Wetland Baseline & Risk Assessment for the proposed Notsi Cluster

PV 3 Solar Photovoltaic Project

Dealesville, Free State Province, South Africa

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CLIENT

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Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Background

The Biodiversity Company was appointed to undertake a wetland functional and impact (risk) assessment for the Notsi Cluster (near Dealesville) Solar Photovoltaic (PV) Project. The proposed project involves the development of a cluster solar facility and associated infrastructure and is located near to the town of Dealesville in the Free State province.

The proposed cluster solar facility will be comprised of multiple PV areas, each treated as separate sub-projects, and each producing up to a total of 100 MW. Each sub-project will include a PV Panel Array, inverters, and connection to the grid, and supportive infrastructure will be developed which includes roads, fencing and small buildings. This report pertains only to the assessment of one of the PV areas and its associated footprints, a separate report is compiled for the assessment of the supportive grid infrastructure.

In order to assess the baseline ecological state of the area and to present a detailed description of the receiving environment, both a desktop assessment as well as a field survey were conducted during 13 to 15 September 2022. Furthermore, the desktop assessment and field survey both involved the detection, identification and description of any locally relevant water resources, and the manner in which these sensitive features may be affected by the proposed development was also investigated. A 500 m radius has been demarcated for the cluster for the identification of wetlands within the prescribed regulation area. This demarcated area is referred to as the Project Area of Influence (PAOI).

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations, 2014 (No. 326, 7 April 2017) of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998). The approach has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 20 March 2020 as well as the Government Notice 1150 in terms of NEMA dated 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". The National Web based Environmental Screening Tool has characterised the aquatic biodiversity theme for the area as predominantly 'Low', with limited areas designated 'Very High' sensitivity due to the presence of wetlands (National Environmental Screening Tool, 2022). This was verified and approved during the field assessment.

The purpose of conducting the specialist study is to provide relevant input into the overall Environmental Authorisation application process, with a focus on the proposed project activities and their associated impacts. This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Registered Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making as to the ecological viability of the proposed project.

1.2 Project Details

Refer to Table 1-1 for details of the ten sub-projects that are to be assessed as part of this report (each producing up to 100 MW):

Table 1-1 The Sub-projects included within the overall Notsi Cluster PV project scope

Name	Size (ha)	Affected Farm Portion
Notsi PV 1	260	Ebenhaezer 1623
Notsi PV 2	220	Ebenhaezer 1623
Notsi PV 3	370	Welgeluk 1622

Notsi PV 4	220	Welgeluk 1622
Notsi PV 5	195	Ebenhaezer 1623 Welgeluk 1622

The following information has been received from the client with regards to the technical details for the proposed project.

The term photovoltaic describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun through a process known as the Photovoltaic Effect. This refers to light energy placing electrons into a higher state of energy to create electricity. Each PV cell is made of silicon (i.e., semiconductors), which is positively and negatively charged on either side, with electrical conductors attached to both sides to form a circuit. This circuit captures the released electrons in the form of an electric current (direct current). The key components of the proposed project are described below:

- PV Panel Array - The proposed facility will require numerous linked rows of PV (single axis) modules placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility with associated support infrastructure (concrete footings, below ground electrical cables) to produce up to 100MW electricity.
- Battery Energy Storage System (BESS) – The battery energy storage system will make use of solid state or flow battery technology and will have a capacity of up to 400MWh. Both lithium-ion and Redox-flow technology are being considered for the project, depending on which is most feasible at the time of implementation. The extent of the system will be 3 ha. The containers may be single stacked only to reduce the footprint. The containers will include cells, battery charge controllers, inverters, transformers, HVAC, fire, safety and control systems.
- Inverters - Sections of the PV array will be wired to inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- Supporting Infrastructure – The following auxiliary buildings with basic services including water and electricity will be required:
    - Temporary Laydown Areas; (~ 20000 m2) and construction site camp/site office;
    - Site Administration Office (~500m²);
    - Switch gear and relay room (~400m²);
    - Staff lockers and changing room (~200m²);
    - Security control (~60m²);
    - Operations & Maintenance (O&M) building (~ 500 m2); and
    - Warehouse.
- Roads – Access will be obtained via the S322 secondary road and various gravel farm roads within the area and affected property. An internal site road network will also be required to provide access to the solar field and associated infrastructure. Access roads will be up to 8m wide (6m wide road surface, with 1m drainage either side).
- Fencing - For health, safety and security reasons, the facilities will require perimeter fencing and internal security fencing. The fencing will be up to 2.4m in height.

Refer to Table 1-2 for a breakdown of the technical specifications that apply to each of the 10 sub-projects:

Table 1-2 Technical specifications pertaining to each of the Sub-projects included within the overall Notsi Cluster PV project scope

Component	Description / dimensions
Height of PV panels	Up to 4.5 meters
Area of PV Array	TBC
Number of inverters required	To be determined as part of the final facility layout design.
Area occupied by inverter / transformer stations / substations	On-site Facility Substation: TBC based on final site layout BESS: TBC based on final site layout
Capacity of the on-site substation	33kV / 132kV
Area occupied by both permanent and construction laydown areas	Up to 4 hectares
Area occupied by buildings	Administration Office (~500m²); Switch gear and relay room (~400m²); Staff lockers and changing room (~200m²); Security control (~60m²);
Width of internal roads	Between 6 and 8 meters
Height of fencing	Approximately 2.4 meters

1.3 Project Area of Influence

A 1265 ha PAOI is delineated to incorporate all the PV areas as part of the overall project, and this represents the total area to be assessed. The PAOI is approximately 13 km southwest of the town of Dealesville and lies adjacent to the large Beta substation. The region is characterised by undeveloped agricultural and grazing land and numerous large saltpans.

A map of the PAOI in relation to the local region is presented in Figure 1-1, and a detailed map of the PAOI and associated PV development footprints is presented in Figure 1-2.

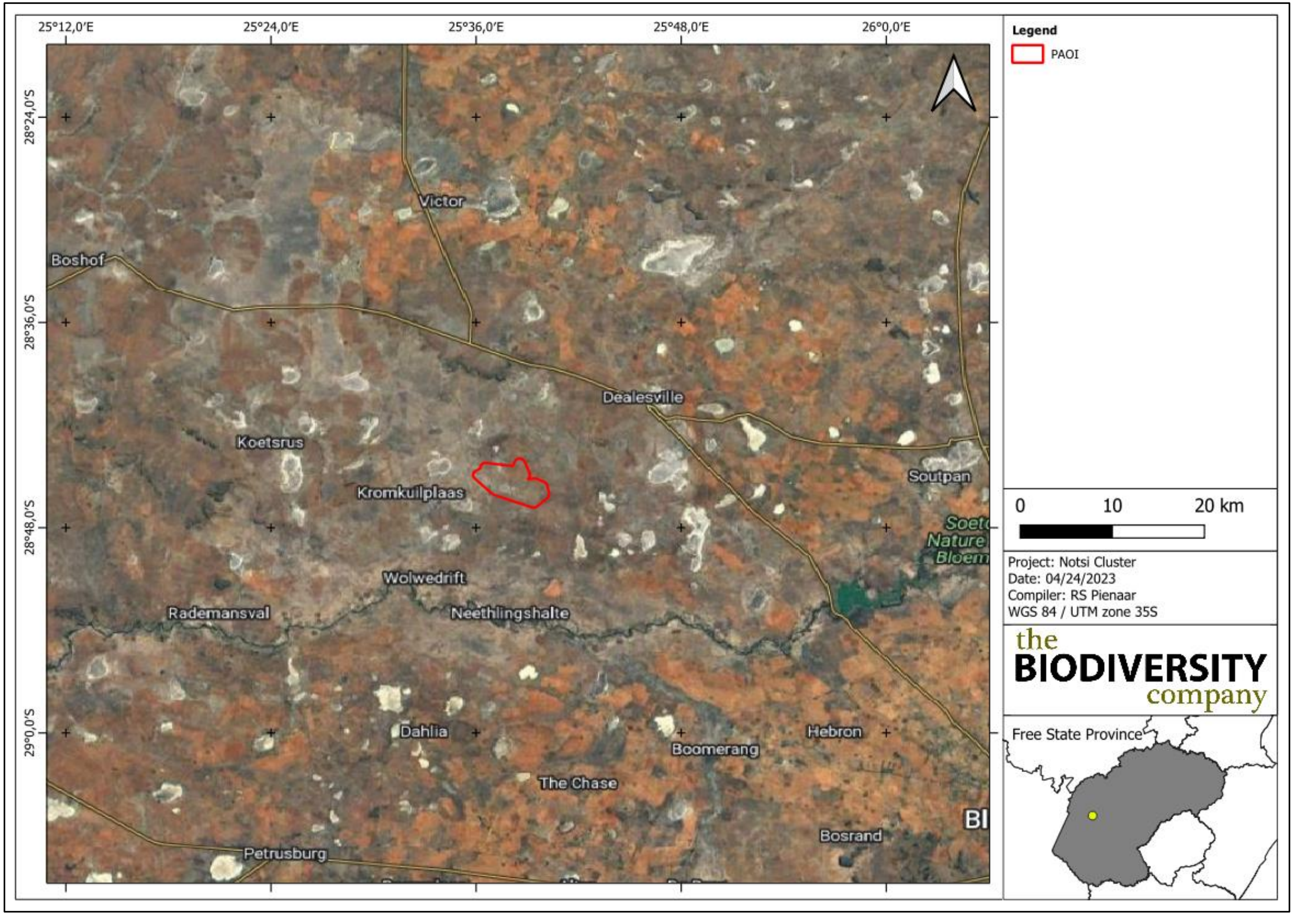

Figure 1-1 ***Map illustrating the regional context of the PAOI***

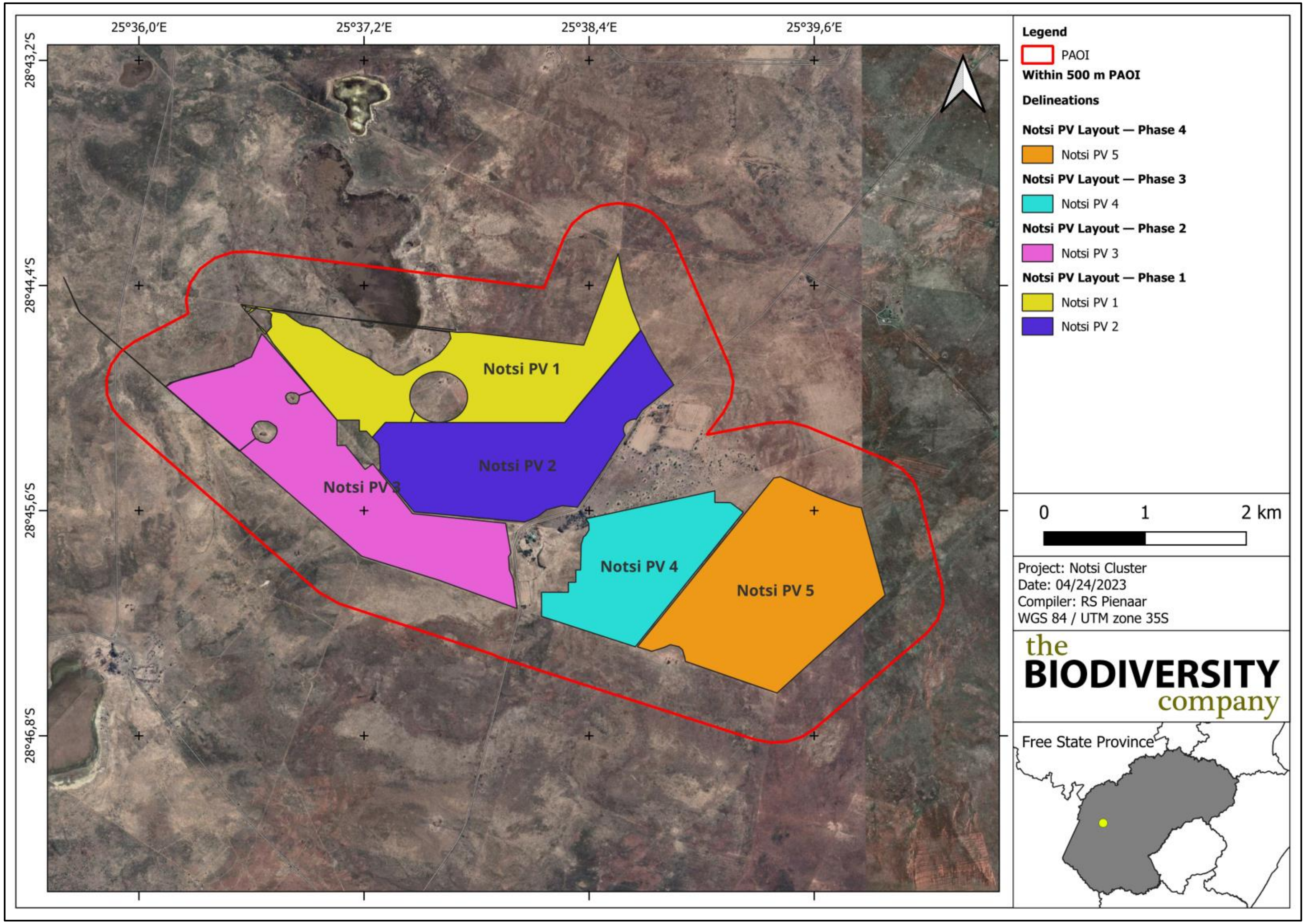

Figure 1-2 Map illustrating the details of the PAOI

1.4 Specialist Details

Report Name	**Wetland Baseline & Risk Assessment for the proposed Notsi PV Custer Project PV 3**	
Reference	**Notsi Cluster**	
Submitted to	ENVIRONAMICS	
Report Writer & Fieldwork	**Rian Pienaar**	
	Rian Pienaar is an aquatic ecologist (Cand. Sci. Nat. 135544) with experience in wetland identification and delineations. Rian completed his M.Sc. in environmental science at the North-West University Potchefstroom Campus. Rian has been part of wetland studies for road and culvert upgrades, power station and dam construction.	
Reviewer	**Andrew Husted**	
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.	
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.	

1.5 Terms of Reference

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

- The delineation, classification and assessment of wetlands within 500 m of the project area;
- Conduct risk assessments relevant to the proposed activity;
- Recommendations relevant to associated impacts; and
- Report compilation detailing the baseline findings.

1.6 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- The focus area was based on the spatial files provided by the client and any alterations to the area and/or missing GIS information would have affected the area surveyed;
- Only the outline area of the proposed site was provided to the specialist; and
- The GPS used for the survey has a 5 m accuracy and therefore any spatial features may be offset by 5 m.

1.7 Key Legislative Requirements

1.7.1 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 itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the 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).

1.7.2 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.

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2 Methods

A single wetland site visit was conducted from the 13th to the 15th of September 2022, this would constitute a dry season survey. Wetlands are not seasonal, so a single survey is required.

2.1 Identification and Mapping

The wetland areas were delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 2-1. 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.

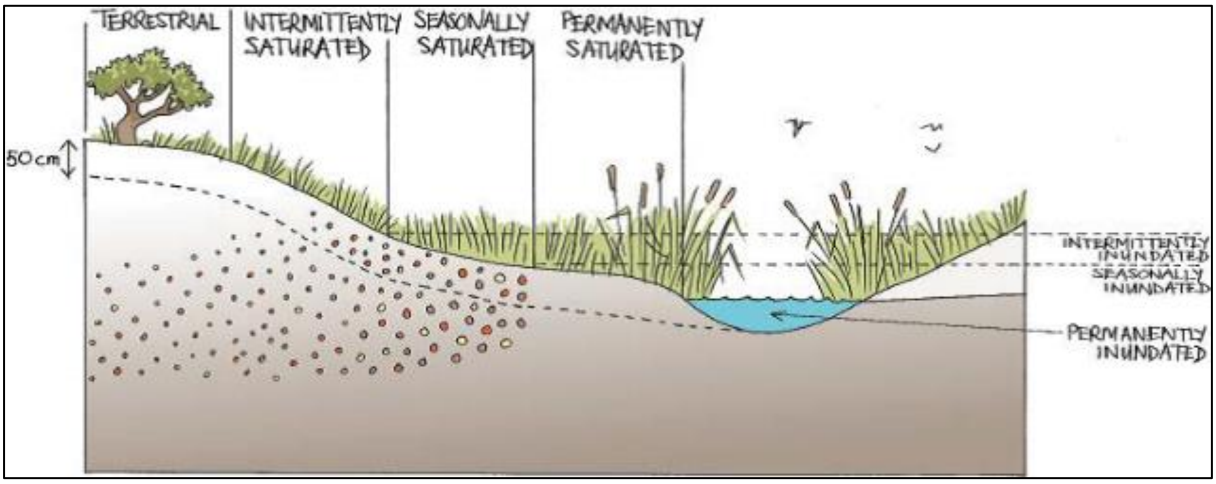

Figure 2-1 Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)

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.

2.3 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. Eco Services serves 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*. 2008). 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 2-1).

Table 2-1 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

2.4 Present Ecological Status

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present 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 2-2.

Table 2-2 The Present Ecological Status categories (Macfarlane, et al., 2008)

Impact Category	Description	Impact Score Range	PES
None	Unmodified, natural	0 to 0.9	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	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	C
Large	Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.0 to 5.9	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	E
Critical	Critical Modification. 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	F

2.5 Importance and Sensitivity

The importance and sensitivity of water resources is determined to establish resources that provide higher than average ecosystem services, biodiversity support functions or are particularly sensitive to impacts. The mean of the determinants is used to assign the Importance and Sensitivity (IS) category as listed in Table 2-3.

Table 2-3 Description of Importance and Sensitivity categories

IS 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**

2.6 Ecological 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).

2.7 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.

3 Results and Discussion

3.1 Desktop Baseline

3.1.1 Vegetation Type

The project area falls within the Western Free State Clay Grassland (Gh 9) vegetation type. This vegetation type is distributed throughout the Free State province and stretches from Bloemfontein in the south to Wesselsbron in the north and from Brandfort in the east to Hertzogville in the west. The latitude suited for this vegetation type is between 1 200 meters above sea level to 1 420 meters above sea level (Mucina & Rutherford, 2006).

This vegetation type is restricted to flat bottoms supporting dry, species-poor grassland with a high abundance of salt pans (playas) within the grassland. The vegetation type is characterised by dwarf karoo shrublands surrounding the salt pans within disturbed areas.

The conservation status of this vegetation type is least threatened with a target percentage of 24. There is currently 0 % statutorily conserved within conservation areas. Approximately twenty percent of the vegetation type have been transformed for wheat and maize cultivation (Mucina & Rutherford, 2006).

3.1.2 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Db 3 land type. This land type consists of prismacutanic and/or pedocutanic diagnostic horizons with the addition of one or more of the following. Additionally, vertic, melanic and red structured diagnostic horizons occur frequently within this land type.

The geology of this area is characterised by deposits of sandstone, shale, and mudstone (Volksrust Formation, Ecca Group) and is found in flat areas with some undulating plains. No rivers or streams drain these plains thus all water drains into the salt pans. Dry, clayey, duplex soils are typically found within this geology (Mucina and Rutherford, 2006).

3.1.3 Climate

The Gh 9 vegetation type is characterised by seasonal rainfall occurring mostly between November and March with a mean annual precipitation (MAP) of 450 mm (see Figure 3-1). The vegetation type is also situated in a cool temperate regime with a mean annual temperature between 16 and 17 °C with frost occurring frequently during winter months.

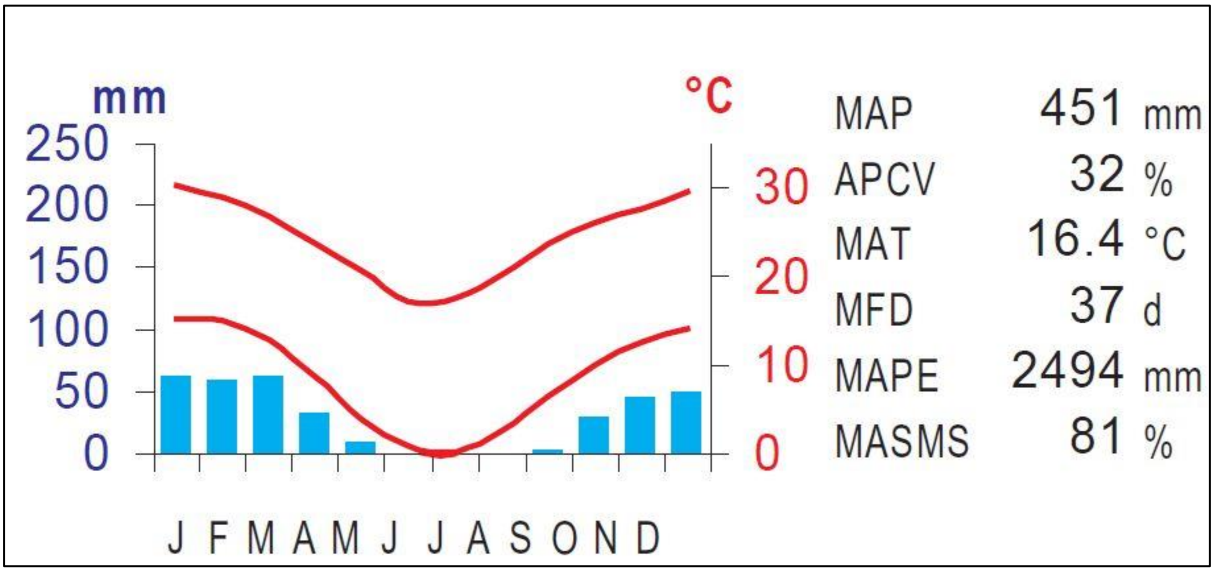

Figure 3-1 Climate for the Western Free State Clay Grassland (Mucina & Rutherford, 2006)

3.1.4 South African Inventory of Inland Aquatic Ecosystems

This spatial dataset is part of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) which was released as part of the National Biodiversity Assessment (NBA 2018). National Wetland Map 5 includes inland wetlands and estuaries, associated with river line data and many other data sets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE, 2018).

Two wetlands of the same type were identified by means of this data set. The wetlands as classified as being depression wetlands (see Figure 3-2). The conditions of these wetlands are classified as being A/B (Natural/Good).

3.1.5 NFEPA Wetlands

Five wetland types have been identified within the 500 m regulated area of the proposed power line, namely depression wetlands, a wetland flat, a hillslope seep, unchannelled valley bottom and a valley head seep wetland (see **Figure 3-2**).

3.1.6 Topographical Inland Water and River Lines

The topographical inland and river line data for “2825” quarter degree was used to identify potential wetland areas within the PAOI. This data set indicates multiple inland water areas of which were classified as being dams, marsh vlei and non-perennial pans as well as a single non-perennial river line located within the PAOI (see **Figure 3-2**).

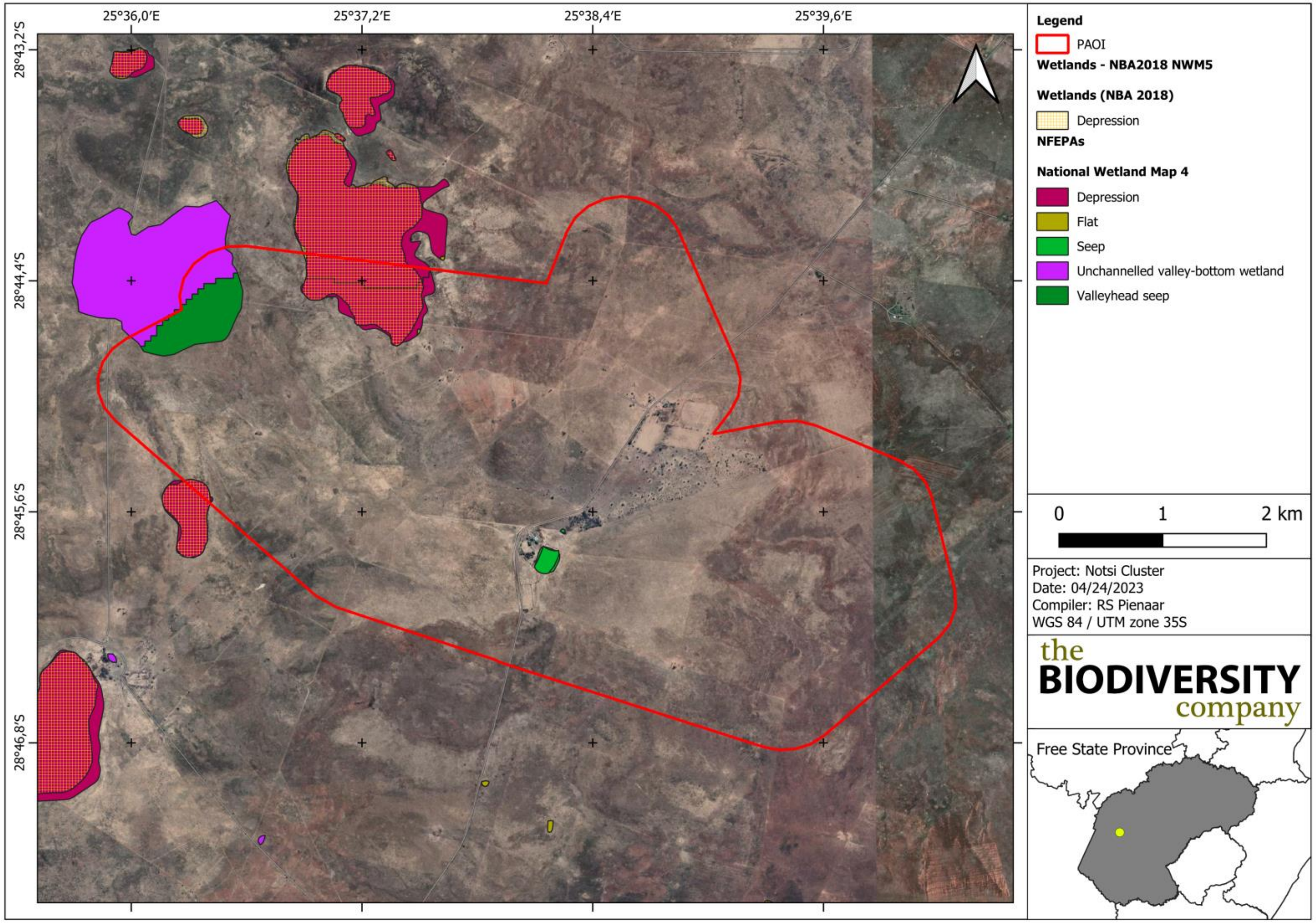

Figure 3-2 SAIIAE and NFEPA wetlands located within PAOI

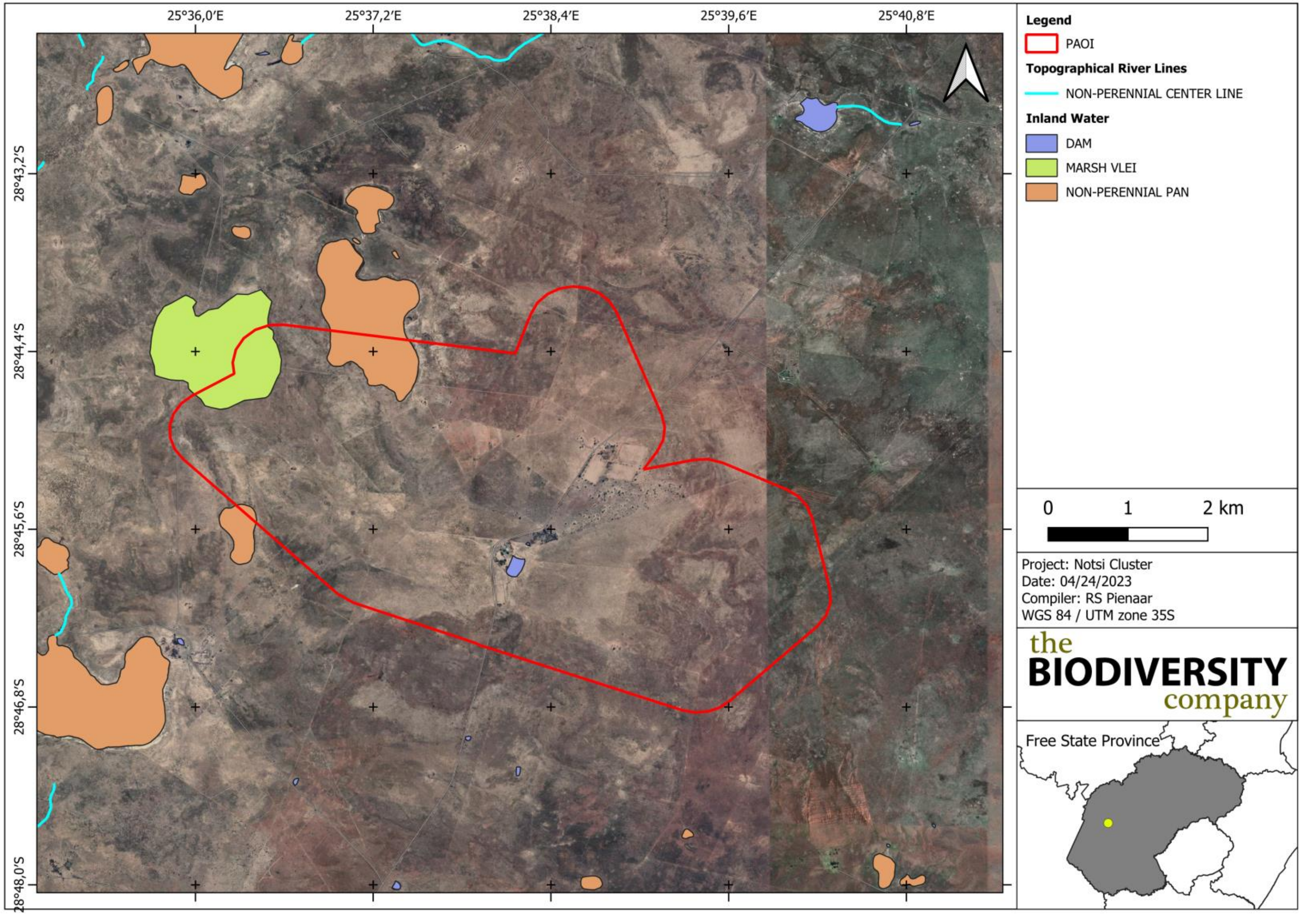

Figure 3-3 Topographical River line and inland water areas located within the PAOI

3.1.7 Terrain

The terrain of the PAOI has been analysed to determine potential areas where water is more likely to accumulate (due to convex topographical features, preferential pathways, or more gentle slopes).

3.1.7.1 Digital Elevation Model (DEM)

A Digital Elevation Model (DEM) has been created to identify lower laying regions as well as potential convex topographical features which could point towards preferential flow paths. The PAOI ranges from 1 216 to 1 261 metres above sea level (MASL). The lower laying areas (generally represented in dark blue) represent the area that will have the highest potential to be characterised as wetlands (see Figure 3-4).

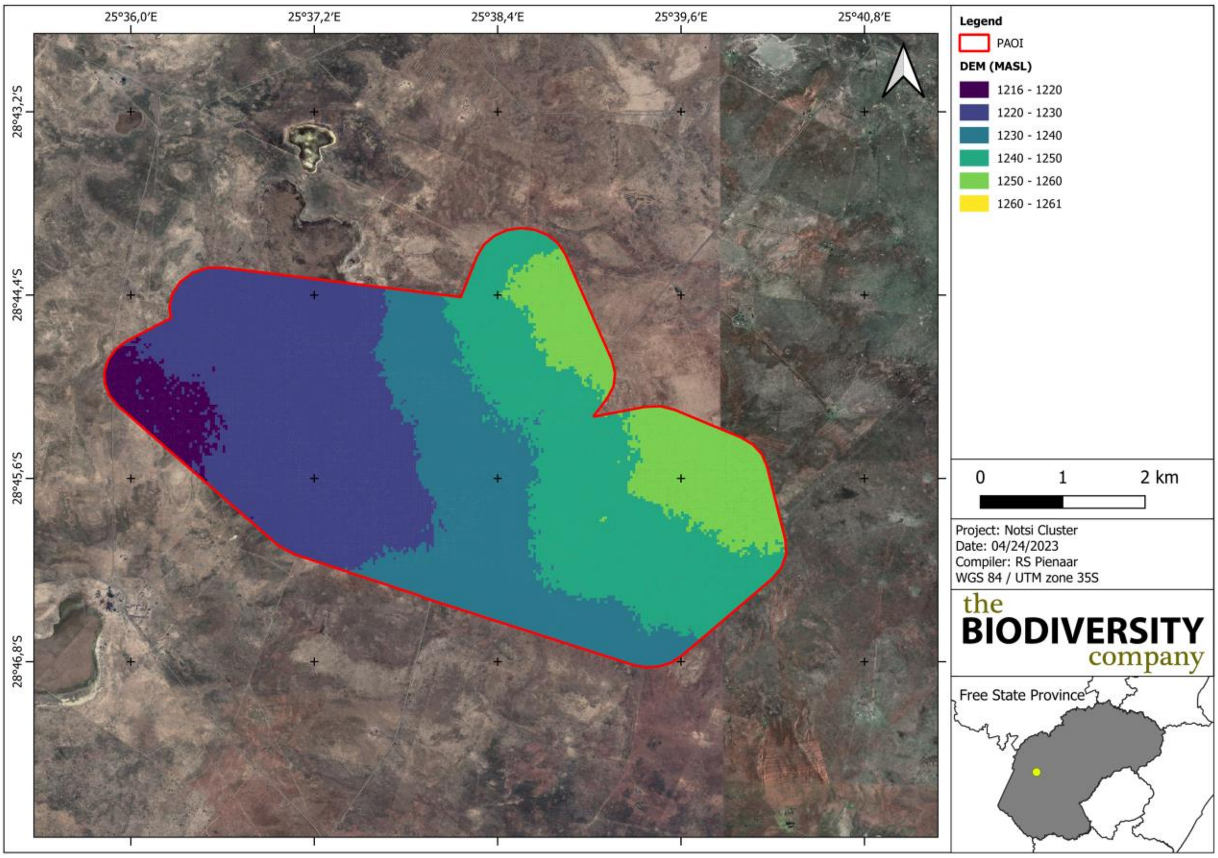

Figure 3-4 Digital Elevation Model of the PAOI

4 Field Assessment

4.1 Delineation and Description

During the site visit, two HGM units were identified within the PAOI (see Figure 4-2). The wetland areas were delineated in accordance with the DWAF (2005) guidelines (see Figure 4-1 and Figure 4-2). HGM units have been classified as two depression wetlands. Multiple artificial wetlands, namely dams were identified to the within the PAOI. According to Ollis *et al* (2013) a dam is classified as '*an artificial body of water formed by the unnatural accumulation of water behind an artificial barrier that has been constructed across a river channel or an unchannelled valley bottom wetland'*. Although these systems do not classify as a natural wetland system it is important to note where the dams are for any planned development in the area. The delineation of the wetland systems and functional assessment have been completed for the unchanneled valley bottom wetlands in which the dams are located.

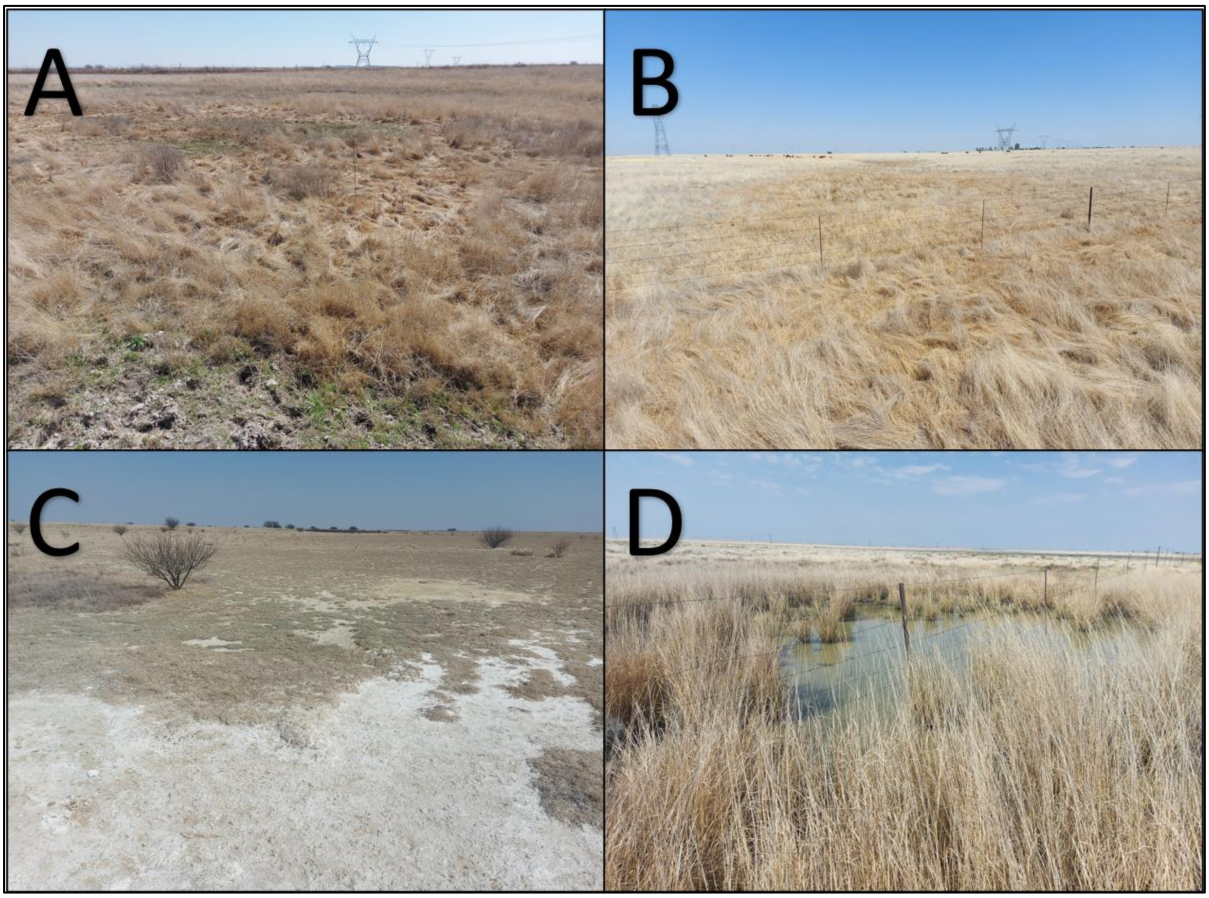

Figure 4-1 Photographical evidence of the different wetland types found within the project area of influence, A & B) Unchannelled valley bottom wetlands, C & D) Depression wetlands.

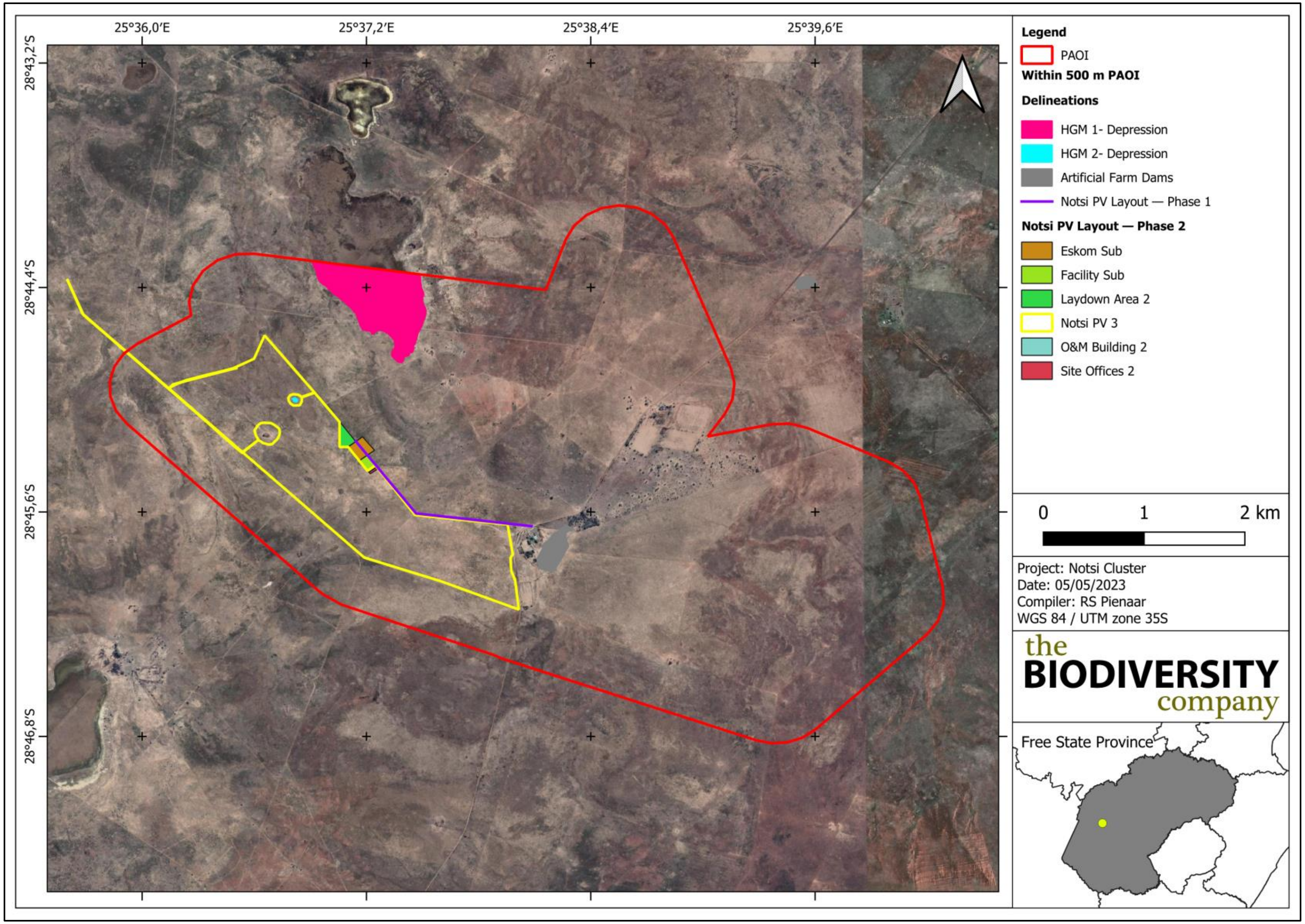

Figure 4-2 Delineation and location of the different HGM units identified within the PAOI

4.2 Unit Setting

Depression wetlands are located on the “slope” landscape unit. Depressions are inward draining basins with an enclosing topography which allows for water to accumulate within the system. Depressions, in some cases, are also fed by lateral sub-surface flows in cases where the dominant geology allows for these types of flows. Figure 4-3 presents a diagram of a typical depression wetland, showing the dominant movement of water into, through and out of the system.

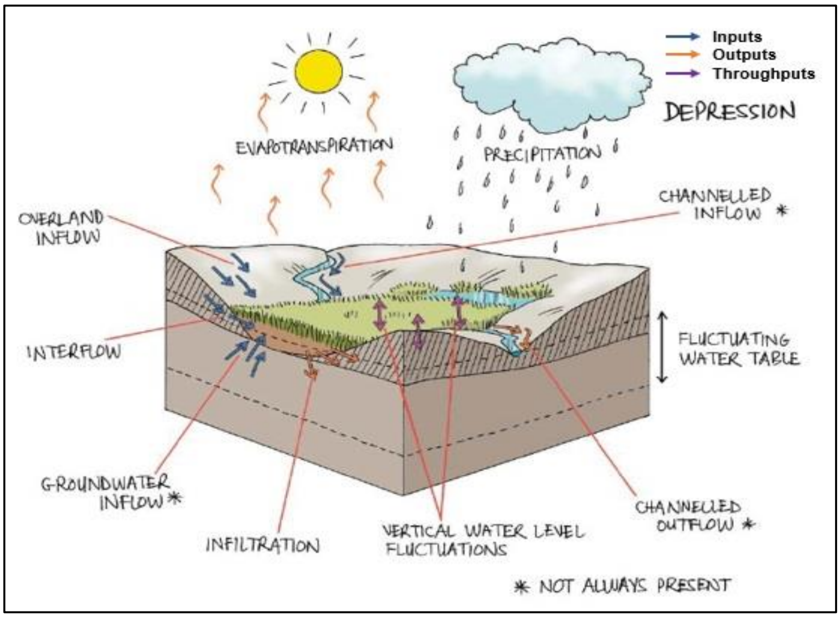

Figure 4-3 Amalgamated diagram of atypical depression wetland, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

4.3 General Functional Description

The generally impermeable nature of depressions and their inward draining features are the main reasons why the streamflow regulation ability of these systems is mediocre. Regardless of the nature of depressions in regard to trapping all sediments entering the system, sediment trapping is another Eco Service that is not deemed as one of the essential services provided by depressions, even though some systems might contribute to a lesser extent. The reason for this phenomenon is due to winds picking up sediments within pans during dry seasons which ultimately leads to the removal of these sediments and the deposition thereof elsewhere. The assimilation of nitrates, toxicants and sulphates are some of the higher rated Eco Services for depressions. This latter statement can be explained the precipitation as well as continues precipitation and dissolving of minerals and other contaminants during dry and wet seasons respectively, (Kotze *et al*., 2009).

Unchanneled valley-bottoms are characterised by sediment deposition, a gentle gradient with streamflow generally being spread diffusely across the wetland, ultimately ensuring prolonged saturation levels and high levels of organic matter. The assimilation of toxicants, nitrates and phosphates are usually high for unchanneled valley-bottom wetlands, especially in cases where the valley is fed by sub-surface interflow from slopes. The shallow depths of surface water within this system adds to the degradation of toxic contaminants by means of sunlight penetration.

It is however important to note that the descriptions of the above-mentioned functions are merely typical expectations. All wetland systems are unique and therefore, the ecosystem services rated high for these systems on site might differ slightly to those expectations.

4.4 Ecological Functional Assessment

The ecosystem services provided by the wetland units identified on site were assessed and rated using the WET-EcoServices method (Kotze *et al.,* 2008). The average ecosystem service scores for the delineated systems are illustrated in Table 4-1 and Figure 4-4.

Table 4-1 Average ecosystem service scores for delineated wetlands

Moderately High	Intermediate
HGM 2	HGM 1

HGM 1, is a salt pan in the north western corner of the PAOI, and scored the lowest ecosystem services of all the identified wetlands. The wetland plays a role in sediment trapping and the assimilation of phosphates, nitrates and toxicant. This is due to the fact that during rainy season the water will runoff into the pan and stay there for long periods of time where the assimilation can take place. Water will also be stored inside the wetland during rainy season and can then be used by humans as well as animals. This helps with biodiversity maintenance of the wetlands. The wetland scored lower ecosystem services due to the fact that the wetland had little to no hydrophyte vegetation present which plays a major role in ecosystem services scores.

HGM 2 scored moderately high. The main factors contributing to the lower scores is the location of the wetlands. The wetlands are located on private land where human interaction is limited. The wetlands thus have very limited tourist attraction as well little to no cultural function. The wetlands also only provide natural resources to a limited amount of people which also lowers the associated benefits.

These wetlands however have high vegetation cover which will play an important role in biodiversity maintenance providing habitat for a wide variety of fauna. The vegetation will also help with streamflow regulation and flood attenuation during the rainy season. Vegetation also plays a vital role in the assimilation of toxicants.

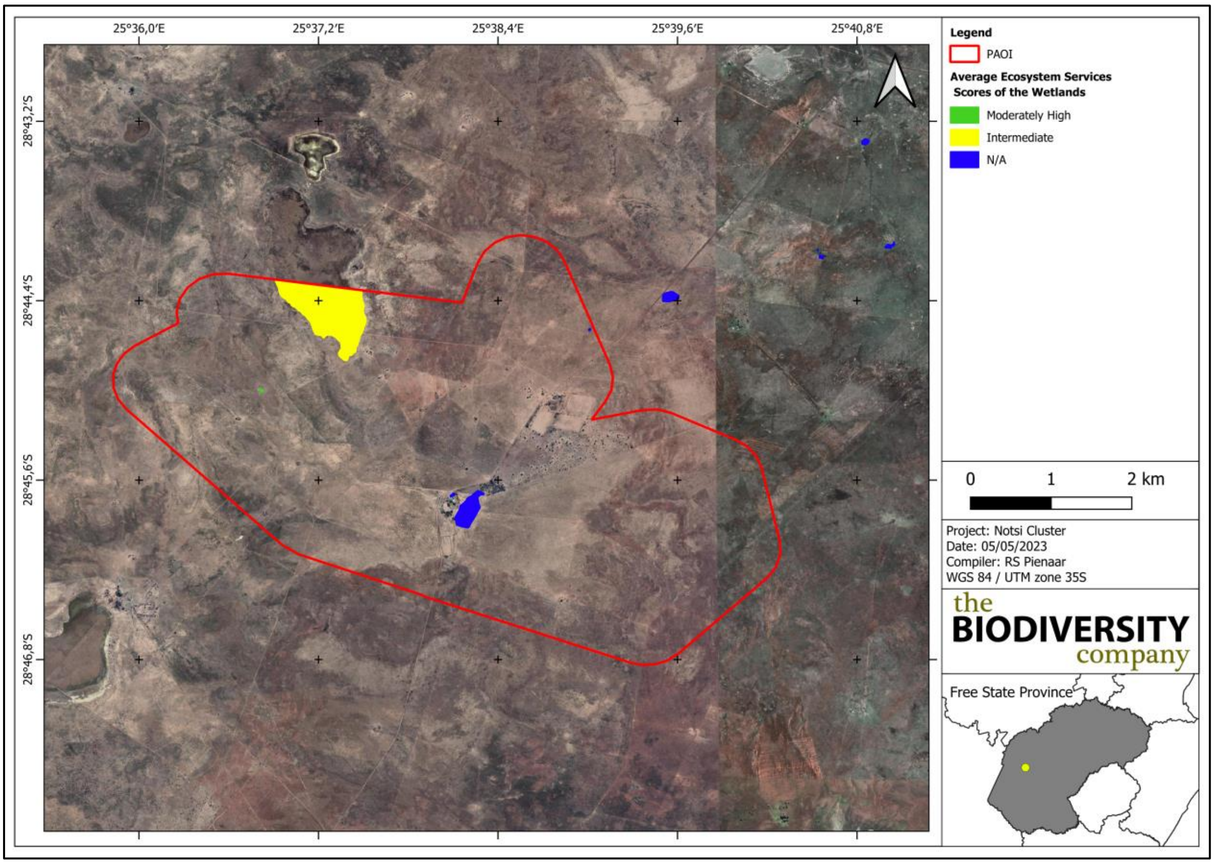

Figure 4-4 Average ecosystem services scores for the delineated wetlands

4.5 Ecological Health Assessment

The PES for the assessed HGM units is presented in Figure 4-6. The delineated wetland systems have been scored overall PES ratings ranging from largely modified (class D) to seriously modified (class E), depending on the level of modification.

The findings from the PES assessment indicate significant disturbances to HGM 2 that has been rated a seriously modified score. HGM unit 1 was classified as being largely modified (class D). Some notable modifications to the delineated wetlands include (see Figure 4-5);

- Alien invasive vegetation;
- Drainage channels;
- Dirt and tar roads;
- Fences through the wetlands;
- Dumping of waste; and
- Grazing of animals.

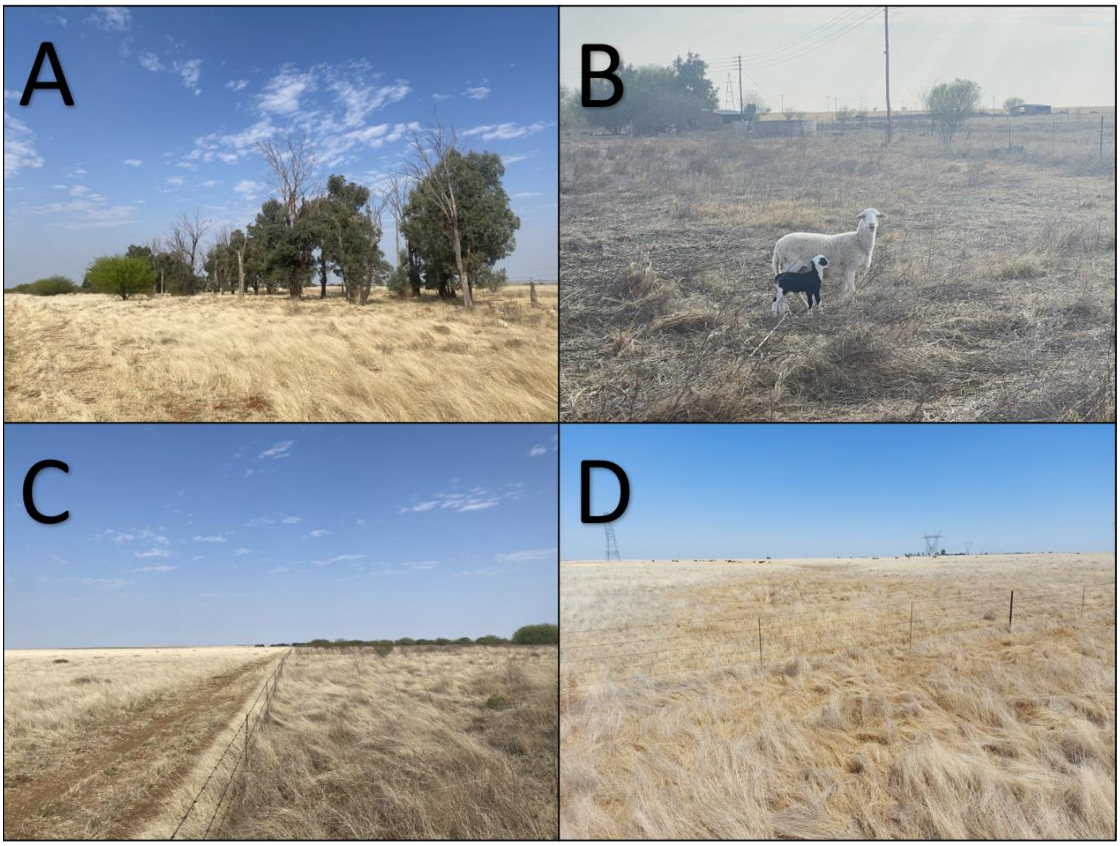

Figure 4-5 Examples of the different impacts on the wetlands within the PAOI.

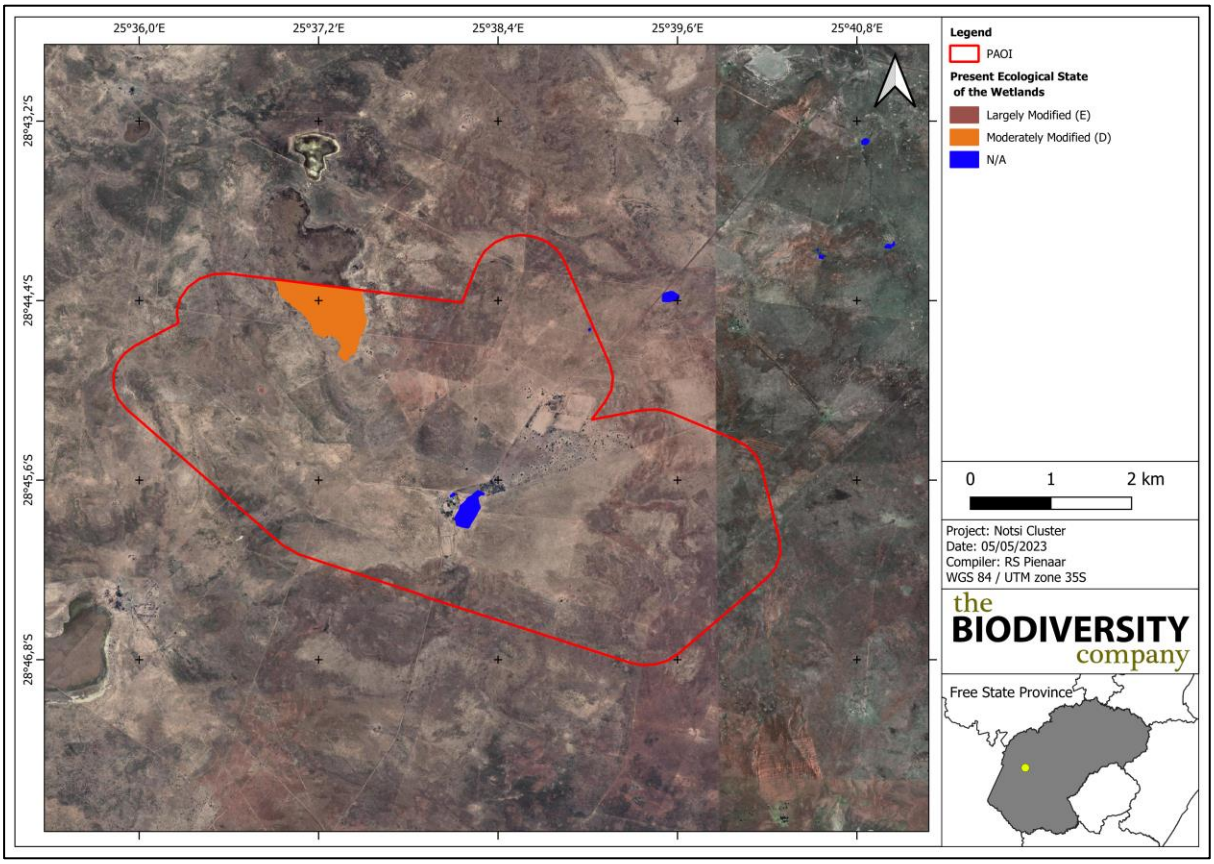

Figure 4-6 Overall present ecological state of delineated wetlands

4.6 Importance & Sensitivity Assessment

The results of the ecological IS assessment are shown in Table 4-2. Various components pertaining to the protection status of a wetland are considered for the IS, including Strategic Water Source Areas (SWSA), the NFEPA wetland vegetation (wet veg) threat status and the protection status of the wetland. The IS for both the depression and unchannelled valley bottom wetland units have been calculated to be “Moderate”, which combines the relatively low threat status and protection level with the low condition and threat status of the wetland.

Table 4-2 The IS results for the delineated HGM units

HGM Type	NFEPA Wet Veg			NBA Wetlands			SWSA (Y/N)	Calculated IS
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018	Ecosystem Protection Level		
Depressions	Dry Highveld Grassland Group 3	Least Threatened	Not Protected	A/B Largely Natural	Least Concerned	Poorly Protected	N	**Moderate**

4.7 Buffer Requirements

It is worth noting that the scientific buffer calculation (Macfarlane *et al*., 2014) was used to determine the size of the buffer zones relevant to the proposed project. A pre-mitigation buffer zone of 30 m is recommended for the identified wetlands, which can be decreased to 15 m with the addition of all prescribed mitigation measures (see Table 4-3).

Table 4-3 Pre- and post-mitigation buffer requirements

Aspect	Pre-Mitigation Buffer Size (m)	Post Mitigation Buffer Size (m)
PV development	30	15

5 Risk Assessment

5.1 Potential Impacts

The impact assessment considered both direct and indirect impacts, if any, to the wetland systems. The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) will be considered for this component of the assessment (Figure 5-1). In accordance with the mitigation hierarchy, the preferred mitigatory measure is to avoid impacts by considering options in project location, sitting, scale, layout, technology and phasing to avoid impacts. Figure 5-2 below indicates the different levels of risk associated with the different PV areas.

The risk assessment for the Notsi 3 PV area where the risks are expected to be medium (pre-mitigation) due to the presence of natural wetlands and drainage features within the proposed development areas. For the PV area avoidance will not be achieved and the risk assessment will thus focus on the second step of the mitigation hierarchy namely minimisation of the impacts. Since direct impacts to the wetlands (and buffers) cannot be avoided, the risk assessment will consider both the direct and indirect risks posed to these systems as a result of the project. Table 5-1 illustrates various aspects that are expected to impact upon the delineated wetlands during the respective project phases.

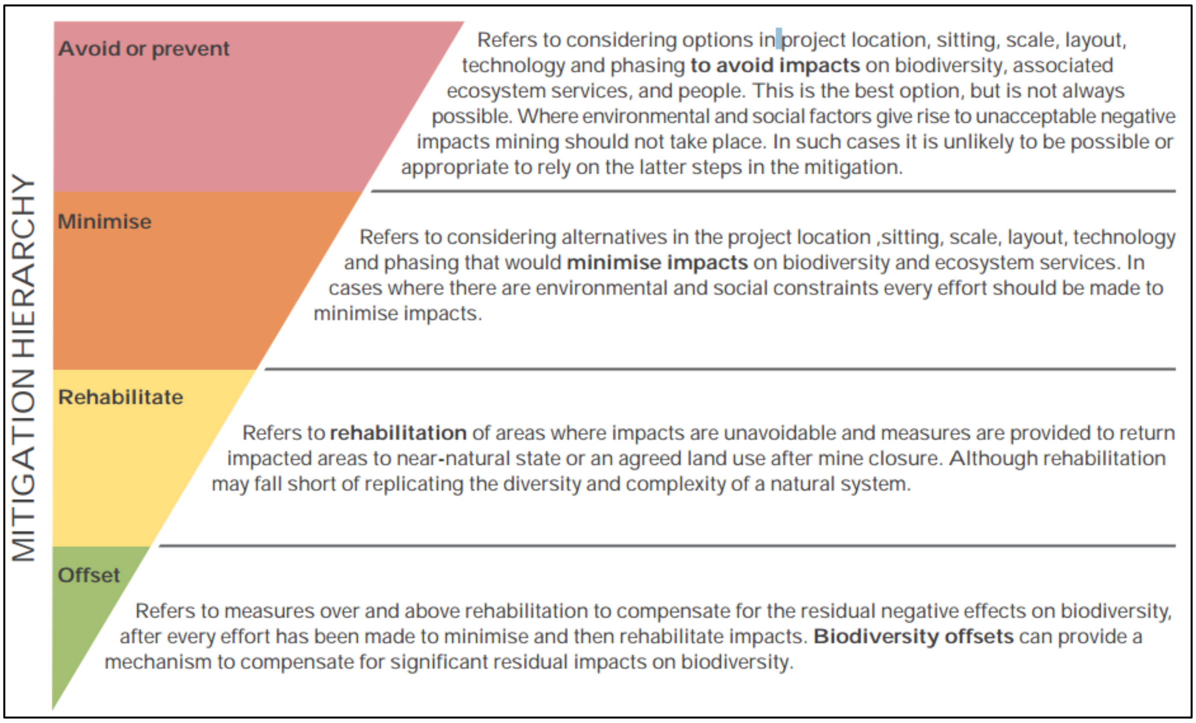

Figure 5-1 The mitigation hierarchy as described by the DEA (2013)

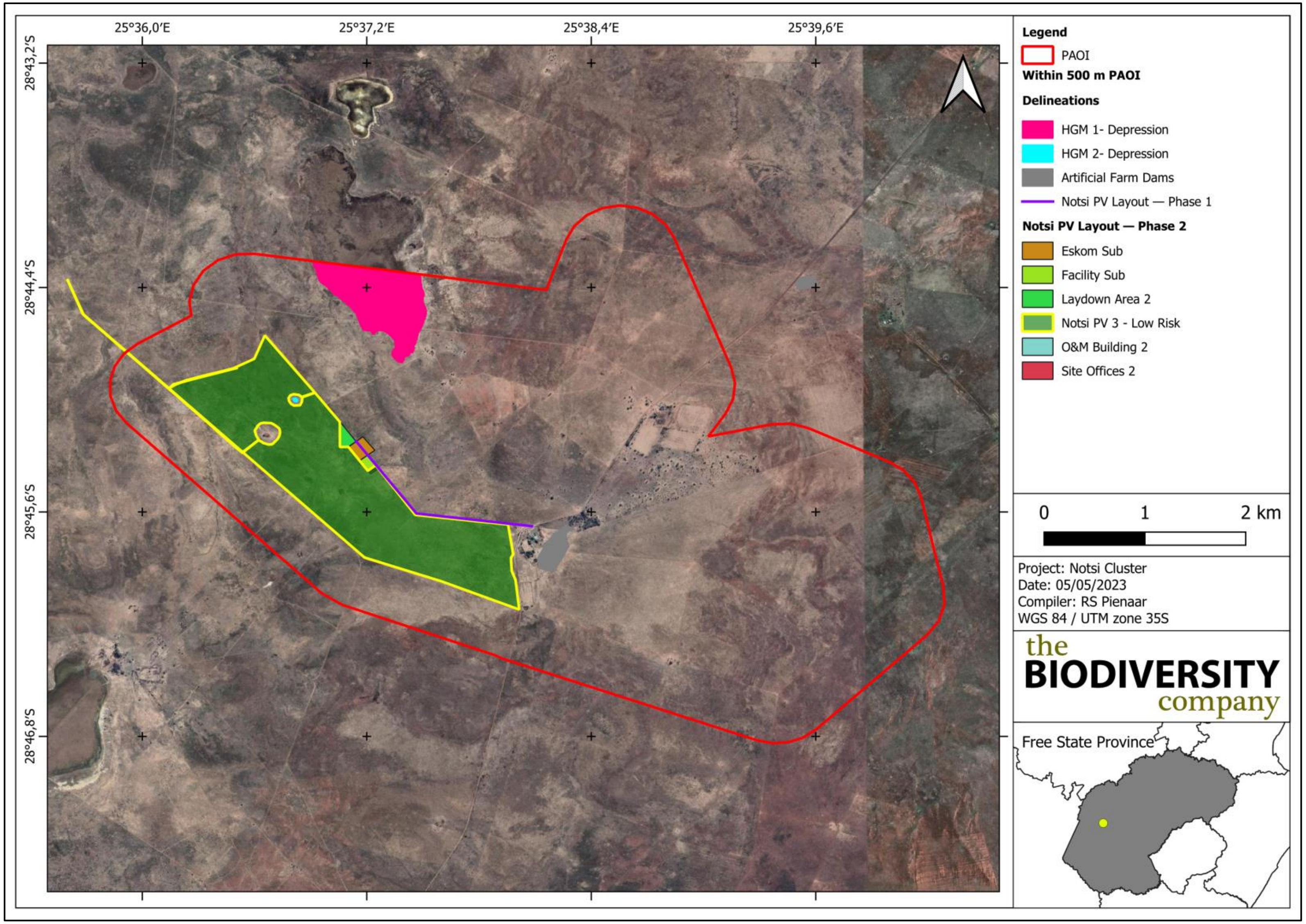

Figure 5-2 The identified risk areas

Table 5-1 DWS Risk Impact Matrix for PV areas (Notsi PV 3) (Andrew Husted Pr Sci Nat 400213/11)

Activity	Aspect	Impact	Mitigation	Severity: Flow Regime	Severity: Water Quality	Severity: Habitat	Severity: Biota	Total	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
Construction																			
Site clearing and preparation.	Wetland disturbance .	Direct disturbance / degradation to wetland soils or vegetation due to the construction of the solar facility.	Without	2	2	1	2	1.75	2	2	5.75	2	2	1	1	6	34.5	L	• Clearly demarcate the construction footprint and restrict all construction activities to within the proposed infrastructure area. • When clearing vegetation, allow for some vegetation cover as opposed to bare areas. • Minimize the disturbance footprint and the unnecessary clearing of vegetation outside of this area. • Use the wetland shapefiles to signpost the edge of the wetlands closest to site. Place the sign 15 m from the edge (this is the buffer zone). Label these areas as environmentally sensitive areas, keep out. • Educate staff and relevant contractors on the location and importance of the identified wetlands through toolbox talks and by including them in site inductions as well as the overall master plan. • All activities (including driving) must adhere to the 15 m buffer area. • Promptly remove / control all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed. • Landscape and re-vegetate all denuded areas as soon as possible.
			With	2	1	1	1	1.25	2	2	5.25	2	2	1	1	6	31.5	L	
	Water runoff from construction site.	Increased erosion and sedimentation.	Without	3	2	1	1	1.75	2	3	6.75	3	3	1	1	8	54	L	• Limit construction activities near (< 50m) wetlands to winter (as much as possible) when rain is least likely to wash concrete and sand into the wetland. Activities in black turf soils can become messy during the height of the rainy season and construction activities should be minimised during

Activity	Aspect	Impact	Mitigation	Flow Regime	Water Quality	Habitat	Biota	Total	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
				Severity															
			With	2	2	1	1	1.5	2	2	5.5	3	2	1	1	7	39	L	these times to minimise unnecessary soil disturbances. • Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash. • No activities are permitted within the wetland and associated buffer areas. • Landscape and re-vegetate all unnecessarily denuded areas as soon as possible.
		Potential contamination of wetlands with machine oils and construction materials.	Without	1	3	2	2	2	1	2	5	3	3	1	2	9	45	L	• Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility. • Appropriately stockpile topsoil cleared from the project area. • Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g. concrete) in such a way as to prevent them leaking and entering the wetlands. • No activities are permitted within the wetland and associated buffer areas.
			With	1	1	1	1	1	1	2	4	1	2	1	2	6	24	L	
Operation																			
Operation of the solar facility.	Hardened surfaces.	Potential for increased stormwater runoff leading to Increased erosion and sedimentation.	Without	2	2	2	2	2	3	2	7	2	2	1	1	6	42	L	• Design and Implement an effective stormwater management plan. • Promote water infiltration into the ground beneath the solar panels. • Release only clean water into the environment. • Stormwater leaving the site should not be concentrated in a single exit drain but spread across multiple drains around the site each fitted with energy dissipaters (e.g. slabs of concrete with rocks cemented in). • Re-vegetate denuded areas as soon as possible. • Regularly clear drains. • Minimise the extent of concreted / paved / gravel areas. • A covering of soil and grass (regularly cut and maintained) below the solar panels is ideal for infiltration. If not feasible then gravel is preferable
			With	1	1	1	1	1	2	2	5	1	2	1	1	5	25	L	

Activity	Aspect	Impact	Mitigation	Flow Regime	Water Quality	Habitat	Biota	Total	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
																			over concrete or paving. • Avoid excessively compacting the ground beneath the solar panels.
	Contamination.	Potential for increased contaminants entering the wetland systems.	Without	2	3	2	2	2.25	2	2	6.25	3	3	1	1	8	50	L	• Where possible minimise the use surfactants to clean solar panels and herbicides to control vegetation beneath the panels. If surfactants and herbicides must be used do so well prior to any significant predicted rainfall events.
			With	1	1	1	1	1	2	2	5	1	2	1	1	5	25	L	
Closure																			
Decommissioning of the solar facility.	Rehabilitation.	Potential loss or degradation of nearby wetlands through inappropriate closure.	Without	2	2	2	2	2	2	3	7	2	2	1	1	6	42	L	• Develop and implement a rehabilitation and closure plan. • Appropriately rehabilitate the project area by ripping, landscaping and re-vegetating with locally indigenous species.
			With	1	1	1	1	1	2	2	5	1	2	1	1	5	25	L	

6 Conclusion and Recommendation

6.1 Baseline Ecology

During the site assessment, two HGM units were identified and assessed within the project area of influence. These comprise of two depression wetlands. The wetlands scored an overall PES scores ranging from D – "Largely Modified" to E "Critically Modified" due to the modification to both the hydrology and vegetation of the wetlands through anthropogenic activities. The wetlands scored "Moderate" importance and sensitivity scores due to the low protection level of both the wetland vegetation and units. The average ecosystem service score was determined to range between "Intermediate" and "Moderately High". A 15 m post mitigation buffer was assigned to the wetland systems.

6.2 Risk Assessment

The risk assessment for the Notsi 3 PV area showed that the proposed activity will pose no risks to any wetlands. Thus, avoidance can be met, and the focus should be to stay clear of the wetlands buffers while constructing the PV plant.

6.3 Specialist Recommendation

Based on the results and conclusions presented in this report, the specialist recommends that if all mitigation measures can be met with the designing of the PV area, it is expected that the proposed activities will pose low residual risks on the wetlands and thus no fatal flaws were identified for the project. A General Authorisation (GN 509 of 2016) is required for the water use authorisation.

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