and maintenance access points					
- Inspect pipeline crossings and maintenance access points regularly for signs of erosion, rutting, settlement, or altered flow. - Re-profile and stabilise any eroded or poorly reinstated areas as soon as practicable. - Restrict maintenance access to approved routes only. - Implement follow-up rehabilitation where reinstated areas show signs of persistent instability. - Natural drainage patterns must be restored. - Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved.					
Mitigation Measures					
ID: WetC12	Operation	Low	Low	Low	
Impact: Disturbance to wetland-edge vegetation from routine maintenance access and associated proliferation of alien invasive plant species					
- Restrict maintenance activities to designated access routes and approved working areas. - Minimise vegetation disturbance during maintenance activities. - Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site. - Ongoing identification of risks and impacts.					
Mitigation Measures					

ID: WetC13		Operation (unplanned)	Low	Low	Low
Impact: Impaired water quality from accidental pipeline leakage or maintenance-related hydrocarbon contamination					
- Inspect pipeline infrastructure and maintenance equipment regularly for signs of leaks or failure. - Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. - Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimize the potential for leakage and to prevent spillage onto the soil. - Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. - Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. - Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.					
Mitigation Measures					
ID: WetC14		Rehab and Closure	Medium Low	Medium to Low	Medium to Low
Impact: Persistent erosion, altered drainage, and water quality impairment resulting from inadequate rehabilitation of the trench corridor and disturbed wetland crossings					
- Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities. - All debris and contaminated soils must be removed and suitably disposed of. - Contours and natural surrounding must be reformed. - All equipment, fencing and other infrastructure will be removed from site. - Natural drainage patterns must be restored. - The stockpiled topsoil will be returned to the surface of the reinstated areas. For topsoil's with highly enriched seedbanks, additional seeding may not be required, but this would need to be monitored over time. If necessary, seed from the surrounding areas should be used to augment the topsoil seedbank. - During and after rehabilitation ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment. - Temporary access routes/roads must be suitably rehabilitated. - Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved.					
Mitigation Measures					
ID: WetC15		Rehab and Closure	Medium to Low	Medium to Low	Medium to Low
Impact: Continued proliferation of alien invasive plants and reduced wetland habitat quality due to failed revegetation of disturbed gathering line servitudes					
Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site.					

- Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities. - The stockpiled topsoil will be returned to the surface of the reinstated areas. For topsoil's with highly enriched seedbanks, additional seeding may not be required, but this would need to be monitored over time. If necessary, seed from the surrounding areas should be used to augment the topsoil seedbank. - During and after rehabilitation ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment. - Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved.				
Mitigation Measures				
ID: WetC16	Rehab and Closure	Low+	Low to Medium +	Medium to low +
Improvement in wetland functionality from successful rehabilitation - Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site. - Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities. - The stockpiled topsoil will be returned to the surface of the reinstated areas. For topsoil's with highly enriched seedbanks, additional seeding may not be required, but this would need to be monitored over time. If necessary, seed from the surrounding areas should be used to augment the topsoil seedbank. - During and after rehabilitation ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment. - Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved.				
<i>*Mitigation listed in red are new additional measures while those in black are mitigation measures which have been previously approved from similar activities within the same region undertaken by the same applicant.</i>				

Table 4-5 **Summative results of the Impact Assessment conducted for the proposed activities in relation to Gas Plant**

ID: WetD1	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Site clearance, earthworks and establishment of the Gas Plant footprint may result in the loss of native vegetation, soil disturbance, erosion, sediment mobilisation and indirect impacts to nearby wetlands and drainage features.	Construction	Medium to High	Medium to Low	Medium to Low
Mitigation Measures				
- Minimise removal of vegetation as far as possible. - Minimise physical footprint of construction. Construction / exploration impacts associated with the proposed project must be contained within the footprint of the assessed areas. - Areas outside the direct project footprint, should under no circumstances be disturbed. - Areas rated as High sensitivity outside of the direct construction / exploration areas should be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery. <i>The Gas Plant footprint must be positioned outside wetlands and, where possible, outside recommended wetland buffers.</i> <i>Topsoil must be stripped and stockpiled appropriately for use during rehabilitation.</i> <i>Stormwater and erosion control measures must be implemented prior to and during construction.</i>				
ID: WetD2	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance

Impact: Storage and handling of fuels, oils, chemicals and construction materials may result in impaired water quality due to contaminated runoff, accidental spills or leaks reaching nearby wetlands and drainage features.		Construction	Medium High to	Low	Low
Mitigation Measures					
- Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. - All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. - Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. - Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. - Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. - Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility. - Dirty water generated within the plant footprint must be contained and managed appropriately.					
ID: WetD3		Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Routine operation of the Gas Plant may result in altered runoff patterns, increased stormwater volumes, localised erosion, and contaminated runoff from hardened surfaces, reducing the quality of adjacent freshwater habitat.		Operation	Medium to Low	Low	Low
Mitigation Measures					
- All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Stormwater systems must be designed to separate clean and dirty water and to prevent discharge to wetlands. - Hard surfaces must be graded and drained appropriately. - Stormwater infrastructure must be inspected and maintained regularly. - Runoff from potentially contaminated areas must be captured and managed before release. - Erosion-prone areas must be stabilised and rehabilitated promptly.					
ID: WetD4		Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Routine maintenance activities, vehicle movement and disturbance within and around the Gas Plant may result in vegetation disturbance, soil compaction and the establishment or spread of alien invasive plant species in adjacent disturbed areas.		Operation	Medium to Low	Low	Low
Mitigation Measures					
Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site.					

• Ongoing identification of risks and impacts. • Areas outside the direct project footprint, should under no circumstances be disturbed. • Disturbed areas not required for ongoing operations should be stabilised and revegetated where feasible. • Alien invasive plant monitoring and control must be implemented within and around the gas plant footprint.				
ID: WetD5	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: A major release of hydrocarbons, condensate, chemicals or other hazardous substances at the Gas Plant or associated production infrastructure could result in contamination of nearby wetlands through runoff, infiltration or accidental discharge, thereby reducing water quality and habitat condition.	Operation (Unplanned)	Medium to High	Medium to Low	Medium to Low
Mitigation Measures				
• Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it. • Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility. • All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. • Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. • Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. • Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. • Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilised. • Accidental hydrocarbon spillages must be reported immediately to the ECO and DWS, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility. • Surface runoff from operational areas must be managed to prevent discharge into wetlands. • Any release must be contained, recovered and cleaned up immediately. • Contaminated soils or other materials must be removed and disposed of lawfully. • Wetland monitoring must be undertaken where contamination risk to nearby wetlands exists.				
ID: WetD6	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Failure of produced water or process water containment systems could result in discharge of contaminated water to surrounding wetland areas, causing salinisation, chemical contamination and impairment of wetland ecological functioning.	Operation (Unplanned)	Medium to High	Medium to Low	Medium to Low
Mitigation Measures				
• All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. • Emergency containment measures must be available for rapid deployment in the event of a release. • Contaminated runoff must be intercepted and prevented from entering wetlands or drainage features.				

- Any contaminated material must be removed and disposed of lawfully. - Affected areas must be inspected and rehabilitated as required.				
ID: WetD7	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: A fire or explosion at the Gas Plant may result in direct damage to adjacent habitat and secondary wetland impacts through contaminated runoff, firefighting activities and emergency access disturbance.	Operation (Unplanned)	Medium to High	Medium to Low	Medium to Low
Mitigation Measures				
- All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Fire detection, suppression and emergency shutdown systems must be installed and maintained. - Incident response planning must incorporate wetland sensitivity constraints. - Emergency access and staging areas must be planned to avoid wetland areas wherever feasible. - Firefighting runoff must be contained where possible to prevent transport to wetlands. - Any wetland areas affected by fire, runoff or response actions must be rehabilitated and monitored.				
ID: WetD8	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Failure of sewage, sanitation or waste handling infrastructure at the Gas Plant or associated support facilities may lead to the release of untreated effluent or waste into nearby wetland systems, causing contamination and habitat degradation.	Operation (Unplanned)	Medium	Low	Low
Mitigation Measures				
- All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill. - Sewage and waste systems must be maintained and serviced regularly. - Waste storage must occur in secure designated areas outside wetlands and buffers. - Emergency response procedures must be implemented for any system failure. - Released waste or effluent must be contained and removed immediately. - Contaminated wetland areas must be rehabilitated and monitored where necessary.				
ID: WetD9	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Failure of stormwater management infrastructure at the Gas Plant during abnormal rainfall or operational upset conditions may cause sediment-laden or contaminated runoff to enter wetlands, resulting in reduced water quality and altered wetland functioning.	Operation (Unplanned)	Medium to High	Low	Low
Mitigation Measures				
- Stormwater infrastructure must be designed for extreme rainfall and upset conditions. - Clean and dirty water systems must be separated and maintained. - All stormwater controls must be inspected regularly and repaired as necessary. - Emergency containment measures must be implemented where failure occurs.				

- Wetlands downstream of the facility must be inspected after major incidents or storm events. - Any sedimentation or contamination impacts must be rehabilitated promptly.				
ID: WetD10	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Inadequate rehabilitation and closure of the Gas Plant footprint may result in persistent erosion, altered runoff patterns, establishment of alien invasive species and reduced recovery of freshwater-sensitive habitat.	Rehab and Closure	Medium to Low	Low	Low
Mitigation Measures				
- Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities. - All debris and contaminated soils must be removed and suitably disposed of. - Contours and natural surrounding must be reformed. - All equipment, fencing and other infrastructure will be removed from site. - Natural drainage patterns must be restored. - The stockpiled topsoil will be returned to the surface of the reinstated areas. - All infrastructure must be removed where required at closure. - Disturbed areas must be ripped, re-profiled and returned as close as possible to pre-disturbance contours. - Topsoil must be replaced and disturbed areas revegetated. - Alien invasive species control must continue until rehabilitation success criteria are met. - Post-closure monitoring must be undertaken to confirm recovery and identify any remedial actions required.				
ID: WetD11	Phase	Pre-Mitigation Significance	Post-Mitigation Significance	Final Significance
Impact: Successful rehabilitation of the Gas Plant footprint and associated disturbed areas may improve local habitat condition and support the recovery of freshwater ecosystem functioning over the longer term.	Rehab and Closure	Low	Low	Low
Mitigation Measures				
- Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site. - Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to its pre-disturbed state as defined in the pre-drill survey. Disturbed areas must be rehabilitated to support its post-closure land use, and this must be undertaken within six (6) months post drilling activities. - The stockpiled topsoil will be returned to the surface of the reinstated areas. - During and after rehabilitation ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment. - Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved. - Rehabilitation success must be monitored and adaptive management applied where recovery is inadequate.				
*Mitigation listed in red are new additional measures while those in black are mitigation measures which have been previously approved from similar activities within the same region undertaken by the same applicant.				

4.3 Impact Management Outcomes

The following tables set out the proposed mitigation and impact management measures for the wetland features associated with the seismic transect, proposed well locations, and gathering lines, including responsibilities, monitoring requirements and performance indicators.

The mitigation approach prioritises avoiding traversing all delineated wetlands and buffers, where, feasible and, where crossings cannot be avoided, using designated, pre-approved existing crossing points only to traverse the watercourse areas.

Table 4-6 Impact Management Measures and Outcomes

Main Activity	ID	Mitigation / Management Measure	Phase	Responsible Party for Implementation	Monitoring (Frequency)	Monitoring Responsibility	Target (Outcome)	Performance Indicators (Monitoring Tool)
Seismic Transect Survey	WetA1	As indicated in Table 4-2 to 4-4.	Construction	Contractor (Site Supervisor)	Daily during works	ECO/Environmental Officer (Weekly)	No new erosion or sedimentation in wetlands	Site inspection reports, photographic records
	WetA2		Construction	Contractor (Site Supervisor)	Daily during works	ECO/Environmental Officer (Weekly)	No visible soil compaction or erosion	Site inspection reports, photographic records
	WetA3		Construction	Contractor (Site Supervisor)	Ongoing during works	ECO/Environmental Officer (Monthly)	No increase in invasive species; native vegetation recovery	Vegetation surveys, invasive species logs
	WetA4		Construction	Contractor (Site Supervisor)	Ongoing during works	ECO/Environmental Officer (Weekly)	No hydrocarbon spills in wetlands	Spill incident logs, water quality tests
	WetA5		Rehab & Closure	Contractor (Site Supervisor)	During rehabilitation	ECO/Environmental Officer (Weekly)	No hydrocarbon contamination during rehab	Spill logs, water quality monitoring
	WetA6		Rehab & Closure	Contractor (Site Supervisor)	Bi-annually	ECO/Environmental Officer (Quarterly)	Full wetland recovery, no ongoing degradation	Rehabilitation inspection reports
	WetA7		Rehab & Closure	Contractor (Site Supervisor)	Bi-annually	Wetland Specialist (Quarterly)	Improved wetland functionality	Vegetation cover, soil stability, water quality data
Drilling Wells	WetB1		Construction	Contractor (Site Supervisor)	Daily during works	ECO/Environmental Officer (Weekly)	No new erosion or sedimentation	Site inspection reports
	WetB2		Construction	Contractor (Site Supervisor)	Daily during works	ECO/Environmental Officer (Weekly)	No soil compaction or erosion	Inspection checklists, erosion monitoring
	WetB3		Construction	Contractor (Site Supervisor)	Ongoing during works	ECO/Environmental Officer (Monthly)	No increase in invasive species	Vegetation/invasive species surveys

WetB4	Construction	Contractor (Site Supervisor)	Ongoing during works	ECO/Environmental Officer (Weekly)	No hydrocarbon spills	Spill logs, water quality tests
WetB5	Construction (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No further erosion or sedimentation	Incident reports, site inspections
WetB6	Construction (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No ongoing compaction or erosion	Inspection reports
WetB7	Construction (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No invasive species proliferation	Invasive species logs, inspection reports
WetB8	Construction (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No hydrocarbon contamination	Spill logs, water quality tests
WetB9	Operations	Contractor (Site Supervisor)	Routine	ECO/Environmental Officer	No hydrocarbon contamination during operations	Water quality monitoring, inspection reports
WetB10	Operations	Contractor (Site Supervisor)	Routine	ECO/Environmental Officer	No ongoing compaction or erosion	Inspection reports
WetB11	Operations	Contractor (Site Supervisor)	Routine	ECO/Environmental Officer	No invasive species proliferation	Invasive species logs, inspection reports
WetB12	Operations (Abnormal/Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No blowout or major hydrocarbon release	Incident reports, water quality monitoring
WetB13	Operations (Abnormal/Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No major spill or hazardous substance contamination	Spill logs, water quality tests
WetB14	Operations (Abnormal/Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No produced/process water release	Water/soil quality monitoring, incident reports
WetB15	Operations (Abnormal/Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No fire/explosion impacts on wetlands	Incident reports, post-incident ecological assessment
WetB16	Operations (Abnormal/Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No sewage/waste system failure impacts	Incident reports, water quality monitoring
WetB17	Operations (Abnormal/Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No stormwater/erosion structure failure impacts	Inspection reports, water quality monitoring
WetB18	Rehab and Closure	Contractor (Site Supervisor)	During rehabilitation	ECO/Environmental Officer (Weekly)	No hydrocarbon contamination during rehabilitation	Water quality monitoring, inspection reports
WetB19	Rehab and Closure	Contractor (Site Supervisor)	Bi-annually	Wetland Specialist (Quarterly)	Full wetland recovery	Rehabilitation inspection reports

	WetB20		Rehab and Closure	Contractor (Site Supervisor)	Bi-annually	Wetland Specialist (Quarterly)	Improved wetland functionality	Vegetation cover, soil stability, water quality data
	WetC1		Construction	Contractor (Site Supervisor)	Daily during works	ECO/Environmental Officer (Weekly)	No altered surface or shallow subsurface flow causing erosion or sedimentation in wetlands	Site inspection reports, photographic records
	WetC2		Construction	Contractor (Site Supervisor)	Daily during works	ECO/Environmental Officer (Weekly)	No visible soil disturbance, compaction, or erosion along trench corridor	Site inspection reports, photographic records
	WetC3		Construction	Contractor (Site Supervisor)	Ongoing during works	ECO/Environmental Officer (Monthly)	No increase in invasive species; native vegetation recovery	Vegetation surveys, invasive species logs
	WetC4		Construction	Contractor (Site Supervisor)	Ongoing during works	ECO/Environmental Officer (Weekly)	No sediment-laden runoff, trench water discharge, or contaminated runoff entering wetlands	Water quality monitoring, site inspection reports
	WetC5		Construction	Contractor (Site Supervisor)	Ongoing during works	ECO/Environmental Officer (Weekly)	No hydrocarbon spills or hazardous substance contamination in wetlands	Spill incident logs, water quality tests
	WetC6		Construction	Contractor (Site Supervisor)	Daily during works	ECO/Environmental Officer (Weekly)	No obstruction or diversion of overland flow by spoil stockpiles or construction materials	Site inspection reports, photographic records
	WetC7		Construction (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No further altered flow, trench instability, erosion, or sedimentation	Incident reports, site inspections
	WetC8		Construction (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No severe erosion or sedimentation from	Incident reports, site inspections

Gathering Lines

As indicated in Table 4-2 to 4-5.

						exposed trenches, soils, or stockpiles	
	WetC9	Construction (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No accelerated invasive species establishment or wetland vegetation degradation	Invasive species logs, inspection reports
	WetC10	Construction (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No hydrocarbon or chemical contamination of wetlands or drainage features	Spill logs, water quality tests
	WetC11	Operation	Contractor (Site Supervisor)	Quarterly	ECO/Environmental Officer (Quarterly)	No altered overland flow or localised erosion at reinstated crossings or maintenance access points	Inspection checklists, photographic records
	WetC12	Operation	Contractor (Site Supervisor)	Quarterly	ECO/Environmental Officer (Quarterly)	No increase in invasive species or wetland-edge vegetation disturbance along maintenance access routes	Vegetation/invasive species surveys
	WetC13	Operation (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No pipeline leakage or hydrocarbon contamination of wetlands or drainage features	Spill logs, water quality tests
	WetC14	Rehab & Closure	Contractor (Site Supervisor)	During rehabilitation	ECO/Environmental Officer (Weekly)	No persistent erosion, altered drainage, or water quality impairment at rehabilitated trench corridors and wetland crossings	Rehabilitation inspection reports, water quality monitoring
	WetC15	Rehab & Closure	Contractor (Site Supervisor)	Bi-annually	Wetland Specialist (Quarterly)	No ongoing invasive species proliferation; restored wetland habitat quality	Vegetation cover surveys, invasive species logs, rehabilitation inspection reports

Gas Plant	WetC16	Rehab & Closure	Contractor (Site Supervisor)	Bi-annually	Wetland Specialist (Quarterly)	Improved wetland functionality	Vegetation cover, soil stability, water quality data
	WetD1	Construction	Contractor (Site Supervisor)	Daily during works	ECO/Environmental Officer (Weekly)	No new erosion or sedimentation in wetlands	Site inspection reports, photographic records
	WetD2	Construction	Contractor (Site Supervisor)	Ongoing during works	ECO/Environmental Officer (Weekly)	No hydrocarbon spills in wetlands	Spill incident logs, water quality tests
	WetD3	Operation	Contractor (Site Supervisor)	Routine	ECO/Environmental Officer	No altered runoff or erosion from plant operations	Inspection reports, water quality monitoring
	WetD4	Operation	Contractor (Site Supervisor)	Routine	ECO/Environmental Officer	No invasive species proliferation	Invasive species logs, inspection reports
	WetD5	Operation (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No major hydrocarbon/chemical release impacts on wetlands	Spill logs, water quality tests, incident reports
	WetD6	Operation (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No produced/process water containment failure impacts	Water/soil quality monitoring, incident reports
	WetD7	Operation (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No fire/explosion impacts on wetlands	Incident reports, post-incident ecological assessment
	WetD8	Operation (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No sewage/waste system failure impacts	Incident reports, water quality monitoring
	WetD9	Operation (Unplanned)	Contractor (Site Supervisor)	As needed	ECO/Environmental Officer (After incident)	No stormwater management failure impacts	Inspection reports, water quality monitoring
	WetD10	Rehab and Closure	Contractor (Site Supervisor)	During rehabilitation	ECO/Environmental Officer (Weekly)	No persistent erosion, altered runoff, or invasive species post-closure	Rehabilitation inspection reports, water quality monitoring
	WetD11	Rehab and Closure	Contractor (Site Supervisor)	Bi-annually	Wetland Specialist (Quarterly)	Improved wetland functionality	Vegetation cover, soil stability, water quality data

4.4 Recommendations

It is recommended that the proposed development be designed to avoid the identified wetlands and their associated buffers.

Should the above not be feasible, strict implementation of the mitigation measures compiled within this report must be enacted. Any activity occurring within a delineated wetland, riparian area or its regulated buffer will need to be supported by a relevant rehabilitation plan. Such a plan will be essential to remedy impacts arising from unavoidable encroachment into these sensitive systems and must be implemented under the supervision of a suitably qualified Environmental Control Officer.

It is further recommended that should the project be authorised and proceed with the current layout, all construction activities within the wetlands must be overseen by an Environmental Control Officer or suitably qualified wetland specialist to ensure no further impact results on the wetlands apart from what is expected (disturbance to a portion of the wetlands).

5 Conclusion

Within the Project Area of Influence (PAOI), a diverse suite of Hydrogeomorphic (HGM) wetland units were delineated during the field and desktop assessment, comprising channelled valley-bottom, unchannelled valley-bottom, seep, depression and floodplain wetland systems, together with associated drainage features. A number of artificial or highly modified water features also occur within the PAOI; however, these are dependent on induced drivers and were not considered to represent natural wetland systems for sensitivity and risk assessment purposes.

Based on the specialist assessment and the spatial relationship between the identified freshwater features and the proposed development components, many of the natural wetlands and riverine features within the PAOI are considered sensitive to disturbance due to their ecological importance, hydrological connectivity and the nature of the proposed activities. The National Environmental Screening Tool identified numerous wetland and river areas as having Very High aquatic biodiversity sensitivity, and this was largely confirmed through the field verification process, with most natural systems assigned Medium to High sensitivity, while artificial features and heavily modified drainage lines were assigned lower sensitivities.

Despite existing anthropogenic pressures within the broader landscape, the assessed wetland systems continue to provide important ecological functions and ecosystem services. The Present Ecological State (PES) of the wetlands ranges from moderately to largely modified, while the Ecological Importance and Sensitivity (EIS) results indicate that these systems retain meaningful ecological and hydrological value. The ecological management objective is therefore to avoid further degradation of these systems as far as possible, while maintaining their functional integrity and associated ecosystem service provision.

The quantitative risk and impact assessment indicates that, with the implementation of the recommended avoidance, mitigation and rehabilitation measures, the majority of impacts associated with the proposed seismic surveys, drilling infrastructure and gathering lines can be reduced to Low or Medium-Low significance. Where wetlands and their associated buffers can be avoided, residual impacts are expected to remain low. Where complete avoidance is not possible, Moderate residual risks may persist, particularly in relation to hydrological alteration, erosion and sedimentation, localised habitat disturbance, and accidental contamination events. As such, layout refinement and the avoidance of delineated wetlands and associated buffers remain the most effective means of reducing freshwater-related risk.

5.1 Risk and Impact Statement

A quantitative risk assessment was undertaken in accordance with the relevant freshwater impact assessment approach for activities associated with the construction, operation and decommissioning phases of the proposed development. Under a conservative assumption that some freshwater features and/or associated buffers may not be fully avoided, the post-mitigation risk profile is dominated by Low to Moderate risks. These risks are primarily driven by:

- Potential disturbance to natural hydrological flow paths;
- Erosion and sedimentation resulting from vegetation clearing, vehicle movement and infrastructure installation;
- Episodic water quality impacts associated with hydrocarbon leaks, spills or contaminated runoff, and;
- Disturbance to wetland habitat and associated ecological functioning.

Where avoidance measures, buffer restrictions, rehabilitation requirements and construction controls are fully implemented, residual risks are expected to reduce to Low for most activities and freshwater features, with Moderate risks potentially persisting only in more sensitive or hydrologically connected systems where disturbance cannot be entirely avoided.

5.2 Specialist Opinion

The Motuoane Production Right Application is situated within a landscape containing numerous natural wetland systems and associated freshwater features that remain functionally important despite ongoing catchment-level pressures. The assessment has shown that these systems retain ecological value and continue to provide relevant ecosystem services, and that the proposed development is not considered to present a fatal flaw from a freshwater perspective, provided that strict avoidance and mitigation principles are applied.

In the specialist's opinion, the project may be favourably considered for authorisation from a freshwater ecological perspective, provided that:

- The final layout if possible, should be refined to avoid delineated wetlands, riverine features and associated buffers as far as reasonably practicable, with preference given to the avoidance of higher sensitivity and more hydrologically connected systems;
- Any unavoidable wetland or drainage crossings are appropriately designed and implemented to maintain hydrological and ecological functioning;
- All recommended mitigation, rehabilitation and monitoring measures contained in this report are strictly implemented for the duration of the project;
- Erosion, sedimentation, stormwater and spill prevention controls are effectively implemented and maintained; and
- All works within or adjacent to freshwater features are undertaken under the supervision of a suitably qualified Environmental Control Officer and/or freshwater specialist, with monitoring undertaken to support adaptive management where required.

6 References

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7 Appendix Items

7.1 Appendix A – Methodology

7.1.1 Desktop Dataset Assessment

The desktop assessment was undertaken using Geographic Information System (GIS) to access, view and overlay the latest available related datasets with the project area. The information represented within the datasets was used to develop the relevant digital maps used to identify potentially environmentally sensitive areas. These datasets and their respective dates of publishing are provided below:

- Vegetation Types - Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018 & Mucina and Rutherford 2006);
- Soils and Geology - Land Types Database (Land Type Survey Staff, 1972 - 2006); and
- Topographical Inland Water Areas and River Lines (based on the 1994 1:500 000 topographic maps as per the Chief Directorate of the National Geo-spatial Information).

7.1.1.1 Vegetation Types - Vegetation Map of South Africa, Lesotho and Swaziland

The Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018) is the latest and updated version of the maps published in earlier time such as those presented by Mucina and Rutherford (2006) and those presented in the National Biodiversity Assessment (2011). The map provides spatial details on the representative vegetation of South Africa and is complemented in this report using information from Strelitzia (Mucina & Rutherford, 2006) to provide insight on the landscape features, biogeography, climate, geology, and soils of the project area.

7.1.1.2 Soils and Geology - Land Type Database

The Land Type Survey provides information on the soils, terrain, climate, and geology of areas within South Africa. The data includes the pedological classification of soils and is used in this report to provide insight on the common soil forms associated with aquatic or freshwater systems of a particular area.

7.1.1.3 Topographical River Lines and Inland Water Areas

Topographical Inland Water Areas and River Lines for South Africa are based on the topographic maps dated 1994 as per the National Geo-spatial Information. These datasets are used in this report to provide insight on potential wetland areas and serves to highlight the location and extent of drainage features, dams, wetlands, reservoirs and other relevant inland waterbodies.

7.1.1.4 Ecologically Important Landscape Features

The datasets listed below were incorporated to establish the relation between the project and ecologically important or sensitive freshwater entities. Emphasis was placed around the following spatial datasets:

- South African Inventory of Inland Aquatic Ecosystems (SAIIAE), NBA 2018 Rivers and Wetlands (Van Deventer *et al.*, 2019);
- National Freshwater Priority Areas, Rivers and Wetlands, 2011 (Nel *et al.*, 2011); and
- Strategic Water Source Areas, 2021 (Lötter & Le Maitre, 2021).

7.1.1.4.1 The South African Inventory of Inland Aquatic Ecosystems

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was established during the 2018 NBA, the SAIIAE is a collection of spatial data layers that represent the extent of river and inland wetland ecosystem types as well as the pressures on these systems. The same two headline indicators, and their associated categorisations, are applied as with the terrestrial ecosystem NBA, namely Ecosystem Threat Status and Ecosystem Protection Level. The Ecosystem Threat Status of river and wetland ecosystem types are based on the extent to which each ecosystem type had been altered from its natural condition.

7.1.1.4.2 National Freshwater Ecosystem Priority Areas, Rivers and Wetlands

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its inland aquatic systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs). The FEPAs are intended to be conservation support tools and it is envisioned that they will guide the effective implementation of measures to achieve the National Environment Management: Biodiversity Act's biodiversity conservation goals (Nel *et al.*, 2011).

7.1.1.4.3 Strategic Water Source Areas

SWSAs are defined as areas of land that supply a disproportionate quantity of mean annual surface water runoff in relation to their size, and therefore contribute considerably to the overall water supply of the country, as well as national aquatic and terrestrial biodiversity resources. These are considered key ecological infrastructure assets and the effective protection of SWSAs is vital for national security because a lack of water security will compromise national security and human wellbeing on all levels.

7.1.2 Wetland Field Survey

7.1.2.1 Identification and Mapping

The wetland areas were delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 7-1. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
- The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

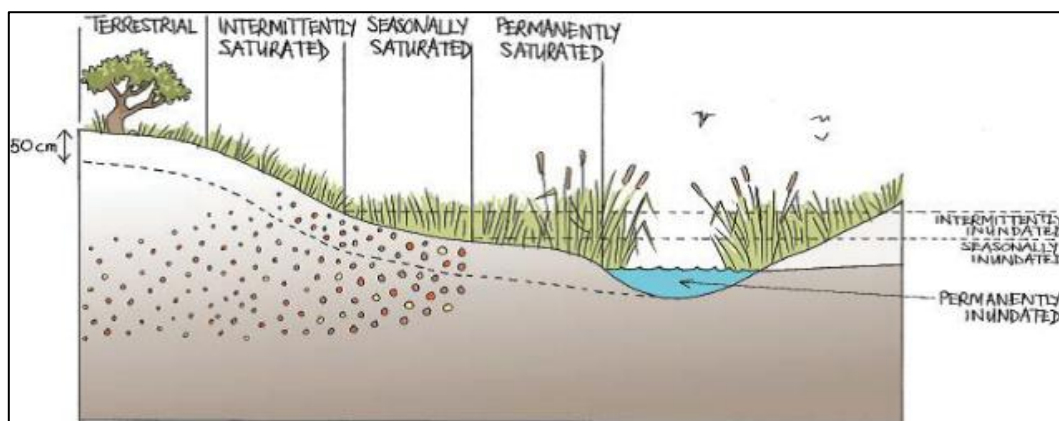


Figure 7-1 Cross section of a wetland, indicating how the soil wetness and vegetation indicators respond to changes in topography (Ollis *et al.* 2013)

7.1.2.2 Delineation

The wetland indicators described above are used to determine the boundaries of the wetlands within the project area. These delineations are then illustrated by means of maps accompanied by descriptions.

7.1.2.3 Classification and Description

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and then also includes structural features at the lower levels of classification (Ollis *et al.*, 2013).

7.1.3 Wetland Functional and Ecological Assessment

7.1.3.1 Functional Assessment

Wetland Functionality refers to the ability of wetlands to provide healthy conditions for the wide variety of organisms found in wetlands as well as humans. Ecosystem Services serve as the main factor contributing to wetland functionality.

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (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 services are provided (Table 7-1).

Table 7-1 Classes for determining the likely extent to which a benefit is being supplied

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

7.1.3.2 Present Ecological Status

The overall approach as described by Macfarlane *et al.*, 2009, is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual

activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 7-2.

Table 7-2 The Present Ecological Status categories (Macfarlane et al., 2009)

Impact Category	Description	Impact Score Range	PES Score (%)	PES
None	Unmodified, natural	0 to 0.9	90-100	A
Small	Largely Natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1.0 to 1.9	80-89	B
Moderate	Moderately Modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2.0 to 3.9	60-79	C
Large	Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.0 to 5.9	40-59	D
Serious	Seriously Modified. The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	6.0 to 7.9	20-39	E
Critical	Critically Modified. The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8.0 to 10	0-19	F

7.1.3.3 Ecological Importance and Sensitivity

The importance and sensitivity of water resources is determined in order to establish resources that provide higher than average ecosystem services, biodiversity support functions or are particularly sensitive to impacts. The mean of the determinants as described by Rountree *et al.*, 2013, is used to assign the Ecological Importance and Sensitivity (EIS) category as listed in Table 7-3.

Table 7-3 Description of Ecological Importance and Sensitivity categories

EIS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	A
High	2.1 to 3.0	B
Moderate	1.1 to 2.0	C
Low Marginal	< 1.0	D

7.1.3.4 Recommended Ecological Category and Recommended Management Objective

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) (Table 7-4) was determined based on the results obtained from the PES and EIS of the assessed wetlands, with the objective of recommending how a water resource should be managed. This is achieved by either maintaining or improving the ecological integrity of the wetland in order to ensure continued ecological functionality (DWA, 1999).

Table 7-4 Recommended Ecological Category and Recommended Management Objectives for water resources based on Present Ecological State and Ecological Importance and Sensitivity scores

		Ecological Importance and Sensitivity			
		Very High	High	Moderate	Low
PES	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

7.1.4 Buffer Requirements

The “Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries” (Macfarlane *et al.*, 2014) was used to determine the appropriate buffer zone for the proposed activity.

7.1.5 Site Sensitivity Verification

The baseline aquatic / freshwater sensitivity of the project area was obtained using the National Web-based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended). The allocated sensitivities for each of the relevant themes are either disputed or validated for the assessed areas based on the specialist assigned Ecological Importance and Sensitivity of the different systems (where applicable), with consideration been given to the presence of observed or likely sensitive fauna and flora.

7.2 Appendix B – Risk and Impact Assessment

7.2.1 Risk Assessment

The Department of Water and Sanitation (DWS) risk matrix assesses impacts in terms of consequence and likelihood. The significance of the impact is rated according to the classes presented in Table 7-5.

Table 7-5 Significance ratings matrix

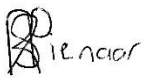
Rating	Class	Management Description
1 – 29	(L) Low Risk	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
30 – 60	(M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
61 – 100	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

7.3 Appendix C – Specialist Declaration of Independence

Declaration

I, Rian Pienaar, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



Rian Pienaar

Ecologist

The Biodiversity Company

May 2026

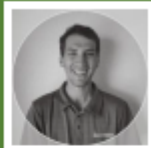
7.4 Appendix D – Specialist CVs

Rian Pienaar

Pr Sci Nat 135544

+27 78 505 0201

rian@thebiodiversitycompany.com



PROFILE SUMMARY

Environmental scientist and Pri Sci Nat (SACNASP 135544) with ~5+ years' specialist consulting experience across Southern Africa. Specialist expertise in wetland delineation and ecological assessments, wetland offset strategy design, rehabilitation and monitoring plans, as well as soil classification and agricultural potential assessments. Experienced in delivering high-quality field surveys and technical reporting aligned with in-country legislative requirements and international lender standards, and currently manages the operations at TBC.

PERSONAL INFO

Nationality: South African
Date of birth: 23 May 1994

EXPERIENCE

Environmental Impact Assessments (EIA)
Environmental Management Programmes (EMP)
Project Management
Logistics

SKILLS

- ✓ Wetland functional assessments
- ✓ Ecology
- ✓ Rehabilitation
- ✓ Monitoring & Management Plans

LANGUAGES

English – Proficient
Afrikaans – Proficient



Signed: Rian Pienaar

ACADEMIC QUALIFICATIONS

North-West University (2020): MASTER OF SCIENCE (MSc) – Environmental Sciences (Cum Lauda):
Title: The use *Clarias gariepinus* and associated helminthic parasites as bio-indicators of metal pollution in a subtropical ecosystem.

North-West University (2018): BACHELOR OF SCIENCE HONOURS IN ENVIRONMENTAL SCIENCE – Aquatic Ecosystem Health

North-West University (2018): BACHELOR OF SCIENCE IN ENVIRONMENTAL AND BIOLOGICAL SCIENCES – Zoology and Microbiology

PROFESSIONAL EXPERIENCE

Sept 2020 – **The Biodiversity Company**
Present Wetland Ecology

Jan 2018 – **National Aquatic Bioassay Facility (NABF)**
Dec 2018 Intern

INTERNATIONAL EXPERIENCE

South Africa, Mozambique,
Botswana, Eswatini

