Wetland Baseline & Risk Assessment for the Transalloys Solar Photovoltaic (PV) Facility

Emalahleni, Mpumalanga Provinces

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CLIENT

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

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1 Introduction

1.1 Background

The Biodiversity Company was appointed by Savannah Environmental (Pty) Ltd (Savannah) to undertake a wetland baseline and risk assessment for the proposed 55 MW Solar Photovoltaics (PV) Energy Facility at Transalloys, Mpumalanga Province. The project area is located approximately 10 km west of Emalahleni, in the Mpumalanga Province.

The approach was informed by the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020) in terms of NEMA, dated 20 March: "*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). The National Web based Environmental Screening Tool has characterised the aquatic theme sensitivity of the project area as "Low" and "Very High".

This assessment has been completed in accordance with the requirements of the published General Notice (GN) 509 by the Department of Water and Sanitation (DWS). This notice was published in the Government Gazette (no. 40229) under Section 39 of the National Water Act (Act no. 36 of 1998) in August 2016, for a Water Use Licence (WUL) in terms of Section 21(c) & (i) water uses. The GN 509 process provides an allowance to apply for a WUL for Section 21(c) & (i) under a General Authorisation (GA), as opposed to a full Water Use Licence Application (WULA). A water use (or potential) qualifies for a GA under GN 509 when the proposed water use/activity is subjected to analysis using the DWS Risk Assessment Matrix (RAM). This assessment will implement the RAM and provide a specialist opinion on the appropriate water use authorisation.

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, as to the ecological viability of the proposed project.

1.2 Project Description

Transalloys (Pty) Ltd proposes to develop PV Energy Facility with a capacity of up to 55 MW and associated infrastructure on Portions 34 and 35 of the Farm Elandsfontein 309 JS and Portions 20 and 24 of the Farm Schoongezicht 308 JS within the Emalahleni Local Municipality. The subject property is located adjacent to the Transalloys existing smelter complex on Clewer Road 1034 in Emalahleni and the site is within the Emalahleni Renewable Energy Development Zone (REDZ 9). The purpose of this Solar PV Energy Facility is to partially meet Transalloys' current electricity demands and future expansion requirements. The plant will be a captive generating plant from which generated electricity will be fed directly into the existing Transalloys' smelter complex for direct consumption.

The Solar PV Energy Facility will include the following:

- Solar PV array comprising PV modules and mounting structures (Bifacial panels with single axis tracking system);
- Inverters and transformers;
- Cabling between the project components;
- 33 kV underground powerline;
- On-site facility substation and a power line to connect the solar PV facility to the existing Transalloys Substation;
- Security office, operations and control, and maintenance and storage laydown areas; and

- Access roads and internal distribution roads.

1.3 Specialist Details

Report Name	**WETLAND BASELINE & RISK ASSESSMENT FOR THE PROPOSED TRANSALLOY PHOTOVOLTAIC (PV) FACILITY**	
Reference	**Transalloy PV**	
Submitted to	savannah environmental	
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.	

1.4 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.

1.5 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 SBPM area and a 20 m corridor around the powerlines have been ground truthed with the surrounding 500 m regulated area being covered via desktop studies; and
- The GPS used for the survey has a 5 m accuracy and therefore any spatial features may be offset by 5 m.

1.6 Key Legislative Requirements

1.6.1 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).

1.6.2 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.

2 Methods

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.

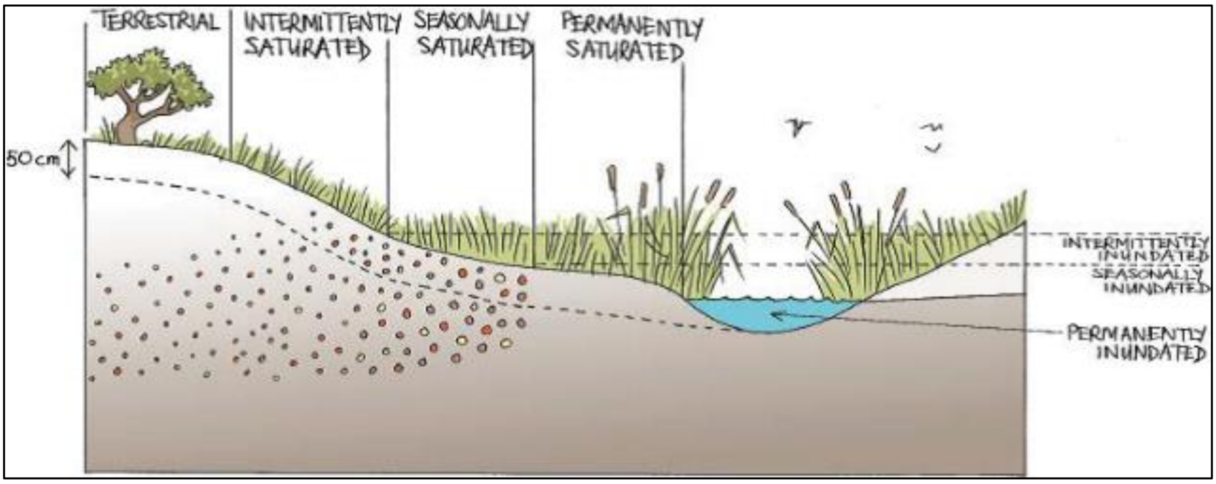

Figure 2-1 ***Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)***

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 Project Area

The proposed solar project is located approximately 10 km west of the town Emalahleni in the Mpumalanga Province of South Africa. The project in located south of the N4 between Witbank and Balmoral. The surrounding land use includes watercourses, residential areas, coal mining as well as agricultural fields.

The project area is situated in the B11K quaternary catchment within the Olifants Water Management Area (WMA) (see Figure 3-2).

3.1.2 Vegetation Types

The project area falls within the Eastern Highveld Grassland (Gm 12) vegetation type. This vegetation type is located in the Gauteng and Mpumalanga province within the plains between Belfast and Johannesburg. This vegetation type also extends to Bethal, the western areas of Piet Retief and Ermelo. The altitude in which this vegetation type occurs ranges between 1 520 meters above sea level to 1 780 meters above sea level, Mucina & Rutherford (2006).

The vegetation of this vegetation type is characterised by short and dense grasslands that occur in moderately undulating plains which include low hills and pan depressions. Small scattered rocky outcrops are common in this area with wiry, sour grasses accompanied by some woody species which include *Celtis africana, Parinari capensis, Protea caffra* etc.

The conservation status of the Gm 12 vegetation type is endangered with a target percentage of 24. Half of the area is already transformed into agriculture, mining, urban etc. with a handful of conservation areas still up and running. These include Holkranse, Nooitgedacht Dam and Morgenstond (just to name a few).

3.1.3 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Bb 13 land type. The Bb land type consists of plinthic catena. Upland duplex and margalitic soils are rare and dystrophic and/or mesotrophic red soils are not widespread.

According to Mucina & Rutherford (2006), the geology and soils aspect of this region is characterised by red to yellow sandy soils of the Ba and Bb land type. The geology of this region includes sandstone and shale of the Madzaringwe Formations (Karoo Supergroup).

3.1.4 Climate

This region is characterised by a strongly seasonal rainfall, dry winters and a mean annual precipitation of approximately 726mm and is relatively uniform across the distribution of the Gm 12 vegetation type. Incidence of frost ranges between 13 to 42 days a year and occurs more at higher elevations (see Figure 3-1).

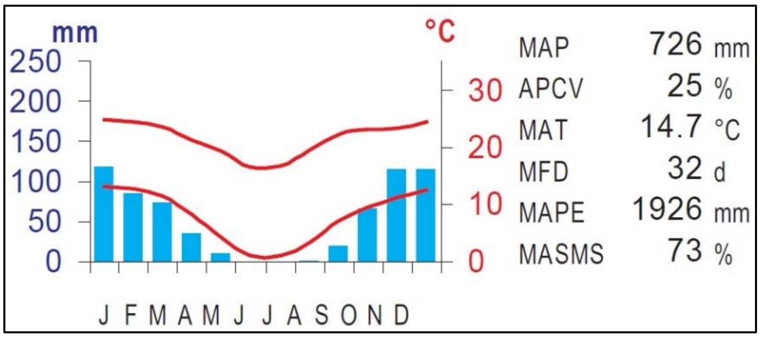

Figure 3-1 Climate for the project area

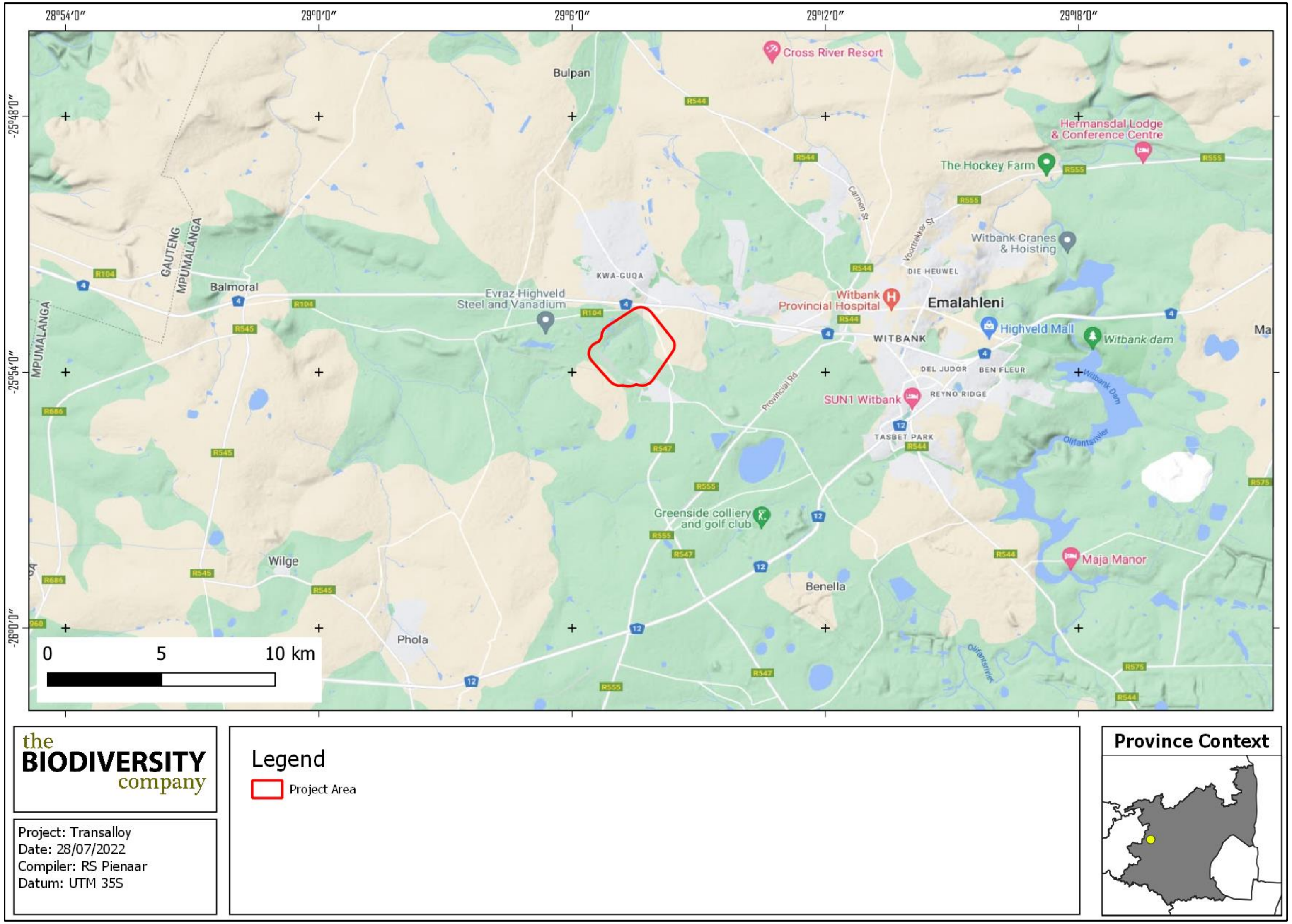

Figure 3-2 Location of the project area

3.1.5 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).

Three wetland types were identified by means of this data set, including channelled valley bottom wetlands, a depression and a hillslope seep (see Figure 3-3). The conditions of these wetlands ranges from “D/E/F” (heavily/critically modified) to “C” (largely modified).

3.1.6 National Freshwater Ecosystem Priority Area Status

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river 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) (Driver *et al.,* 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act’s (NEM:BA) biodiversity goals (Nel *et al.,* 2011).

Three wetland types were identified using the FEPA database namely, channelled valley bottom, unchannelled valley bottom and wetland flats, (see Figure 3-3). According to the database all these wetlands have been classified as being artificial wetland areas.

3.1.7 Topographical Inland Water and River lines

The topographical inland and river line data for “2529” quarter degree was used. This data set indicates two perennial rivers as well as two non-perennial rivers running through the 500 m regulated area. These areas indicate potential wetland areas (see Figure 3-3).

3.1.8 Mpumalanga Highveld Grassland Wetlands (MPHG)

The Mpumalanga Highveld Grassland Wetland Layer indicates additional wetland areas located within the 500 m regulated area, namely two channelled valley bottom wetlands and a hillslope seep wetland (see Figure 3-4).

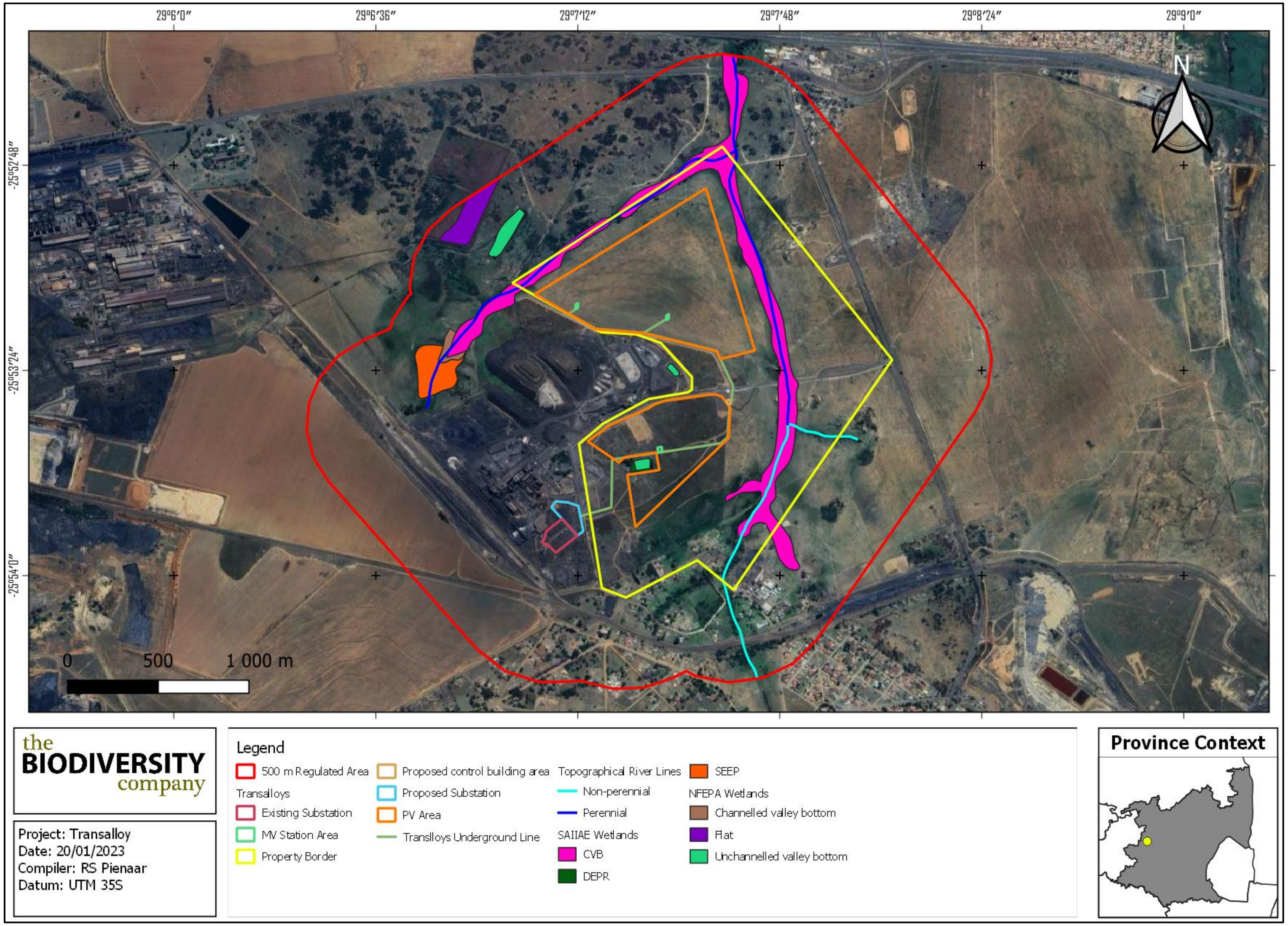

Figure 3-3 SAIIAE, NFEPA wetland and Topographical River areas located within 500 m regulated area

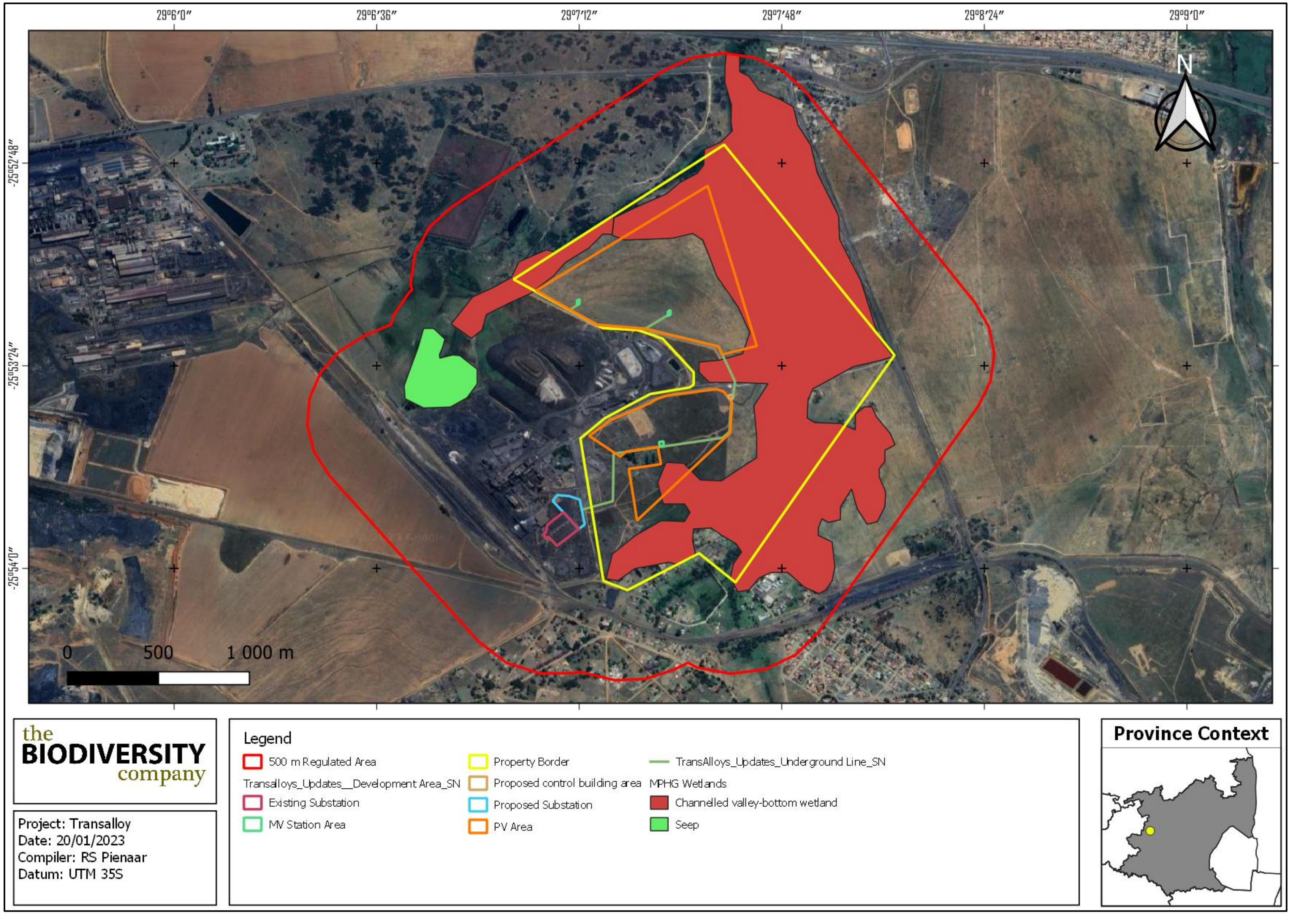

Figure 3-4 Illustration of the Mpumalanga Highveld Grassland Wetlands located within the 500 m regulated area

3.1.9 Terrain

The terrain of the 500 m regulated area has been analysed to determine potential areas where wetlands are more likely to accumulate (due to convex topographical features, preferential pathways, or more gentle slopes).

3.1.9.1 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 500 m regulated area ranges from 1 473 to 1 569 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 3-5).

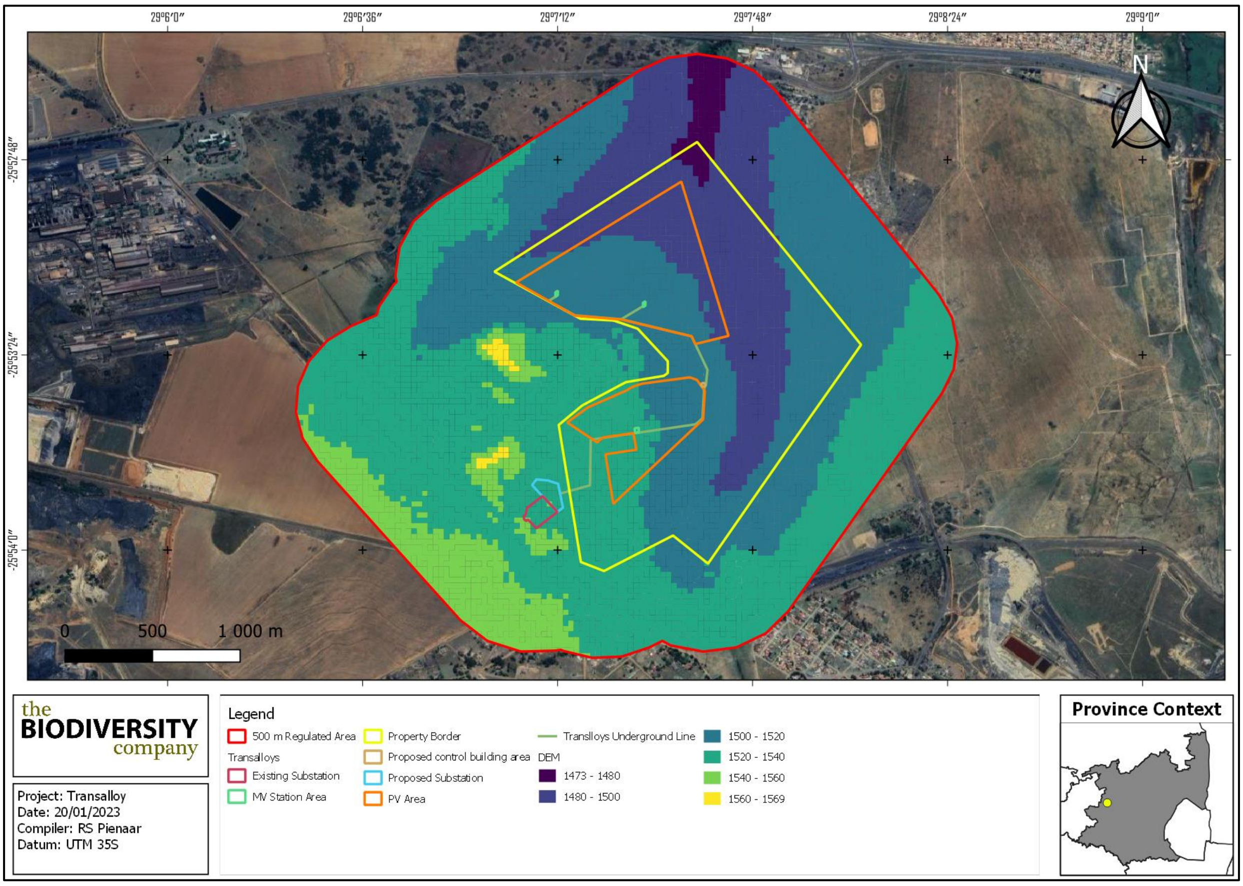

Figure 3-5 Digital Elevation Model of the 500 m regulated area

3.2 Field Assessment

3.2.1 Delineation and Description

During the site visit, five HGM units were identified within the 500 m regulated area (see Figure 3-7). The wetland areas were delineated in accordance with the DWAF (2005) guidelines (see Figure 3-6 and Figure 3-7). Three HGM units have been identified as hillslope seep wetlands, one as a channelled valley bottom wetland and one as an unchannelled valley bottom wetland. Along with the wetlands a leaking pipe as well as a few dams were also delineated. Although these systems do not classify as a wetland system it is important to note where they are and to preserve them.

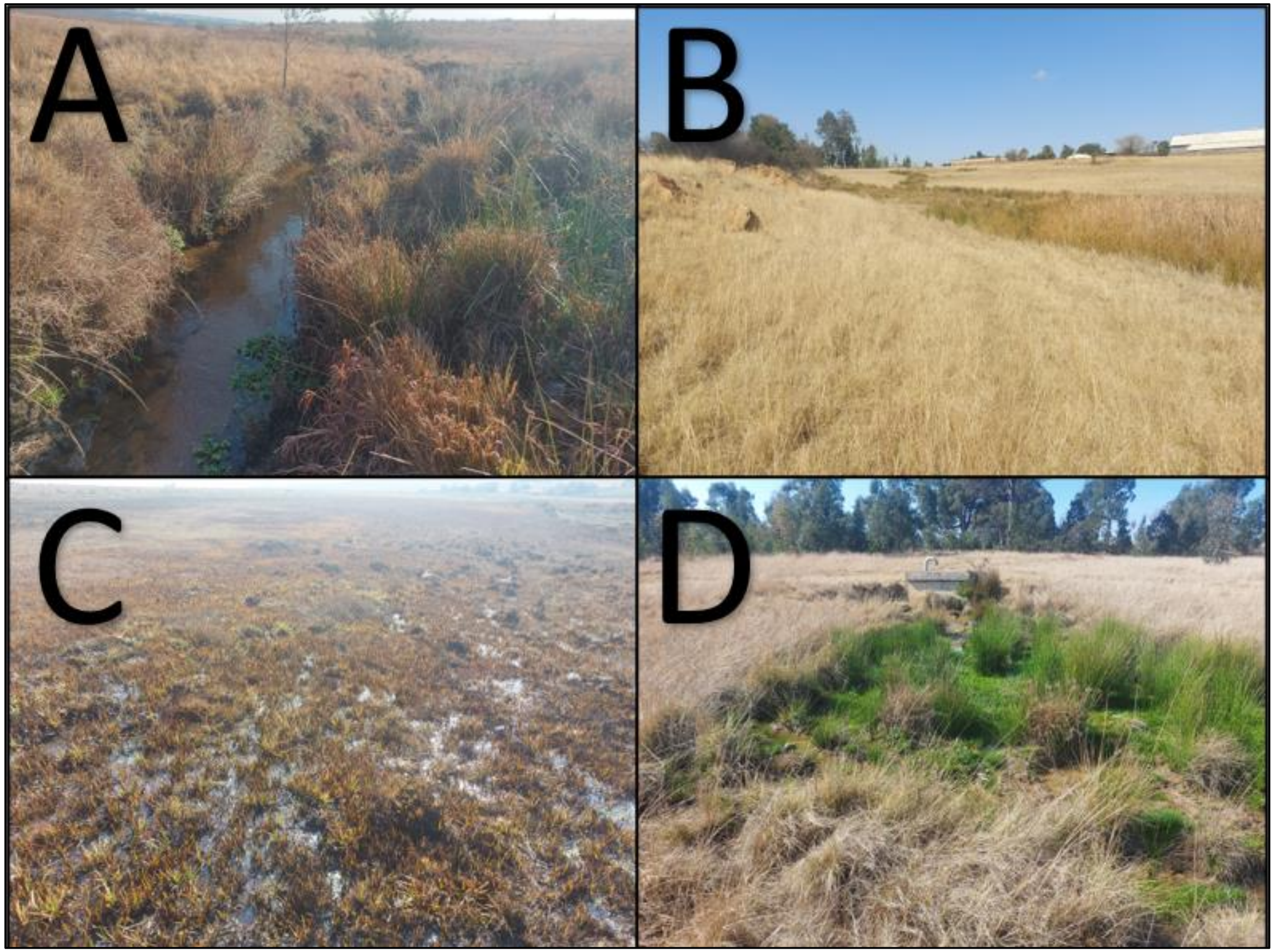

Figure 3-6 ***Photographical evidence of the different wet areas found within the 500 m regulated area, A) Channelled valley bottom. B) unchannelled valley bottom wetlands, C) Hillslope Seep, and D) Artificial wetland.***

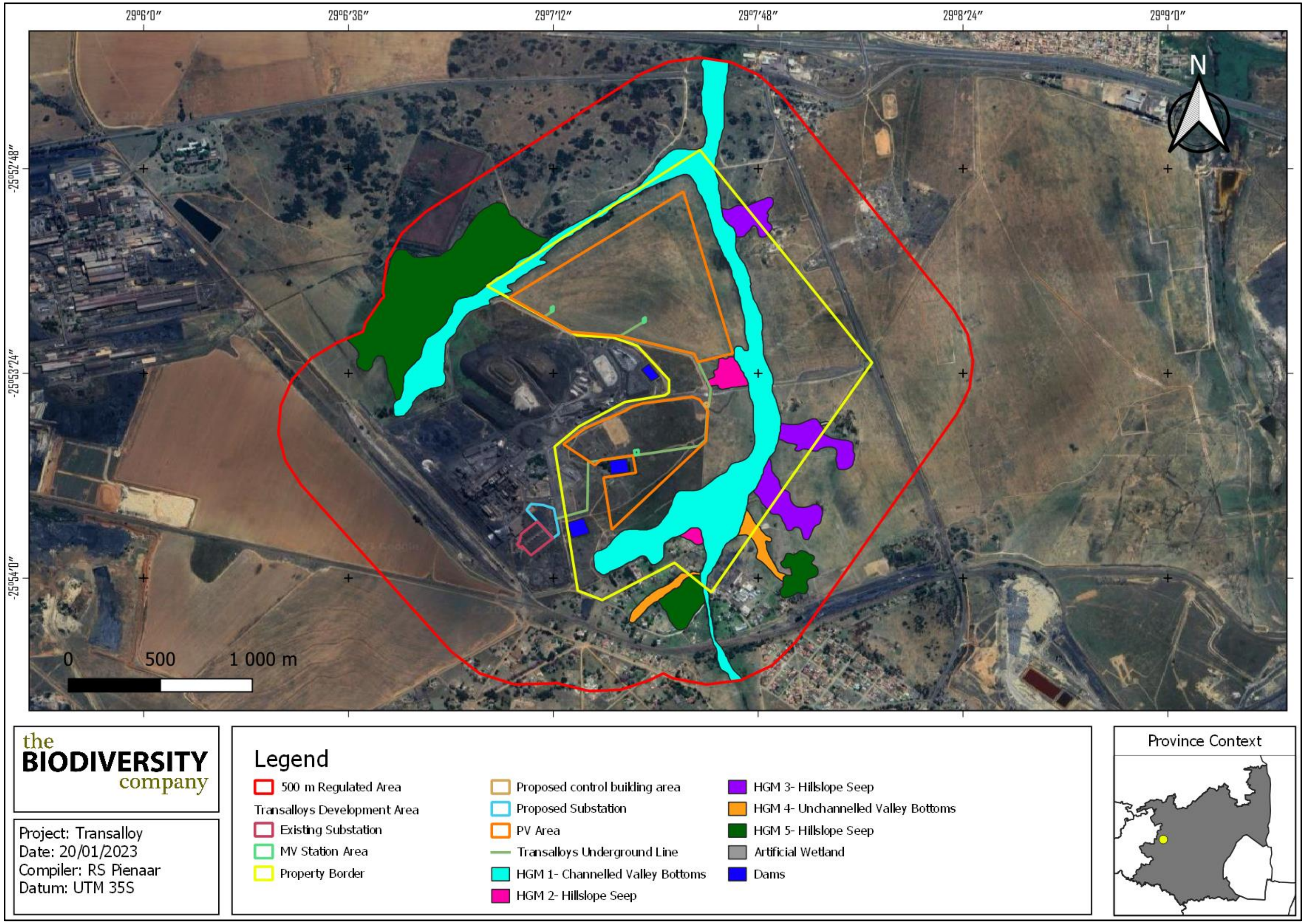

Figure 3-7 Delineation and location of the different HGM units identified within the 500 m regulated area

3.2.2 Unit Setting

Channelled valley bottom wetlands are typically found on valley floors with a clearly defined, finite stream channel and lacks floodplain features, referring specifically to meanders. Channelled valley bottom wetlands are known to undergo loss of sediment in cases where the wetlands' slope is steep and the deposition thereof in cases of low relief. Figure 3-8 presents a diagram of a typical channelled valley bottom, showing the dominant movement of water into, through and out of the system.

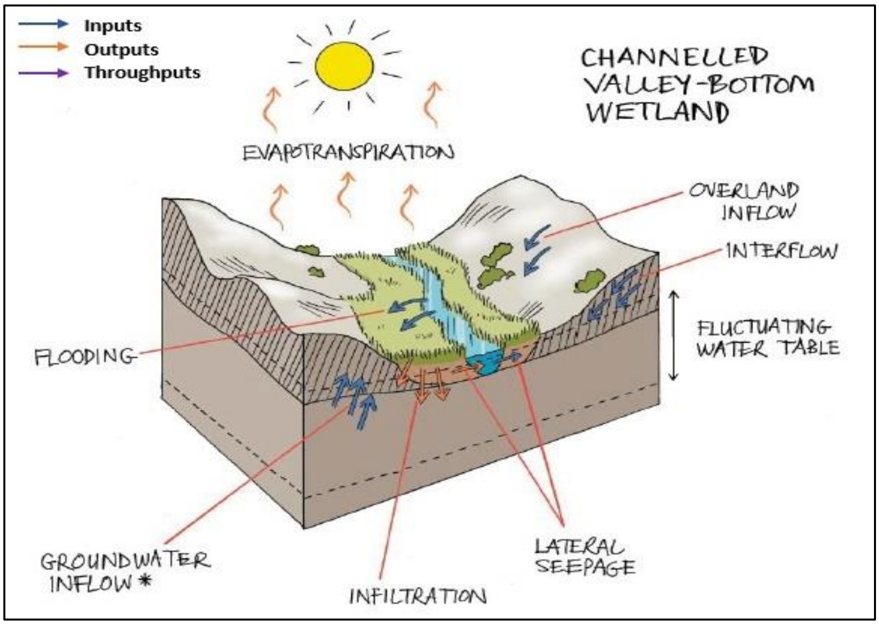

Figure 3-8 ***Amalgamated diagram of a typical channelled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)***

The hillslope seeps are located within slopes. Isolated hillslope seeps are characterised by colluvial movement of material. These systems are fed by very diffuse sub-surface flows which seep out at very slow rates, ultimately ensuring that no direct surface water connects this wetland with other water courses within the valleys. Figure 3-9 illustrates a diagram of the hillslope seeps, showing the dominant movement of water into, through and out of the system.

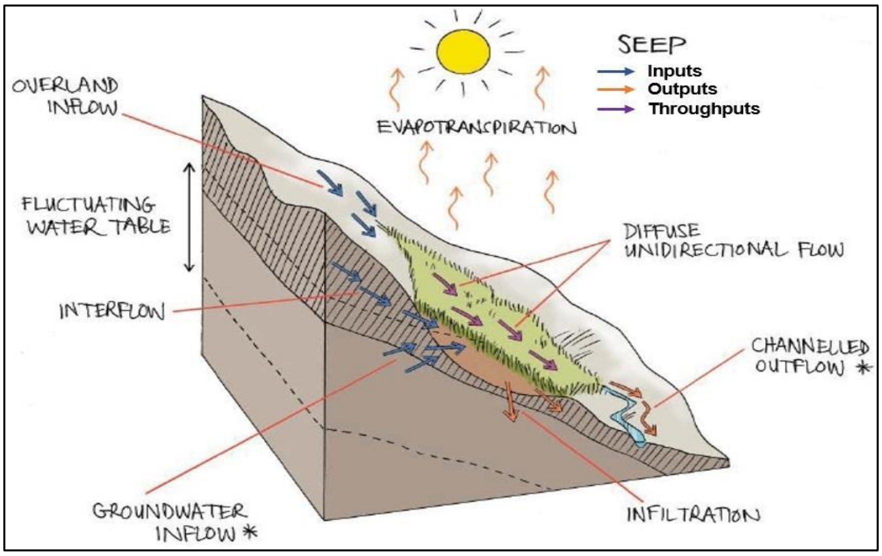

Figure 3-9 ***Amalgamated diagram of a typical hillslope seep, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)***

Unchanneled valley bottom wetlands are typically found on valley floors where the landscape does not allow high energy flows. Figure 3-10 presents a diagram of the relevant HGM unit, showing the dominant movement of water into, through and out of the system.

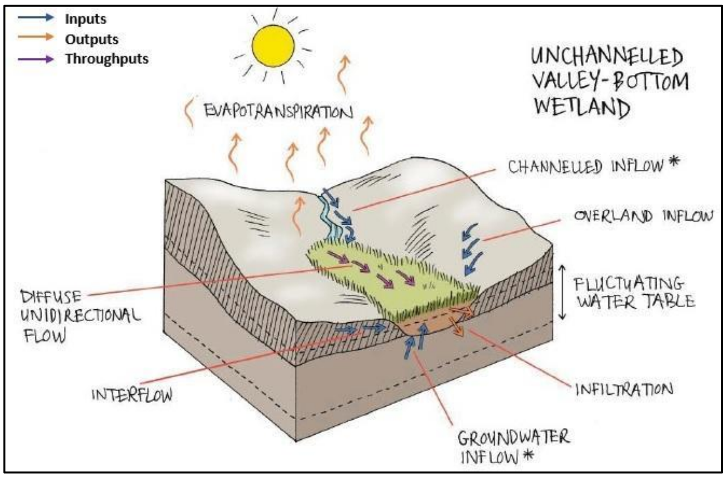

***Figure 3-10** Amalgamated diagram of a typical unchanneled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)*

3.2.3 Indicators

3.2.3.1 Hydromorphic Soils

According to (DWAF, 2005), soils are the most important characteristic of wetlands in order to accurately identify and delineate wetland areas. Two dominant soil forms were identified within the identified wetland, namely the Iswepe and Katspruit soil forms (see Figure 3-11) (Soil Classification Working Group, 2018).

The Iswepe soil form consists of an Orthic topsoil on top of an albic horizon. The soil family group identified for the Iswepe soil form on-site has been classified as the "1110" soil family given the dark topsoil and the grey albic subsoil horizon.

The Katspruit soil form consists of an Orthic topsoil on top of a Gleyic horizon. The 2210 family group is applicable to this soil form given the grey colours, the firm texture and structure of the soil form and the absence of lime.

Orthic topsoils are mineral horizons that have been exposed to biological activities and varying intensities of mineral weathering. The climatic conditions and parent material ensure a wide range of properties differing from one orthic topsoil to another (i.e. colouration, structure etc) (Soil Classification Working Group, 2018).

Albic horizons are often characterised by uniform white-greyish colours from the residual clay and quartz particles making up the matrix of the horizon. The main characteristic of this diagnostic horizon is a bleached colouration, which is a resultant product of distinct redox and ferrolysis pedological processes combined with eluvial processes. According to the Soil Classification Working Group (2018), albic horizons often receive lateral sub-surface flows from hillslope processes.

Gley horizons that are well developed and have homogenous dark to light grey colours with smooth transitions. Stagnant and reduced water over long periods is the main factor responsible for the formation of a gley horizon and could be characterised by green or blue tinges due to the presence of a mineral called Fougerite which includes sulphate and carbonate complexes. Even though grey colours are dominant, yellow and/or red striations can be noticed throughout a gley horizon. The structure of a gley horizon mostly is characterised as strong pedal, with low hydraulic conductivities and a clay texture, although sandy gley horizons are known to occur. The gley soil form commonly occurs at the toe of hillslopes (or benches) where lateral water inputs (sub-surface) are dominant and the underlaying geology is characterised by a low hydraulic conductivity. The gley horizon usually is second in diagnostic sequence in shallow profiles yet is known to be lower down in sequence and at greater depths (Soil Classification Working Group, 2018).

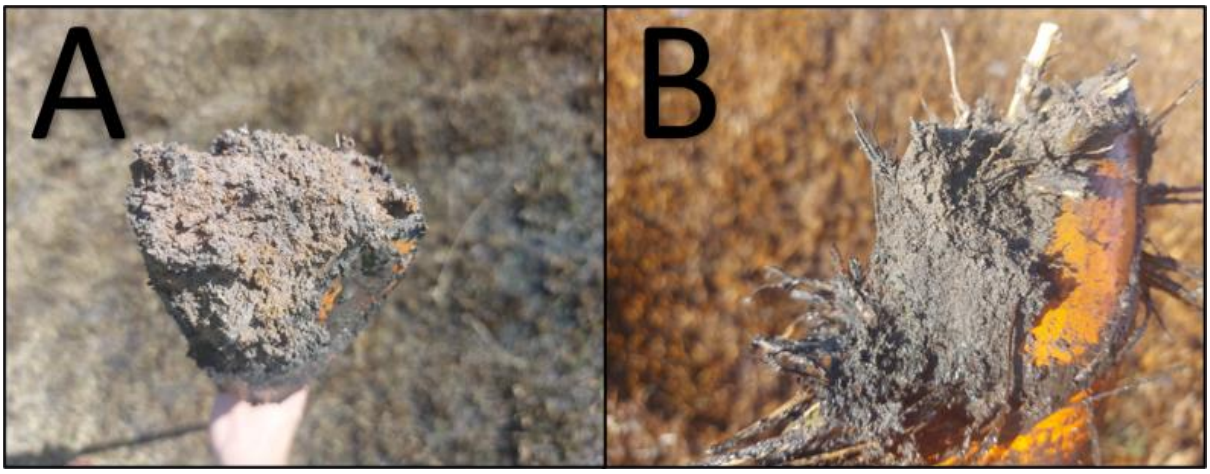

Figure 3-11 Different soil forms found inside the wetlands, A) Orthic topsoil with mottling of the Iswepe soil form. B) Gleyic horizon with signs of wetness.

3.2.3.2 Hydrophytes

Vegetation plays a considerable role in identifying, classifying and accurately delineating wetlands (DWAF, 2005). During the site visit, various hydrophytic species were identified (including facultative species). Examples include *Schoenoplectus spp., Typha capensis, Imperata cylindrica.* and *Phragmites australis* (See Figure 3-12).

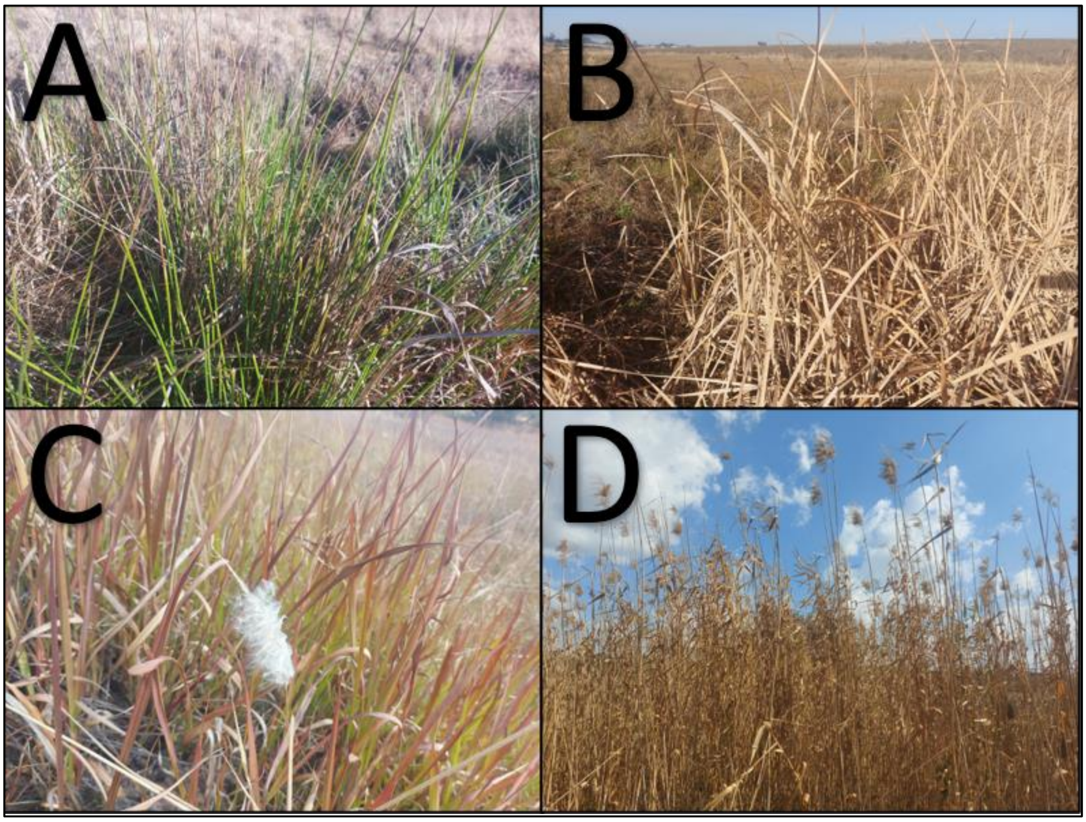

Figure 3-12 Hydrophytic vegetation identified within delineated watercourses. A) Schoenoplectus spp. B) Typha capensis. C) Imperata cylindrica D) Phragmites australis.

3.2.4 General Functional Description

Channelled valley bottom wetlands tend to contribute less to sediment trapping and flood attenuation than other systems. Channelled valley bottom wetlands are well known to improve the assimilation of toxicants, nitrates and sulphates, especially in cases where sub-surface flows contribute to the system's water source (Kotze et al., 2009).

Hillslope seeps are well documented by Kotze *et al*., 2009 to be associated with sub-surface ground water flows. These systems tend to contribute to flood attenuation given their diffuse nature. This attenuation only occurs while the soil within the wetland is not yet fully saturated. The accumulation of organic material and sediment contributes to prolonged levels of saturation due to this deposition slowing down the sub-surface movement of water. Water typically accumulates in the upper slope (above the seep). The accumulation of organic matter additionally is essential in the denitrification process involved with nitrate assimilation. Seeps generally also improve the quality of water by removing excess nutrient and inorganic pollutants originating from agriculture, industrial or mine activities. The diffuse nature of flows ensures the assimilation of nitrates, toxicants and phosphates as well provides erosion control. These Eco Services are not provided by the wetland given the nature of the typical seep's position on slopes.

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 (Kotze *et al.,* 2009).

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.

3.2.5 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). HGM units 1,4 & 5 scored "Moderately High" ecosystem service scores with HGM 3 scoring "Intermediate" and HGM 2 scoring "Moderately Low". The average ecosystem service scores for the delineated systems are illustrated in Table 3-1 and Figure 3-13.

Ecosystem services contributing to these scores include flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation, toxicant assimilation, erosion control, biodiversity maintenance and tourism and recreation.

Table 3-1 Average ecosystem service scores for delineated wetlands

Moderately High	Intermediate	Moderately Low
HGM 1	HGM 3	HGM 2
HGM 4		
HGM 5		

The HGM units that scored moderately high ecosystem services scores are located in close proximity to active mining activities or settlements where pollution flow into the systems. These wetlands then play an important role in the assimilation of toxicant, nitrates and phosphates from the water coulomb. This assimilation ensures cleaner water for use down steam. These wetlands also play a role in flood attenuation and sediment trapping through the high volume of hydrophytes present inside the systems. The hydrophyte vegetation also plays an important role in biodiversity maintenance by provided different habitats to charismatic animals and also provides resources for human use. During the site visit some cultural practises were also observed within HGM 1.

HGM 3 scored intermediate ecosystem services score due to the wetland type. Hillslope seep wetlands plays an important role by providing water through out the year. The HGM unit have hydrophyte vegetation even during the winter months which will provide resources for human use such as feeding for livestock. The HGM units will also act as a sink for toxicants and phosphates through the hydrophyte vegetation.

HGM 2 scored moderately low ecosystem services due to the lack of hydrophyte vegetation to provide resources as well as to aid in the assimilation of nutrients from the ecosystem. The wetlands are modified to such an extent that almost all of their functions are lost. The wetlands however still play some role in the ecosystem by providing water seeping from the water table to the surface.

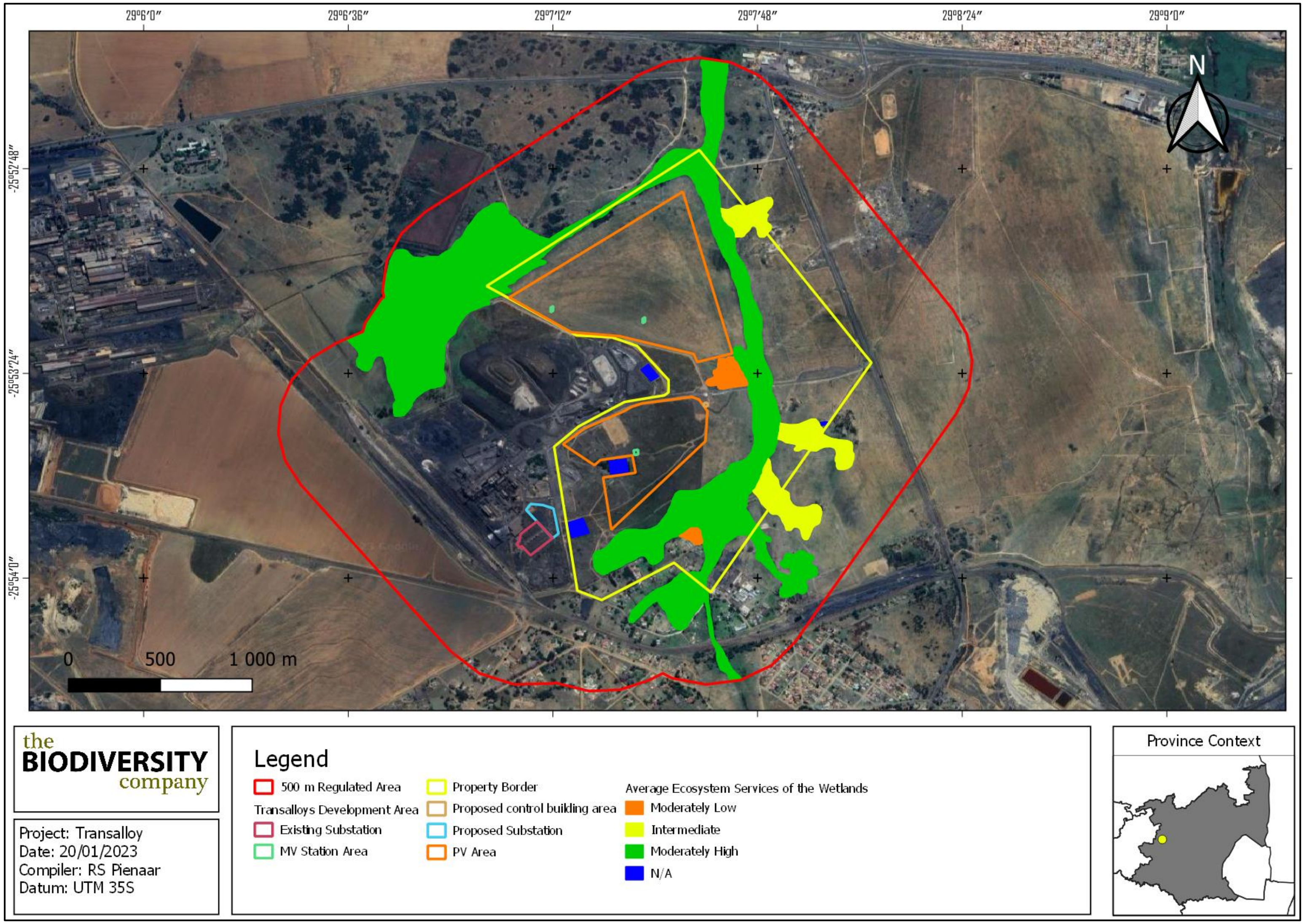

Figure 3-13 Average ecosystem service scores for the delineated wetland systems

3.2.6 The Ecological Health Assessment

The PES for the assessed HGM units is presented in Table 3-2 and Figure 3-14. The delineated wetland systems have scored overall PES ratings ranging between “Moderately Modified” (class C) to “Seriously Modified” (class E).

The HGM 4 that were rated as “Moderately Modified” is located to the south of the project area away from the active mining activities. The HGM unit is unchanneled valley bottoms running from a seep towards the channelled valley bottom. There are some modifications done to the banks of the wetlands but not to the same extent as the modifications to the rest of the HGM units.

The wetlands that were rated as “Largely Modified” are located in the more natural areas of the project area within the game farm. Although the wetlands are located within more natural areas, multiple anthropogenic impacts still occur on the systems. These systems are characterised by overgrazing and trampling by livestock as well as the building of fences and roads through the wetlands. There is mining going on within the catchment of the wetlands which will also alter the ecological state of the wetlands. The wetland that was rated as “Seriously Modified” is modified by the complete removal of hydrophyte vegetations as well as the presence of roads throughout the wetlands. The wetlands are also overgrazed by livestock and trampled.

Table 3-2 Average present ecological state of the wetlands

Moderately Modified	Largely Modified	Seriously Modified
HGM 4	HGM 1	HGM 2
	HGM 3	
	HGM 5	

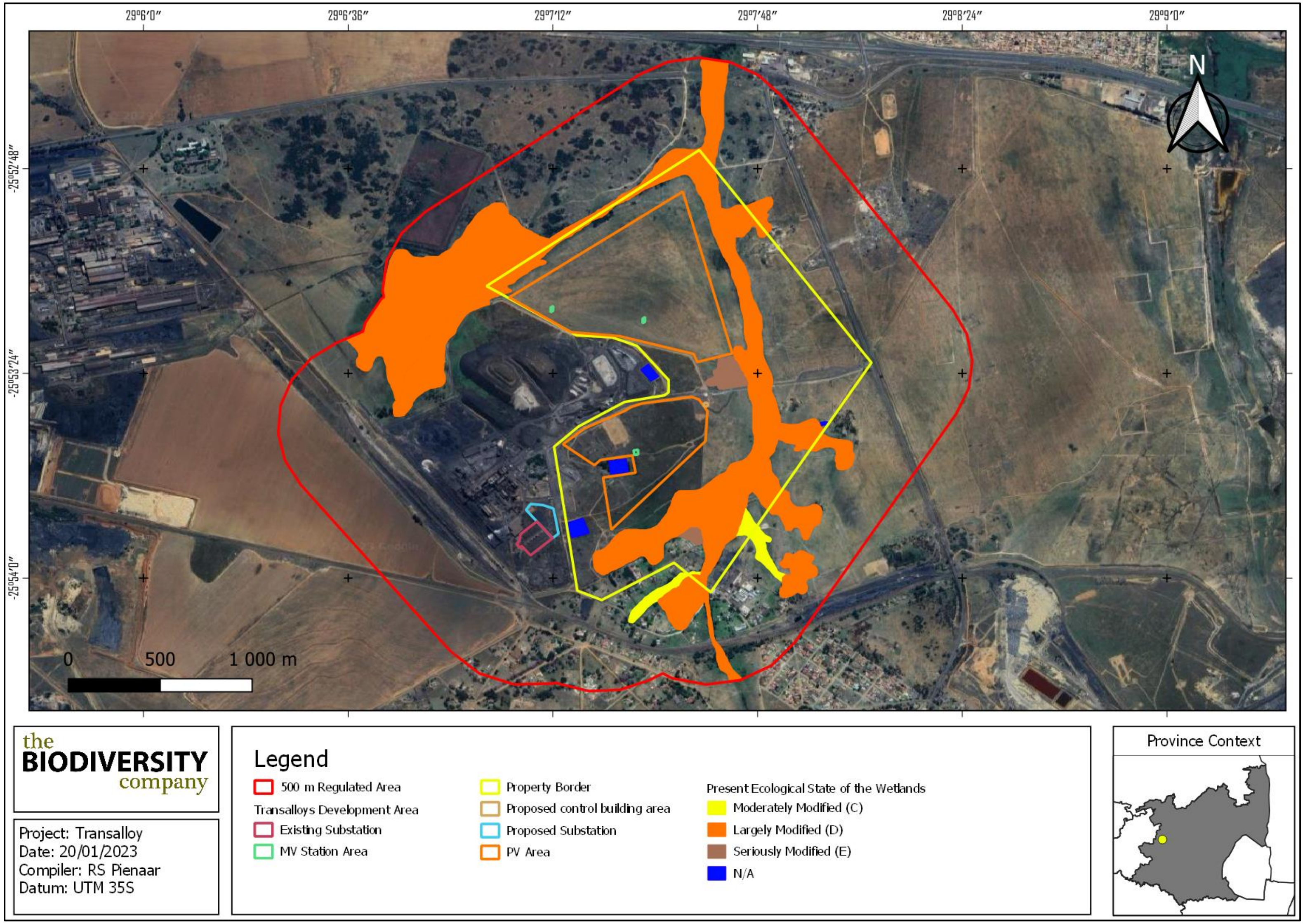

Figure 3-14 Overall present ecological state of delineated wetlands

3.2.7 The Importance & Sensitivity Assessment

The results of the ecological IS assessment are shown in Table 3-3. Various components pertaining to the protection status of a wetland are considered for the IS, including Strategic Water Source Areas (SWSA), the NFEPA wet veg protection status and the protection status of the wetland itself considering the NBA wetland data set. The IS for the channelled valley bottom HGM unit have been calculated to be "High", which combines the low protection status of the wet veg type and the low protection status of the wetland itself. The IS of the hillslope seep HGM units has been calculated to be "High" due to the low protection for both the wet veg and the wetland itself. IS for the unchannelled valley bottom wetland were calculated as "High".

Table 3-3 The IS results for the delineated HGM unit

HGM Type	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		
HGM 1	Mesic Highveld Grassland Group 4	Critically Endangered	Not Protected	D/E/F Seriously Modified	Critical	Poorly Protected	N	High
HGM 2,3 & 5	Mesic Highveld Grassland Group 4	Endangered	Not Protected	C	Critical	Not Protected	N	High
HGM 4	Mesic Highveld Grassland Group 4	Critically Endangered	Not Protected	N/A	N/A	N/A	N	High

3.2.8 Buffer Requirements

The scientific buffer calculation (Macfarlane *et al*., 2014) was used to determine the size of the buffer zones relevant to the proposed development of the PV facility The buffer size for the development was determined to be 15 m post mitigation (see Table 3-4 and Figure 3-15).

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

Aspect	Pre-Mitigation Buffer Size (m)	Post Mitigation Buffer Size (m)
PV facility	36	15

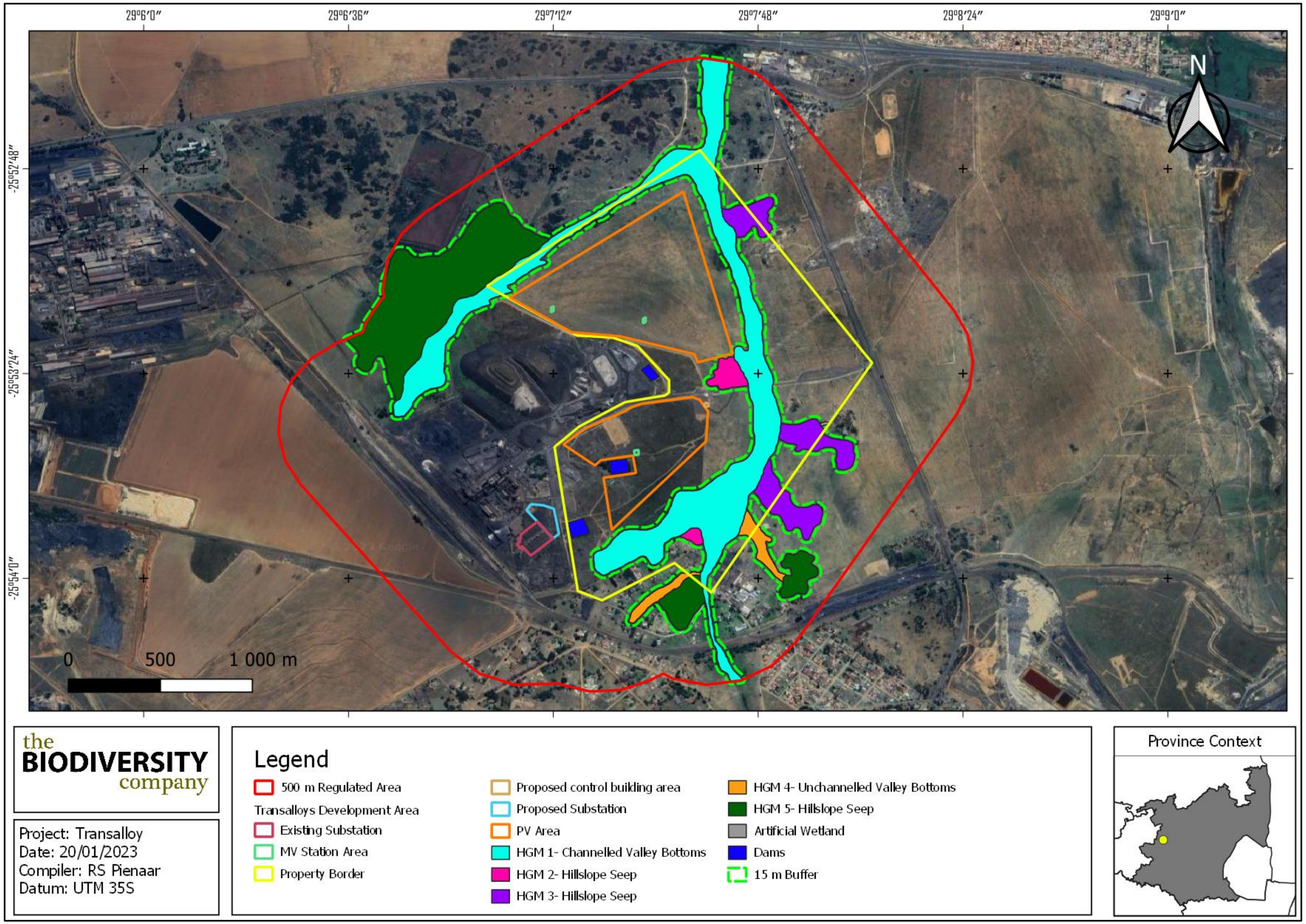

Figure 3-15 Recommended 15 m buffer zone for the delineated wetlands

4 Risk Assessment

4.1 Potential Impacts

Due to the presence of wetland systems within the 500 m regulatory area, a risk assessment was conducted in line with Section 21 (c) and (i) of the National Water Act, 1998, (Act 36 of 1998).

The impact assessment considered both direct and indirect impacts, if any, to the wetland system. The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) will be considered for this component of the study (Figure 4-1). 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 4-2 below indicates that avoidance will be possible.

Three levels of risk have been identified and considered for the overall risk assessment, these include high, medium and low risks. The high risks refer to the wetlands directly impacted by the PV solar panels themselves these risks can be avoided by placing the PVs outside the wetland buffer. Medium risk refers to wetland areas that are either directly affected or on the periphery of the infrastructure and at an indirect risk. These risks are associated with powerlines crossing over wetlands as well as the PV located over drainage features identified within the 500 m regulated area. Low risks are wetland systems beyond the project area that would be avoided, or wetland areas that could be avoided if feasible. The medium risks were the priority for the risk assessment, focussing on the expected potential for these indirect risks. The significance of all post-mitigation risks was determined to be low.

For this project it is evident that the proposed activities will encroach into the wetlands systems and thus the first step in the hierarchy which is the avoidance of the impacts on the wetland will not be met. We will thus focus on the second step of the hierarchy which is minimisation of the impacts. Figure 4-2 illustrates various aspects that are expected to impact upon the delineated wetlands for the project.

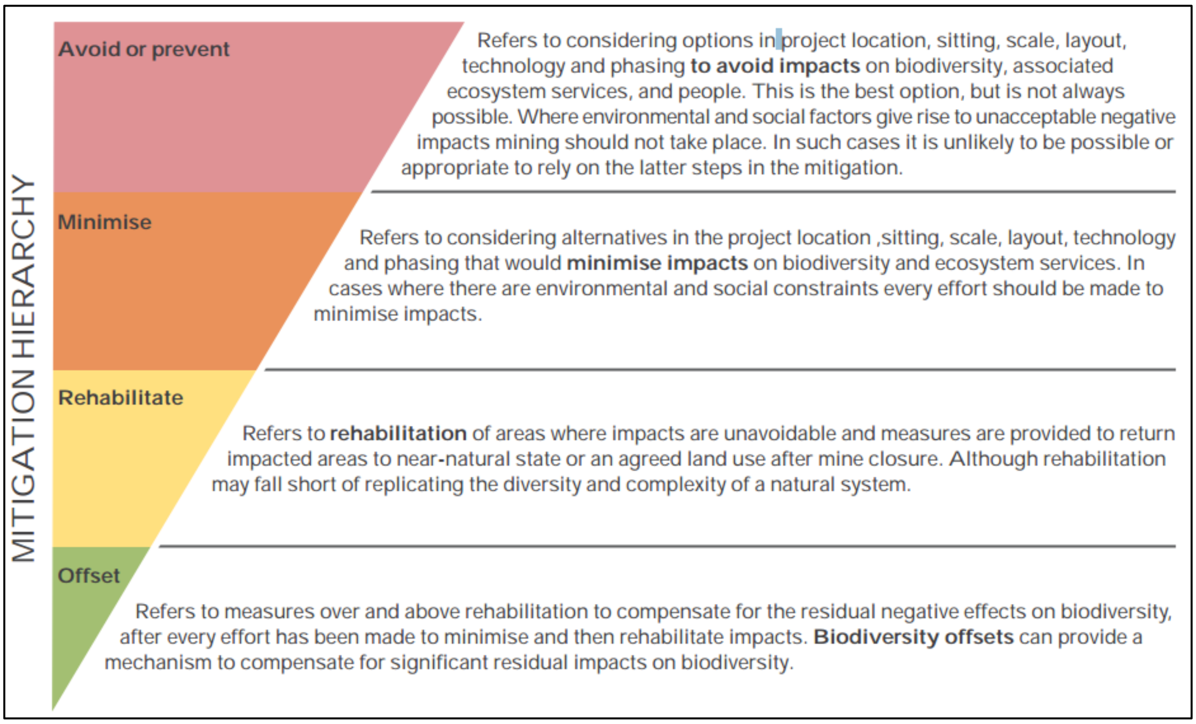

Figure 4-1 The mitigation hierarchy as described by the DEA (2013)

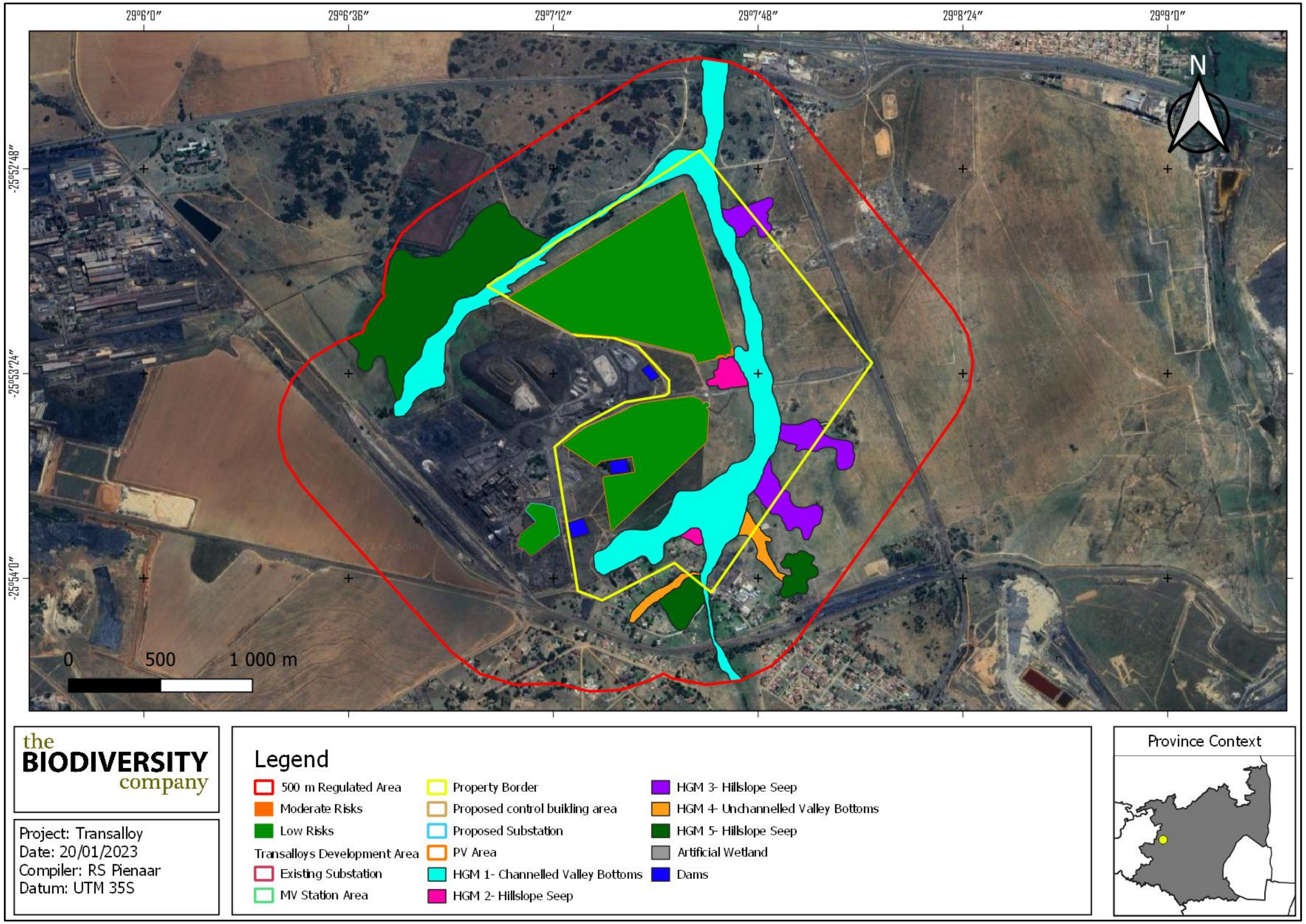

Figure 4-2 The identified risk areas

Table 4-1 Impacts assessed for the proposed project

Activity	Aspect	Impact
Construction Phase	Clearing of vegetation	• Altered surface flow dynamics; • Erosion; • Alteration of sub-surface flow dynamics; • Sedimentation of the water resource; • Direct and indirect loss of wetland areas; • Water quality impairment; • Compaction; • Decrease in vegetation; • Change of drainage patterns; • Altering hydromorphic properties; and • Indirect loss of wetland areas.
	Stripping and stockpiling of topsoil	
	Establish working area	
	Minor Excavations	
	Vehicle access	
	Leaks and spillages from machinery, equipment & vehicles	
	Solid waste disposal	
	Human sanitation& ablutions	
	Re-fuelling of machinery and vehicles	
	Laying of core samples	
	Backfill of material	
Operational Phase	Traffic	
	Waste Disposal	
	Altered Overflow Dynamics	
Decommissioning Phase	Removal of structures, machinery and equipment	
	Rehabilitation of site to agreed land use	

Table 4-2 DWS Risk Impact Matrix for the proposed project

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase (PV site, Substations and Powerline)								
Removal of vegetation	3	1	3	3	2,5	1	4	7,5
Stripping and stockpiling of soil	3	1	3	3	2,5	1	4	7,5
Establish working area	3	2	2	2	2,25	2	2	6,25
Minor Excavation	3	1	2	2	2	1	2	5
Vehicle access	1	2	2	2	1,75	1	2	4,75
Domestic and industrial waste	1	3	2	2	2	1	2	5
Storage of chemicals, mixes and fuel	1	3	2	2	2	1	2	5
Physical construction of buildings	3	2	2	2	2,25	1	2	5,25
Use of machinery/vehicles within and close to wetlands	2	3	2	2	2,25	1	4	7,25
Ablution facilities	1	3	2	2	2	1	2	5
Backfill of material	2	1	2	2	1,75	1	2	4,75
Operational Phase (PV site, Substations and Powerline)								
Traffic	2	3	3	2	2,5	2	5	9,5
Overland flow contamination	1	1	2	2	1,5	1	5	7,5
Increased anthropogenic activities in wetland	3	3	3	3	3	1	5	9
Loss of sub-surface flows	1	1	1	1	1	2	5	8
Decommissioning Phase (PV site, Substations and Powerline)								
Removal of structures, machinery and equipment	1	2	1	2	1,5	2	1	4,5
Rehabilitation of site to agreed land use	1	2	1	2	1,5	2	1	4,5

Table 4-3 DWS Risk Impact Matrix for the proposed project continued

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase								
Removal of vegetation	1	3	5	2	11	82,5	Moderate	Moderate
Stripping and stockpiling of soil	1	3	5	2	11	82,5	Moderate	Low
Establish working area	2	3	5	2	12	75	Moderate	Moderate
Minor Excavation	1	3	5	2	11	55	Low	Low
Vehicle access	3	3	1	3	10	47,5	Low	Low
Domestic and industrial waste	1	3	1	2	7	35	Low	Low
Storage of chemicals, mixes and fuel	1	3	1	3	8	40	Low	Low
Physical construction of buildings	1	3	1	2	7	36,75	Low	Low
Use of machinery/vehicles within and close to wetlands	3	3	5	2	13	94,25	Moderate	Low
Ablution facilities	3	3	5	2	13	65	Moderate	Low
Backfill of material	1	3	1	3	8	38	Low	Low
Operational Phase								
Traffic	5	2	1	1	9	85,5	Moderate	Moderate
Overland flow contamination	2	2	1	2	7	52,5	Low	Low
Increased anthropogenic activities in wetland	2	2	1	2	7	63	Moderate	Moderate
Loss of sub-surface flows	1	1	1	3	6	48	Low	
Decommissioning Phase								
Removal of structures, machinery and equipment	2	2	1	3	8	36	Low	Low
Rehabilitation of site to agreed land use	2	2	1	3	8	36	Low	Low

4.2 Mitigation Measures

The following general mitigation measures are prescribed:

- The wetland and buffer areas must be avoided;
- 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;
- Avoid the disturbance footprint and the unnecessary clearing of vegetation outside of this area.
- 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.
- 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;
- A stormwater management plan must be compiled and implemented for the project, facilitating the diversion of clean water to the delineated resources;
- Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash;
- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access;
- Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility;
- 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;
- Laydown yards, camps and storage areas must be within project area;
- Promote water infiltration into the ground beneath the solar panels. 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 over concrete or paving;
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
- It is preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces;
- All chemicals and toxicants to be used for the construction must be stored within the drilling site and in a bunded area;
- 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;
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems;

- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;
- Appropriately rehabilitate the project area by ripping, landscaping and re-vegetating with locally indigenous species;
- No dumping of material on-site may take place; and
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.

5 Conclusion and Recommendation

5.1 Baseline Ecology

During the site assessment, five HGM units were identified and assessed within the 500 m regulated area namely three hillslope seep wetland a channelled valley bottom wetland as well as a unchannelled valley bottom wetland. One of the HGM unit scored overall PES scores of C – “Moderately Modified” due to the modification to the hydrology and vegetation of the wetland through anthropogenic activities. Most of the HGM units scored overall PES scores of D – “Largely Modified” with the remaining HGM unit scoring an overall PES scores of E – “Seriously Modified”. All the HGM units scored “High” importance and sensitivity scores due to the high protection level of both the wet veg and wetland units. The average ecosystem service score ranges between “Moderately Low” and “Moderately High”. A 15 m post mitigation buffer was assigned to the wetland systems.

5.2 Specialist Recommendation

It is the opinion of the specialist that no fatal flaws were identified for the project. Due to the moderate risks associated with the project, a Water Use Licence is required for the project. The proposed layout will result in the partial loss of wetland areas, and this loss should be compensated for by means of onsite rehabilitation of remaining wetland areas.

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