Tate Environmental

Specialist Services

Bundu Sands

Water Resource Study

Gauteng, South Africa

April 2024

TATE ENVIRONMENTAL SPECIALIST SERVICES

Hydrology Biodiversity Ecology

Document Reference	Tate R. 2024. Bundu Sands. Water Resource Study, Gauteng, South Africa. V3.	
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Declaration

I, Russell Tate, declare that:

- I act as the independent specialist in this study;
- I will perform the work relating to the study 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 science relevant to this study, including knowledge of the Act, regulations and any guidelines that have relevance to the study;
- 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 study;
- 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.
- Please refer to appendix A for the specialist CV.

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TESS

April 2024

Executive Summary

Tate Environmental Specialist Services (TESS) was appointed by Aqua Strat Solutions to complete a water resource specialist study for areas associated with the proposed Bundu Sands Project located approximately 9 km northwest of Atteridgeville Gauteng Province, South Africa.

The aim of this study was to derive the extent and condition of the watercourses associated with the project and investigate the nature of the anticipated impacts of the activities.

The hydrological setting of the project was within the A21H quaternary catchment of the Limpopo Water Management Area. The nearest Sub Quaternary Reach associated with the project includes A21H-01069 of the Swartspruit.

The outcome of this assessment delineated 2 watercourse hydrogeomorphic units within the AoI. The summarised information is presented in Table E-1. These watercourses were derived to range from seriously modified (class E) to largely modified (class D) Present Ecological Status (PES). The watercourses were classified as having Very High and High Ecological Importance and Sensitivity (EIS) ratings. A scientific buffer was calculated for the watercourses, where a 35m buffer for wetlands and a 30m buffer for drainage lines was utilised to protect these sensitive environments.

Table E-1: PES and EIS Summaries

Watercourse Unit	PES	EIS	Buffer
HGM1	Class E	Very High	35m
HGM2	Class D	High	35m

The outcomes of the risk assessment indicate minor impacts from the proposed activities. The minor impacts can be attributed to the use of the existing disturbed areas as well as the relative minor scale of the project. Implementation of sediment and stormwater controls is expected to minimize impacts on wetlands.

In conclusion, no fatal flaws were identified for the proposed activities, provided that the recommended mitigation actions, including avoidance measures, are implemented.

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1 Introduction

Tate Environmental Specialist Services (TESS) was appointed by Aqua Strat Solutions to complete a water resource specialist study for areas associated with the proposed Bundu Sands Project located approximately 9 km northwest of Atteridgeville Gauteng Province, South Africa (Figure 2-3).

This document presents the information relating to the wetland and freshwater biodiversity components (water resource) required as part of the process to obtain environmental authorisation (EA) and Water Use License (WUL) application for the proposed development.

Details pertaining to the proposed activities are provided in Section 5.3.2 of this report. The proposed project will be for the expansion of an existing historical quarry where processing activities are to take place on existing disturbed footprint areas.

The aim of this study was to derive the extent and condition of the watercourses associated with the project and investigate the nature of the anticipated impacts of the activities. In line with the aims of the study, the following Scope of Work (SoW) was established:

1. Comply with the specialist assessment protocols established in Government Gazette 43110 – GN320 and other relevant legislation.
2. Assess the nature and extent of the watercourses associated with the development;
3. Establish the Present Ecological Status (PES) of the associated watercourses;
4. Provide shapefiles and maps which visualise sensitive habitats;
5. Provide a risk assessment for the completed activities; and
6. Provide recommendations for mitigation and avoidance actions.

1.1 Definitions

According to the National Water Act (NWA) Act Number 36 of 1998 the definition of wetland and riparian areas are provided as:

- **Wetland**: Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.
- **Riparian:** The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

Further definitions provided in the NWA defines a watercourse as:

- 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
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse.
- The watercourse includes, where relevant its bed and banks.

The definition of the extent of a watercourse is defined in the amendment of the General Authorisation for section 21 (c) and (i) water uses (RSA Government, 2016). The extent of the watercourse 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; and
- Wetlands and pans: the delineated boundary (outer temporary zone) of any wetland or pan.

The definition of wetland areas is further defined by the Department of Water and Forestry (DWAF) 2005 guidelines (DWAF, 2005) where the following is considered pertinent to their classification:

- The presence, either permanently, seasonally or temporarily, of water at or near the surface
- Distinctive redoximorphic features in the soils, and
- Vegetation which is adapted to or tolerant of saturated soils.

2 Description of the Study Area

The study area was located approximately 9 km northwest of Atteridgeville Gauteng Province, South Africa (Figure 2-3). The Mean Annual Precipitation (MAP) for the derived Area of Interest (AoI) over the periods 2009-2022 was 695 mm, peaking in 2014 at 900 mm, with the lowest value recorded in 2015 at 435 mm (Figure 2-1). The temporal distribution of rainfall in the AoI consisted of a unimodal flood regime where peak precipitation volumes are observed in the summer between November and March (Figure 2-2).

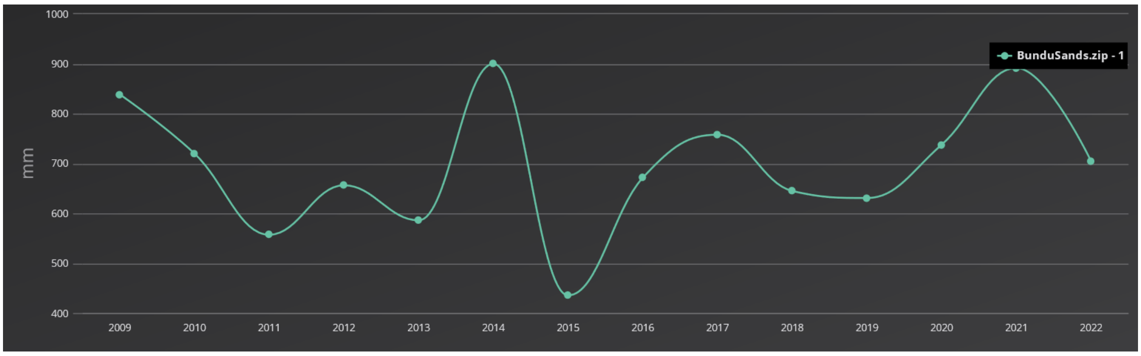

Figure 2-1: Annual precipitation in the Area of Interest (WaPOR, 2024)

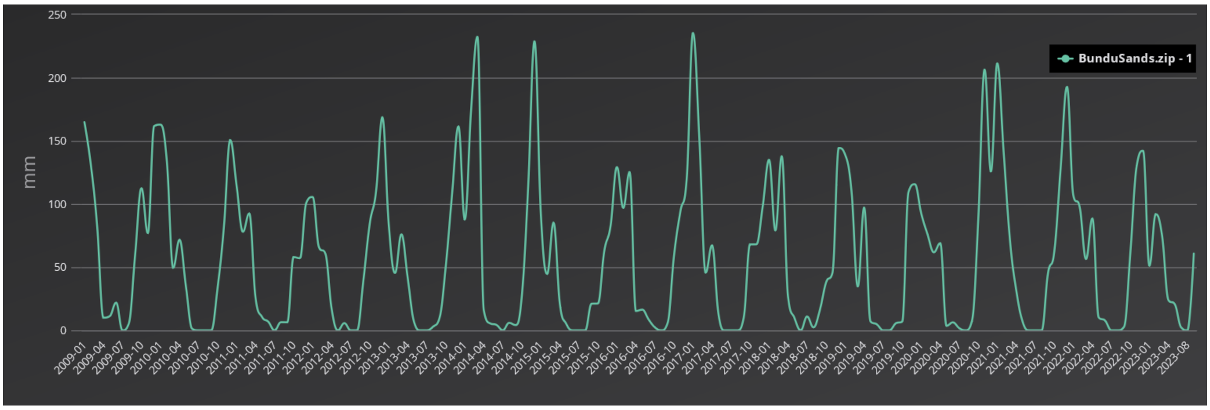

Figure 2-2: Monthly precipitation rates in the Area of Interest between 2009 and 2022 (WaPOR, 2024)

The hydrological setting of the project was within the A21H quaternary catchment of the Limpopo Water Management Area. The nearest Sub Quaternary Reach associated with the project includes A21H-01069 of the Swartspruit, a tributary that flows into the Crocodile River within the Hartbeespoort Dam. The National Freshwater Ecosystem Priority Area (NFEPA), National Biodiversity Assessment (2018) and South African topographical maps indicated that there are non-perennial watercourses, impoundments and an Unchanneled Valley Bottom (UVB) related watercourses within the AoI (Figure 2-4,Figure 2-5).

Figure 2-3: Hydrological and Local Setting of the Study Area

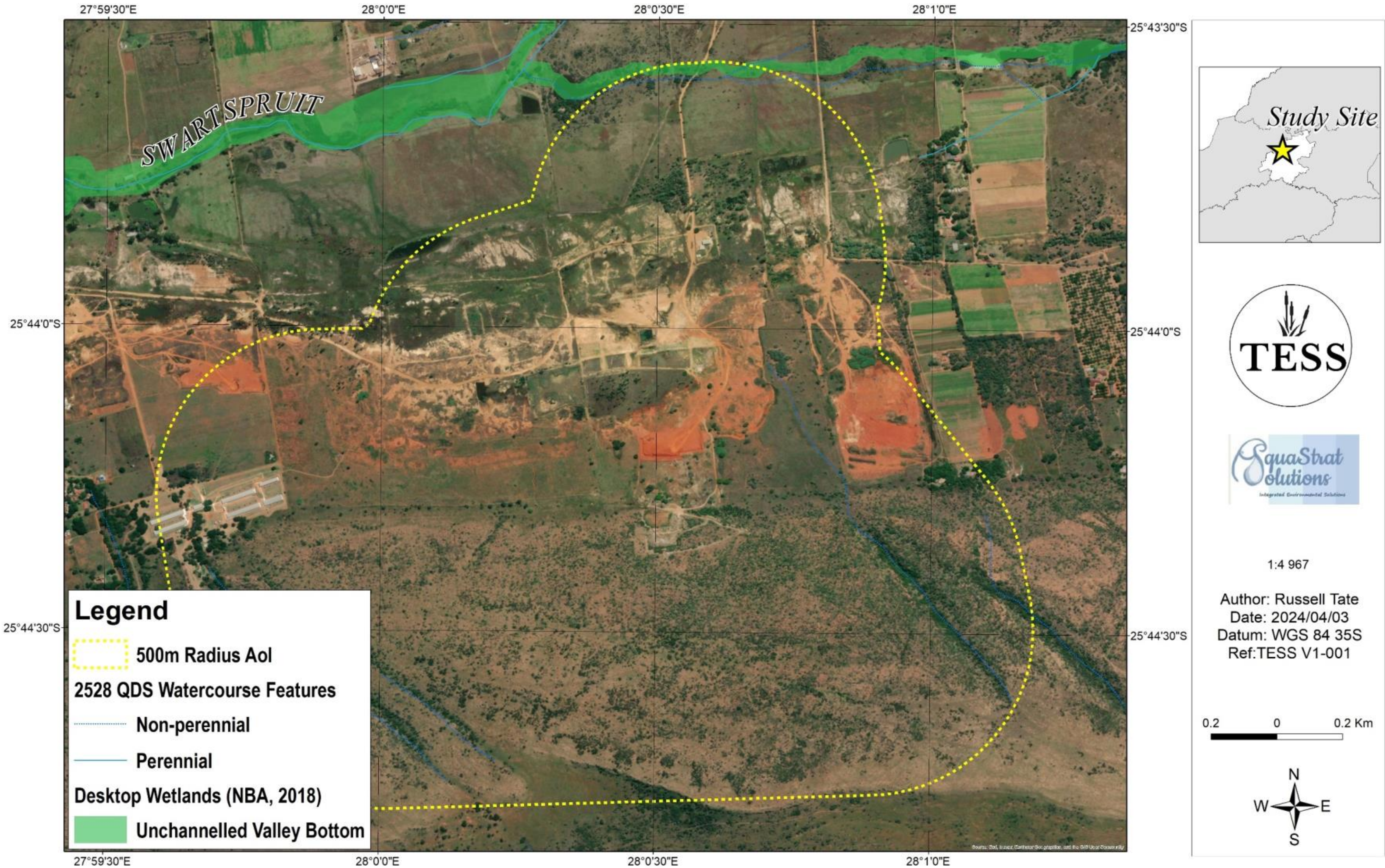

Figure 2-4: Desktop Wetlands (NBA, 2018)

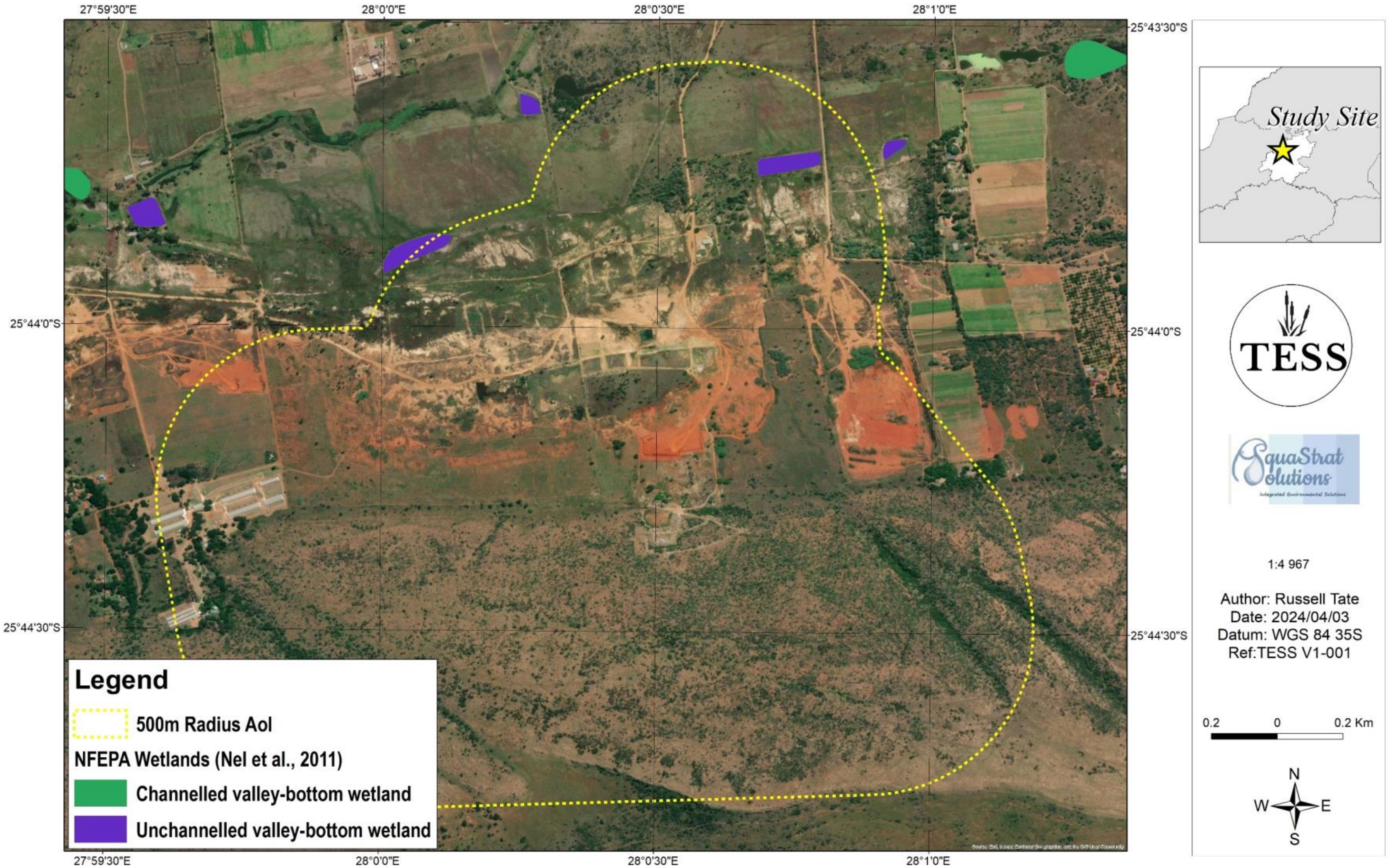

Figure 2-5: Desktop Wetlands (NFEPA)

3 Methods

3.1 Survey

A single survey was completed for this study and the survey was between the 7th of March 2024. The proposed development infrastructure areas was enlarged by 500m to delineate the screening area. This 500m screening area was considered for the watercourse assessment.

3.2 Wetland Ecology

Following the desktop assessment, the wetland areas were delineated in accordance with the procedures stipulated in Department of Water and Sanitation (DWS) (2008) guidelines, where a cross section of a typical wetland profile is presented in Figure 3-1.

The identification of the wetland areas was completed by considering the following specific indicators:

- The terrain unit Indicator was used to identify areas in the landscape where wetlands are likely to occur;
- The soil form indicator, utilised the soil classifications where focus was drawn to soils that are associated with saturation;
    - Soils were assessed using a 75mm open bucket soil auger where notes on soil condition were made up to a depth of 50cm.
- The soil wetness indicator was utilised to study the morphological signatures of the soil profiles;
    - The following characteristics were used:
        - Permanent – Prominent Grey Matrix, Few to no high chroma mottles, sulphuric odour
        - Seasonal – grey matrix >10%, many low chroma mottles
        - Temporary – Minimal grey matrix <10%, few high chroma mottles
- The vegetation indicator was then used to confirm and identify hydrophilic vegetation associated with saturated soils according to the lists provided in DWAF (2005).

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) was used to classify the wetland hydrogeomorphic (HGM) types for this study (Ollis et al., 2013). This system uses a hierarchical classification where defining a wetland is based on the principles of the HGM approach which includes the assessment of the structural features of the wetland (Ollis et al., 2013).

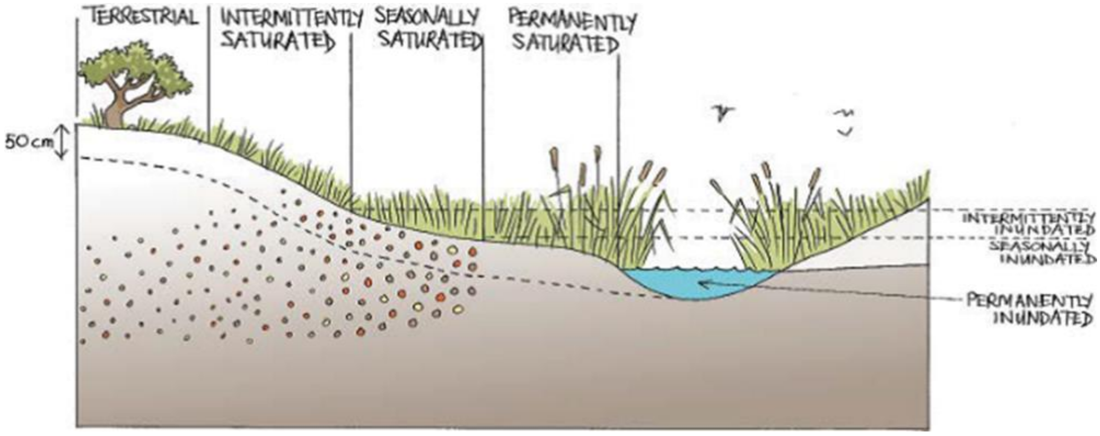

Figure 3-1: Cross section through a wetland (Ollis et al., 2013)

3.2.1 Literature Survey

The literature and spatial databases utilised to inform this study are presented below:

- Wetland Map 5 (NBA, 2018)
- National Freshwater Ecosystem Priority Areas (NFEPA, Nel et al., 2011)

3.2.2 Wetland Present Ecological Status

The overall approach used in the PES method followed the established guidelines presented in Macfarlane et al. 2020. A level 1 assessment was completed. The method relies on the assessment of land cover types within an established watershed, within incoming stream and wetland buffers, as well as within homogenous disturbance units established in the delineated wetland.

The PES method relies on the comparison of the subject wetland to an expected reference condition. The method makes use of 4 primary metrics including:

- Hydrology
- Geomorphology
- Water quality
- Vegetation

Through the assessment of land cover and the nature of impacts within disturbance units, the wetland can be classified into a PES category as provided. The PES field techniques included the assessment of the 4 metrics within the homogenous disturbance units.

Table 3-1: The Present Ecological Status categories, (Macfarlane et al., 2020)

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**

Impact Category	Description	Impact Score Range	PES
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**

3.2.3 Eco-Services and Functional Assessment

Wetland areas and watercourses are known to provide numerous and important ecosystem services to local communities. It is therefore of importance to study the ecological services of a wetland system in order to provide data which supports effective water resource management.

The assessment of the ecosystem services supplied by the identified wetland was conducted as per the guidelines as described in the WET-EcoServices manual (Kotze et al., 2020). A desktop assessment was completed prior to the survey where the following aspects related to domestic, agricultural, subsistence, commercial and recreational activities were noted:

- Downstream water users
- Within wetland water users
- Within wetland and downstream effected communities

The wetlands under consideration were then rated based on the findings from a field survey and further informed by aerial imagery. Following the rating of criteria the eco-services were classified into categories as provided in Table 3-2.

Table 3-2: 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

3.2.1 Ecological Importance and Sensitivity

The method used for the Ecological Importance and Sensitivity (EIS) determination was adapted from the method as provided by DWS (1999). The method takes into consideration PES scores obtained for WET-Health as well as function and service provision of the systems to enable determination of the representative EIS category for the wetland feature. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 3-3, (Rountree et al., 2013).

Table 3-3: 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**

3.3 Limitations and Assumptions

The following limitations and assumptions form part of this study:

- The results of this study were derived from rapid ecological assessments.
- No floodline delineation was completed for this assessment.
- Areas directly affected by the project were surveyed, whilst within the 500m screening area, desktop information was utilised.
- Watercourses are defined by dynamic processes. Temporal variation of the extent and condition of the watercourses is a naturally occurring process. Therefore, the spatial extent of the watercourses provided in this study should be reconsidered within at least 5-10 years from the publishing of this study.
- No hydrological assessment was completed for this assessment.
- The delineations of the project were restricted within the accessible farm portions.
- Aside for discussions with local land owners and specialists working on the overall project, there was no additional consultation completed for this project.
- The project AoI has been significantly altered by historical mining activities which has likely reduced the elevation of the ground level.
- The PES assessment completed for HGM2 was primarily based off desktop based land cover and informed thereafter by survey information.

4 Results

4.1 Screening Tool Results

The results of the Department of forestry, fisheries and the environment screening tool for aquatic biodiversity is provided in Figure 4-1. The screening tool identified “Very High” sensitivities for the various identified wetland system located to the north of the AoI. Considering the sensitivity level of the proposed development area, this study was completed and serves as the site sensitivity verification report.

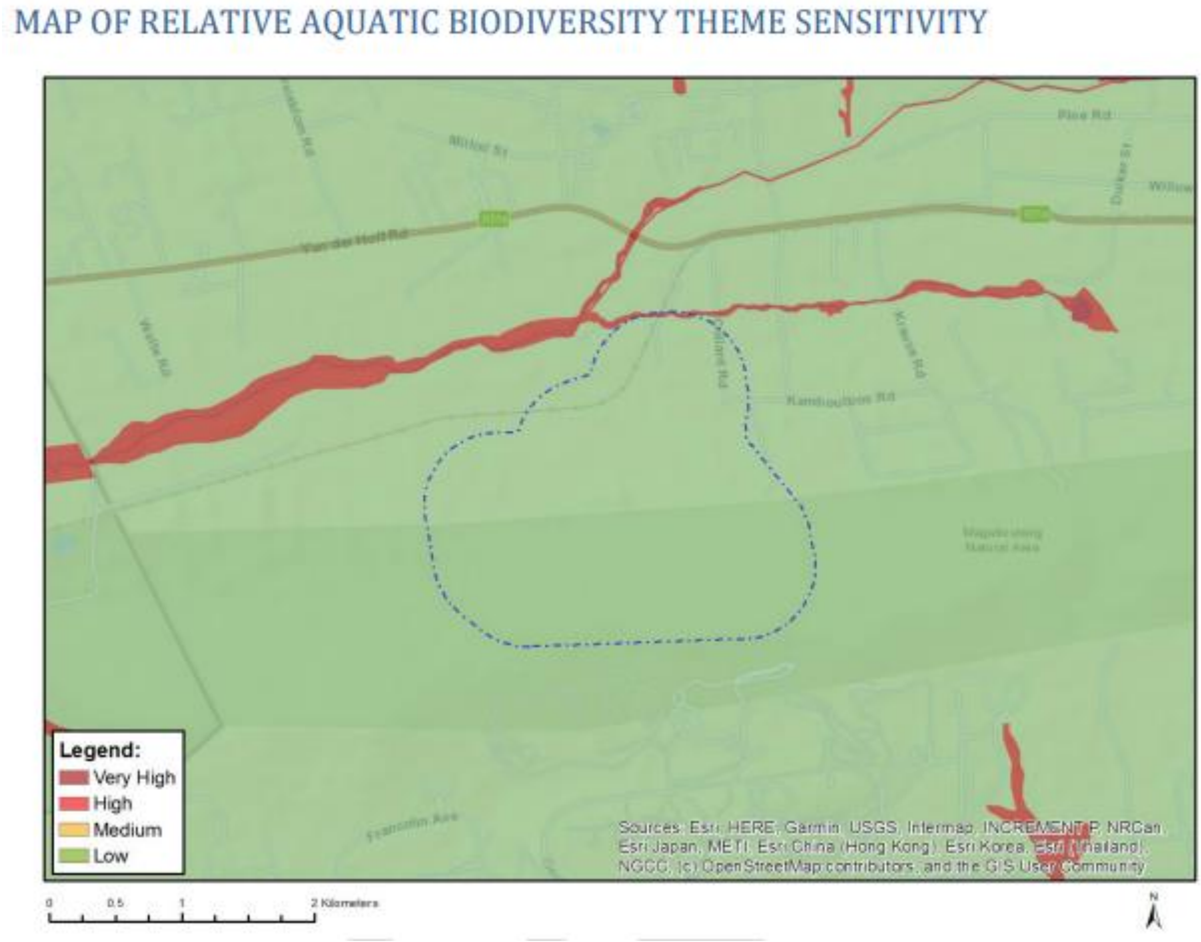

Figure 4-1: Results of the Screening Tool Assessment

4.2 Watercourse Type and Classification

Two HGM types were observed during the survey within the 500m screening area. These HGM types consisted of seep and UVB wetland types (Figure 4-2 and Figure 4-3). Several artificial wetlands were also identified during the survey and included historical sediment management ponds and impoundments created to capture surface runoff (Figure 4-5). Additional drainage features associated with the project include drainage lines (Figure 4-4). The wetland areas could be separated into 2 distinct HGM units as detailed in Table 4-1. The wetland delineations are provided in Figure 4-7.

Table 4-1: Wetland classification within 500m screening zone

HGM Name	Hectares	System	DWS Ecoregion/s	NFEPA Wet Veg Group/s	Landscape Unit	HGM Type
HGM1	76.9	Inland	Western Bankenveld	Central Bushveld Group	Slope	Seep

HGM Name	Hectares	System	DWS Ecoregion/s	NFEPA Wet Veg Group/s	Landscape Unit	HGM Type
HGM2	1.98	Inland	Western Bankenveld	Central Bushveld Group	Valley	Unchanneled Valley Bottom

Figure 4-2: The seep unit at HGM1 (March 2024)

Figure 4-3: The UVB unit at HGM2 (March 2024)

Figure 4-4: Drainage line system with dense stands of trees within the AoI (March 2024)

Figure 4-5: An artificial system (impoundment) located in the AoI (March 2024)

Figure 4-6: A large pond constructed at the terminus of a berm constructed to likely constructed to capture sediments from mining activities (March 2024)

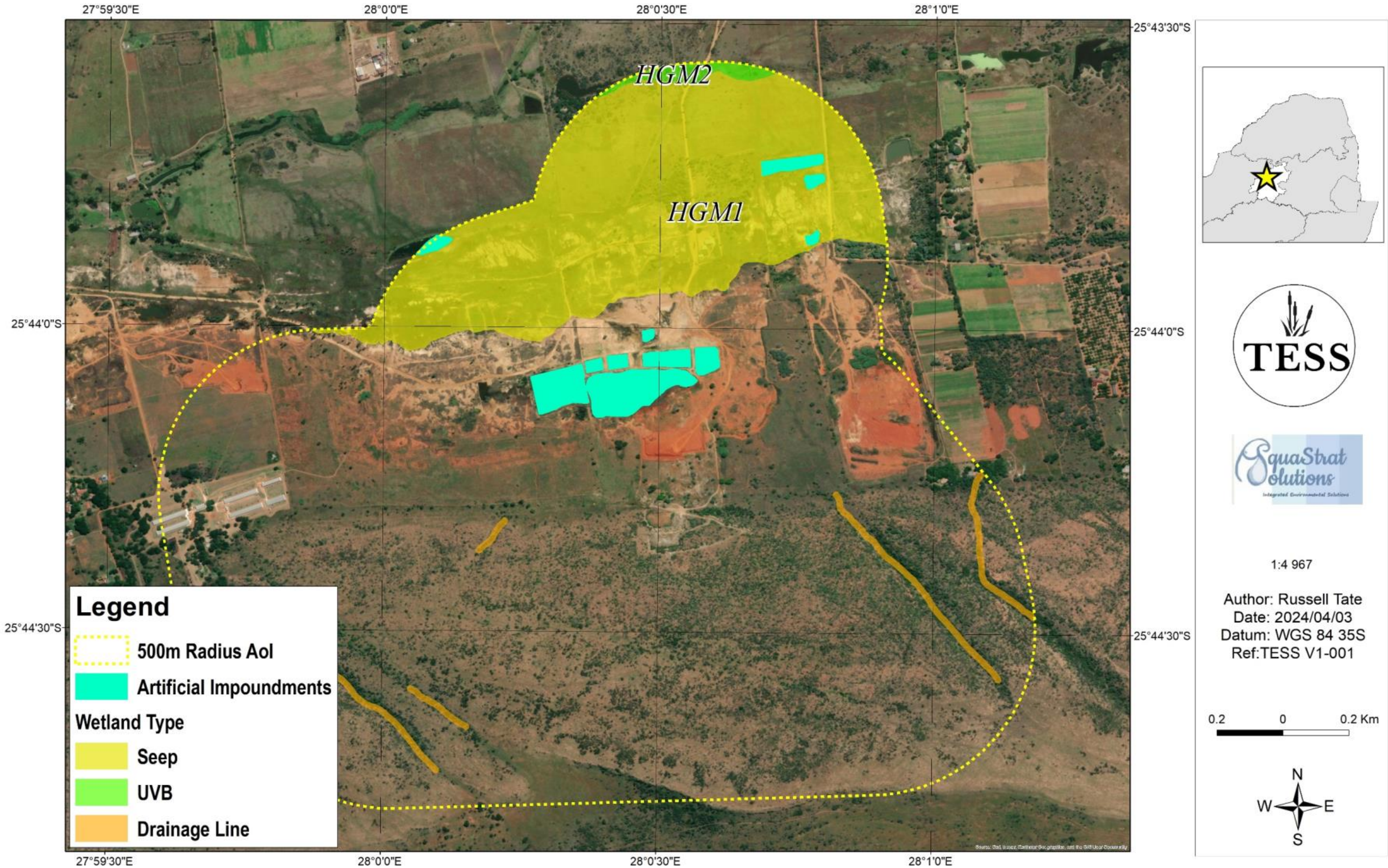

Figure 4-7: Delineation of the watercourses in the project area

4.3 Geomorphology, Hydrology and Soils

The geology of the region primarily consists of quartzite of the Magaliesberg Formation. The project AoI is located on the northern slopes of the Magaliesberg mountains, with a ridge located in the south of the AoI and a valley located to the north (Figure 4-8). The topography of the project AoI is generally gentle (3-5%) in the areas which are located off the ridge.

The landforms within the project area have been notably altered by past sand, gravel, and stone mining operations. Berms, impoundments, and the excavation of soils have resulted in a reduction in ground level elevations, ensuring that the water table and ground surface are within 50 cm of each other, facilitating the development of an extensive seep wetland (Figure 4-9).

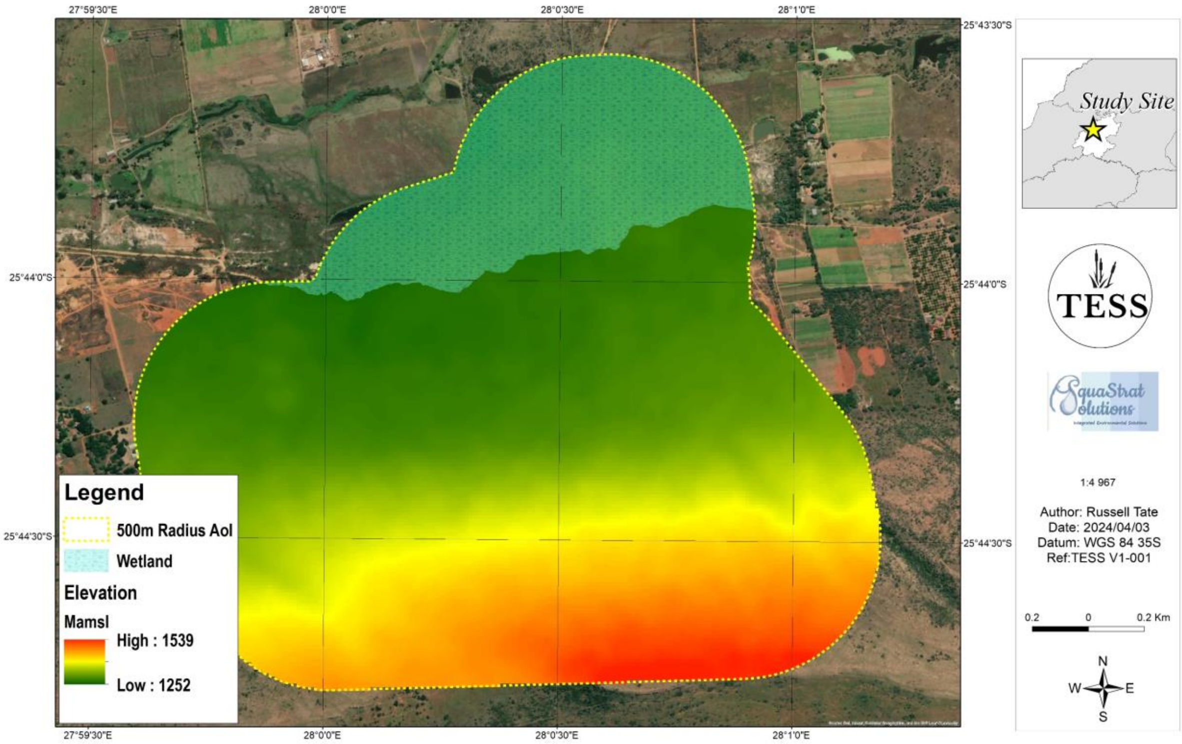

Figure 4-8: Elevation of the Area of Influence

Figure 4-9: Example of high groundwater table in a cavity within the AoI in the seep wetland (March 2024)

The hydrological sources of the seep wetland associated with project include direct runoff and infiltration from the ridge structure in the south, well the UVB system is primarily fed by runoff and seepage from upslope catchment areas.

The land types present in the AoI includes the Ib3 (Figure 4-10) and Ba8 (Figure 4-11) land types. Wetland soil types typically present in the IB3 land type includes Rensburg soil forms which are typically located in the valley bottom terrain types. Within the Ba8 land type the soil types which may contain wetlands include the following:

- Avalon
- Bainsvlei
- Rensburg
- Longlands

These soil types are typically present on the midslope, foot slope and valley bottom terrain types in the diagrams presented below.

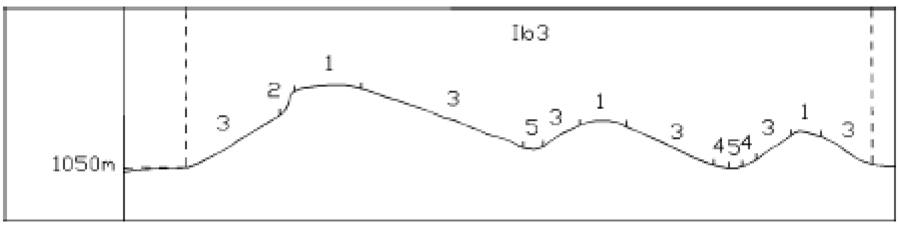

Figure 4-10: The Ba8 land type

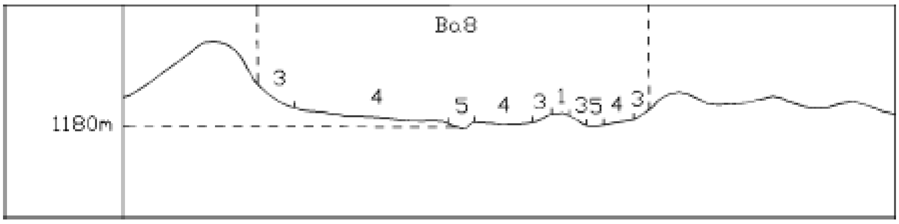

Figure 4-11: The Ba8 land type

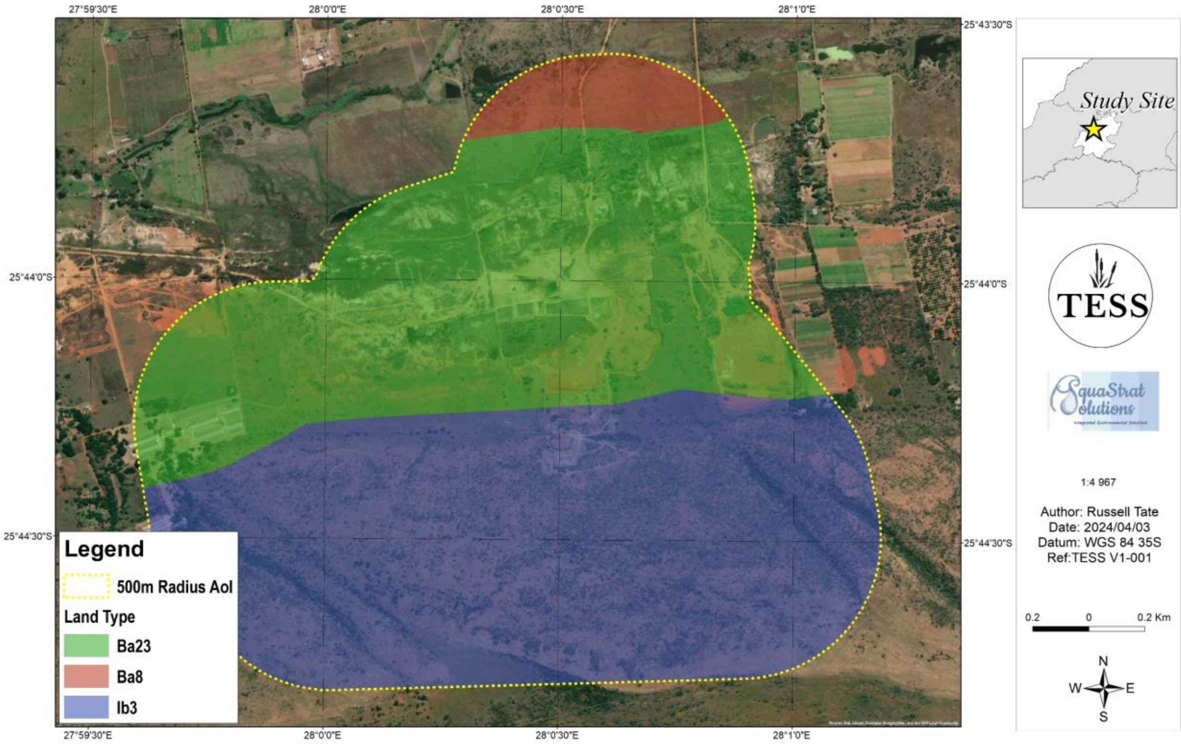

Figure 4-12: Land type of the Area of Influence

The hydraulic soil classes present in the AoI are provided in Figure 4-13 where the project was composed of class B/C and class C hydraulic soil groups. The interpretation of the soil classes is provided in Table 4-2. The soil classes and elevations are expected to be the primary driving features in the landscape responsible for wetland formation. Precipitation runoff emanating from the ridge structure which flows northward towards the valley bottom must flow over the class B/C soil types which are typical of moderately well drained soils resulting in the rapid loss of surface water which is supplied by the nearby drainage lines. Thereafter the precipitation runoff/infiltration flows over more impermeable soils which have lower infiltration rates, this is the region where wetlands were primarily observed in March 2024.

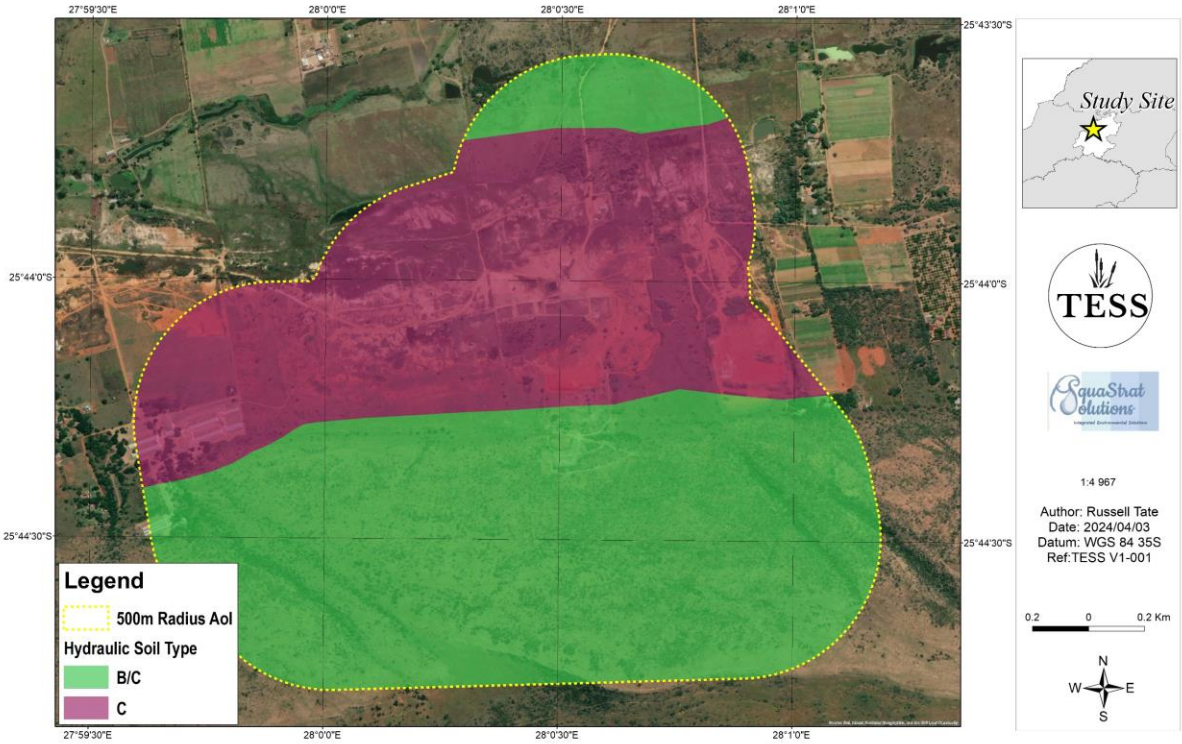

Figure 4-13: Hydraulic soil classes of the Area of Influence

Table 4-2: Soil Conservation Services Hydrologic Soil Class Interpretation (SANRAL. 2013)

CLASS	DESCRIPTION
CLASS A	Sand, loamy sand or sandy loam types of soils. It has low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission.
CLASS B	Silt loam or loam. It has a moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
CLASS C	Soils are sandy clay loam. They have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.
CLASS D	Soils are clay loam, silty clay loam, sandy clay, silty clay or clay. This HSG has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

During the March 2024 survey, although the AoI was significantly modified by historical mining activities, wetland soils types were noted to have formed as indicated in Figure 4-14 and Figure 4-15. The wetland soils presented in the AoI indicated the presence of seasonal and temporary wetlands which were dispersed throughout the identified wetland areas. Seasonal wetland types were noted to have formed in any areas which were previously bermed while temporary wetlands were associated with hydrologically active wetland areas with bleached soils.

Figure 4-14: Typical wetland soils located in the AoI showing bleached and gleyed soils (March 2024)

Figure 4-15: Typical wetland soils types showing redoximorphic features in the AoI (March 2024)

4.4 Vegetation

The vegetation types of the AoI consisted of the Gold Reef Mountain Bushveld vegetation type, while the Moot Plains Bushveld vegetation type was only present over a limited area in the north of the AoI (Figure 4-16). This vegetation type consists primarily of grassland habitats interspersed with open woodland vegetation. Given the historical modification activities that occurred in the AoI grasslands dominated the landscape (Figure 4-17). Diverse assemblages of wetland adapted flora were present in the AoI where wetland obligate flora were confirmed to be present and subsequently supported delineation activities presented in this study (Figure 4-19).

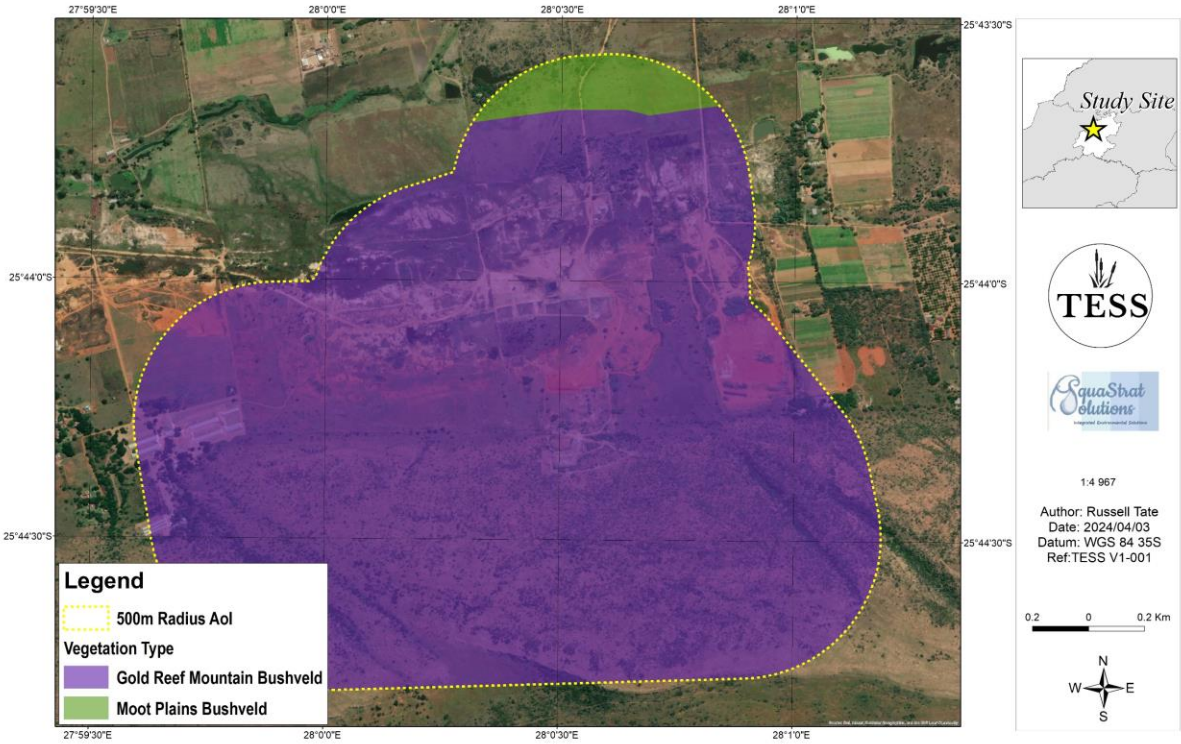

Figure 4-16: Vegetation type of the AoI

Figure 4-17: Typical vegetation of the AoI consisting primarily of grasslands

Figure 4-18: Stands of *Andropogon cf. eucomus* in the AoI (March 2024)

Figure 4-19: Diverse assemblages of wetland adapted flora in the AoI (March 2024). *Monopsis decipiens* (top left), *Chironia cf. palustris* (bottom left), *Fuirena cf. pubescebs* (top right), *Cyperus congestus* (bottom right)

4.5 Wetland Present Ecological Status

The land cover the AoI is presented in Figure 4-24 while the land cover for the HGM2 watershed is presented in Figure 4-26. The project AoI has primarily been modified from reference condition by historical mining activities. Although it is apparent that some rehabilitation activities have taken place, berms, stockpiles, erosion gullies and bare areas were noted to be present in the AoI. A summary of the wetland impacts is illustrated in Figure 4-25. Wetland PES results for the two HGM units is presented in Table 4-3 and Table 4-4.

Figure 4-20: Bare landscapes in the AoI (March 2024)

Figure 4-21: An erosion gully in the AoI (March 2024)

Figure 4-22: Stands of non-native vegetation (*Eucalyptus sp.)* within the AoI (March 2024)

Figure 4-23: Roadways crossing wetland areas in the AoI (March 2024)

Table 4-3: Wetland Present Ecological Status for HGM1 (March 2024)

Final Scores				
PES Assessment	**Hydrology**	**Geomorphology**	**Water Quality**	**Vegetation**
Impact Score	7.5	7.3	4.4	7.5
PES Score (%)	25%	27%	56%	25%
Ecological Category	E	E	D	E
Trajectory of change	→	→	→	→
Confidence (revised results)	Low	Low	Low	Low
Combined Impact Score	7.0			
Combined PES Score (%)	30%			
Combined Ecological Category	E			
Hectare Equivalents	23.2 Ha			

Table 4-4: Wetland Present Ecological Status for HGM2 (March 2024)

Final Scores				
PES Assessment	**Hydrology**	**Geomorphology**	**Water Quality**	**Vegetation**
Impact Score	4.2	3.5	4.4	7.5
PES Score (%)	58%	65%	56%	25%
Ecological Category	D	C	D	E
Trajectory of change	→	→	→	→
Confidence (revised results)	Low	Low	Low	Low
Combined Impact Score	4.8			
Combined PES Score (%)	52%			
Combined Ecological Category	D			
Hectare Equivalents	0.9 Ha			

The results of the PES assessment for the March 2024 surveys indicated that HGM1 was seriously modified (class E) while HGM2 was largely modified (class D). The primary modifying features of the wetlands could be attributed to:

- General urbanisation and cultivation of the wetland watershed's resulting in hydrological process alteration.
- Indirect impacts from cultivated and urban landcover runoff.
- Direct impacts from impoundments.
- Direct impacts from historical sand/gravel and stone quarrying activities resulting in significant geomorphological impacts.
- Impacts from stands of non-native species not limited to *Eucalyptus, Populus alba, Verbena, Zinnia* and *Arundo donax*.

4.6 Notes on Historical Conditions

Using the Google Earth™ software an assessment of the wetland presence and condition was made. The following conclusions were drawn from the assessment:

- According to the historical images there was indication that a seep wetland was present to the north of the AoI but in a position which was closer to the UVB system of the Swartspruit (Figure 4-27).
- Based on the reviewed information as early as 1950 sand, gravel and stone quarrying/mining activities were taking place in the AoI (Figure 4-28).
- The removal of material by historical mining activities has lowered the surface elevation to be within proximity to the water table resulting in the formation of the extensive seep wetland which extends southward of the natural reference condition presented in Figure 4-27.
- Based on the analysis of the historical imagery it is clear that the seep wetland identified in this study has been artificially broadened/extended by historical mining activities.

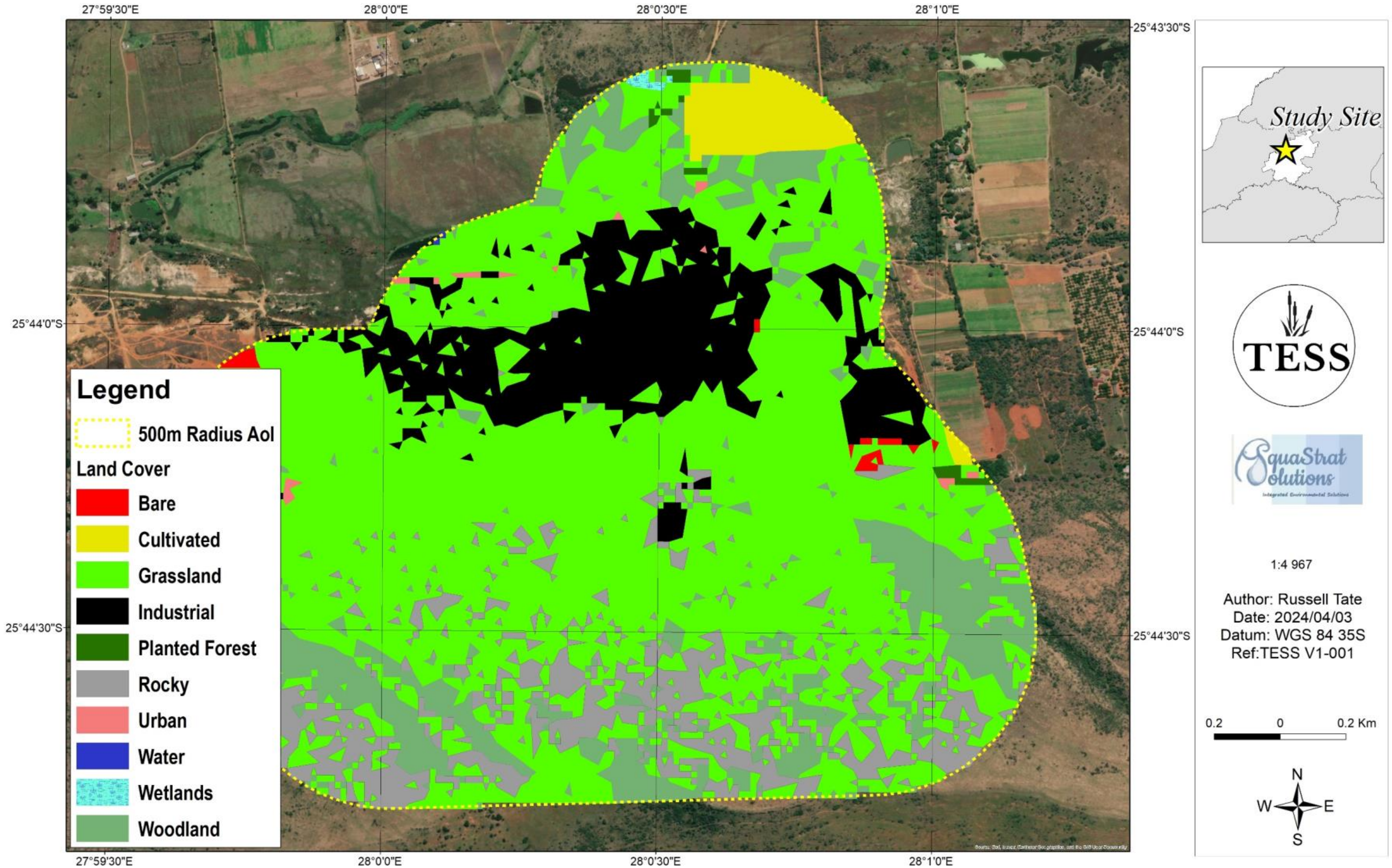

Figure 4-24: Land cover of the AoI (Thompson, 2019)

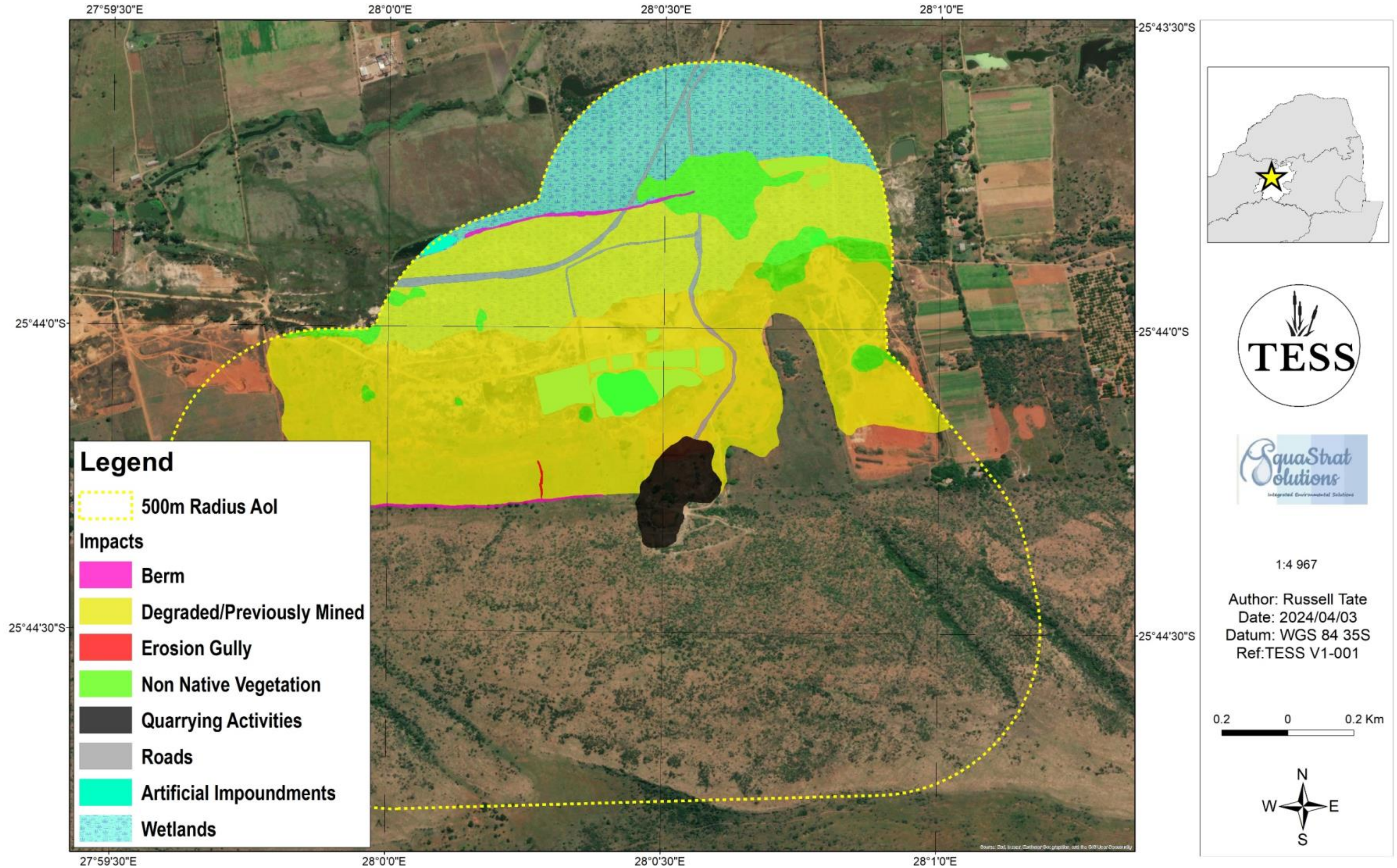

Figure 4-25: Impacts in the AoI as identified in March 2024 and via historical imagery

Figure 4-26: Land cover in the HGM2 watershed (Thompson, 2019)

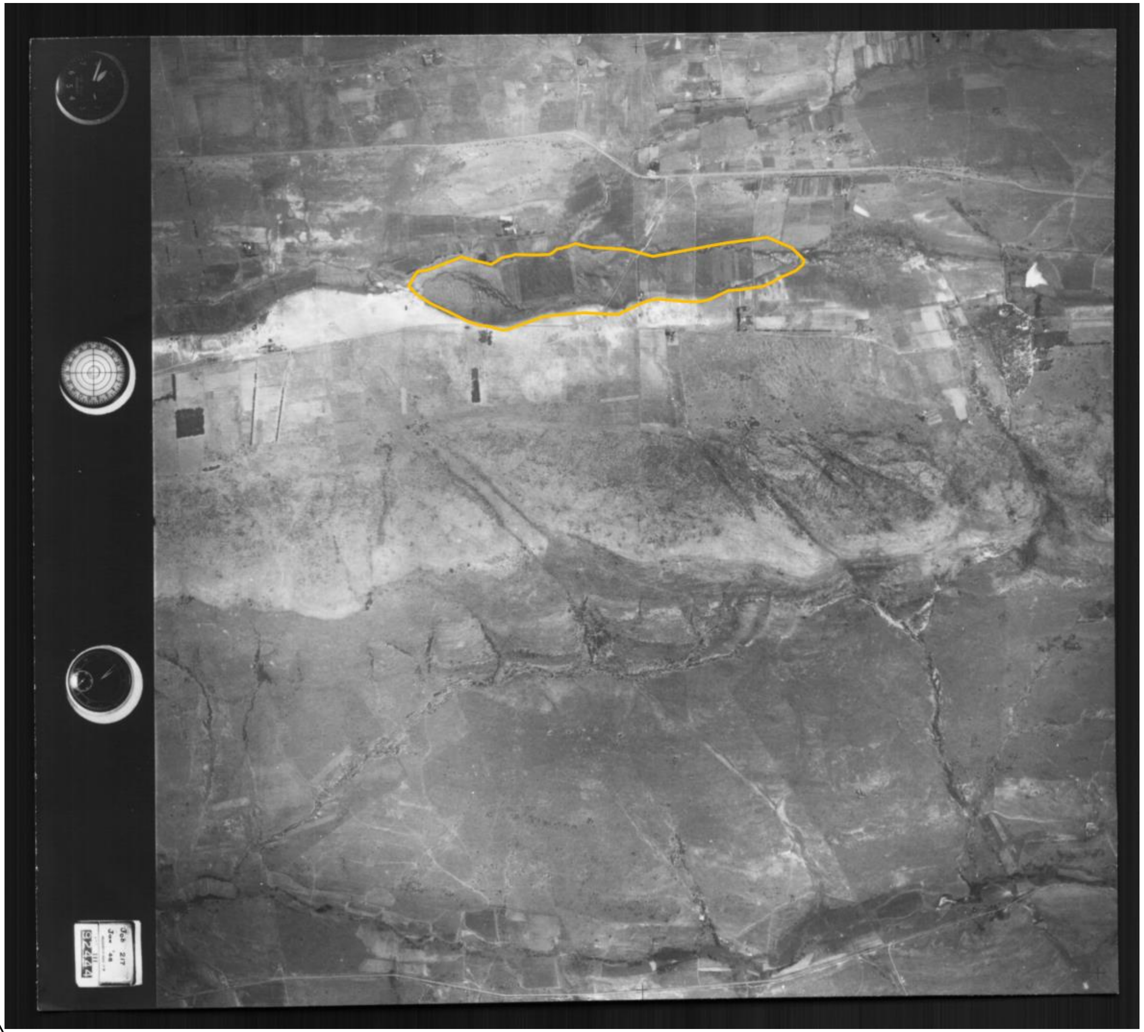

Figure 4-27: Historical imagery in the AoI (1948) with orange area indicating possible area of seep wetland

Figure 4-28: Historical mining activities in the wetland areas occurring as early as 1950 with orange area indicating possible seep region

4.7 Ecosystem Services, Sensitivity and Importance

The results of the ecoservices assessment are presented in Table 4-5. The results of the ecoservices assessment show that the following ecosystem services are important (moderate and above) within the HGM units:

- Phosphate assimilation
- Nitrate assimilation
- Toxicant assimilation
- Sediment trapping
- Biodiversity maintenance
- Food for livestock

The watercourses were found to provide moderate to high ecosystem services for downstream and in project area users.

Based on the layout and shapefiles provided in the Gauteng Conservation Plan, the watercourses under consideration fall within an Ecological Support Area (ESA). When considering the NFEPA watershed data the project is associated with an upstream management area (Nel et al., 2011). The watercourses are not associated with any strategic water use areas.

The Ecological Importance and Sensitivity of the watercourses were derived to be very high and moderate as presented in Table 4-6. The UVB system was indicated to have a very high EIS whilst the seep was derived to have a moderate EIS.

Table 4-5: Ecological Function Assessment Results (March 2024)

ECOSYSTEM SERVICE		UVB	Seep
REGULATING AND SUPPORTING SERVICES	Flood attenuation	Very Low	Very Low
	Stream flow regulation	Very Low	Very Low
	Sediment trapping	High	Moderately Low
	Erosion control	Very Low	Very Low
	Phosphate assimilation	Moderately High	Low
	Nitrate assimilation	Moderately Low	Low
	Toxicant assimilation	Moderately High	Moderately Low
	Carbon storage	Low	Very Low
	Biodiversity maintenance	Moderate	Very Low
PROVISIONING SERVICES	Water for human use	Very Low	Very Low
	Harvestable resources	Low	Very Low
	Food for livestock	Very Low	Moderate
	Cultivated foods	Very Low	Low
CULTURAL SERVICES	Tourism and Recreation	Very Low	Very Low
	Education and Research	Very Low	Very Low

ECOSYSTEM SERVICE		UVB	Seep
	Cultural and Spiritual	Very Low	Very Low

Table 4-6: Ecological Importance and Sensitivity

Wetland Importance and Sensitivity	UVB	Seep
Ecological Importance and Sensitivity	2.7	2.0
Hydrological/functional importance	3.4	1.8
Direct human benefits	2.2	1.8
Highest Value	**3.4**	**2.0**
EIS Category	**Very High**	**Moderate**

4.8 Buffers and Regulated Areas

It is important to note that the proposed project falls within the legislated 500m regulated area as per the following definition:

Regulated area of a watercourse for Section 21 (c) or (i) of the Act water uses in terms of the Notice means:

- (c) A 500m radius from the delineated boundary (extent) of any wetland or pan.

According to the National Environmental Management Act (Act no. 107 of 1998), Amendment of the Environmental Impact Assessment Regulations listing notice 1 of 2014, should no existing setback be defined, an area of 32 metres from the edge of the watercourse must not be developed (buffered).

Wetland buffer zones were defined according to Macfarlane et al. (2009). It is noted that the proposed project is to take place within the regulated areas within 500m from the delineated wetland areas. The proposed project will be for the expansion of an existing quarry and processing of weathered quartzite to produce aggregate and sand products.

The threat assessment for the proposed project is indicated in Table 4-7. The results of the buffer analysis are presented in Table 4-8 and Table 4-9 whilst this is mapped in Figure 4-31. The buffer analysis indicated a 35m buffer requirement for delineated wetland systems, whilst 30m were provided for drainage line systems.

It should be noted that the quarry and mining processing facilities are currently active and the project would be for the expansion of the quarry site only.

Table 4-7: The pre-and post- mitigation threat analysis defined for the project

Phase	Threat	Before Mitigation	After mitigation
Construction Phase	1. Alteration to flow volumes	VL	VL
	2. Alteration of patterns of flows (increased flood peaks)	L	L
	3. Increase in sediment inputs & turbidity	VH	VH
	4. Increased nutrient inputs	VL	VL
	5. Inputs of toxic organic contaminants	VL	VL
	6. Inputs of toxic heavy metal contaminants	L	L
	7. Alteration of acidity (pH)	VL	VL
	8. Increased inputs of salts (salinization)	VL	VL
	9. Change (elevation) of water temperature	VL	VL
	10. Pathogen inputs (i.e. disease-causing organisms)	VL	VL
Operational Phase	1. Alteration to flow volumes	L	L
	2. Alteration of patterns of flows (increased flood peaks)	VL	VL
	3. Increase in sediment inputs & turbidity	VH	VH
	4. Increased nutrient inputs	L	L
	5. Inputs of toxic organic contaminants	L	L
	6. Inputs of toxic heavy metal contaminants	L	L
	7. Alteration of acidity (pH)	L	L
	8. Increased inputs of salts (salinization)	L	L
	9. Change (elevation) of water temperature	L	L
	10. Pathogen inputs (i.e. disease-causing organisms)	VL	VL

Table 4-8: Buffer requirements before and after mitigation in the Seep wetland

Phase	Before mitigation	After mitigation	Recommended Buffer
Construction	110	35	35
Operation	110	35	35

Table 4-9: Buffer requirements before and after mitigation in the UVB wetland

Phase	Before mitigation	After mitigation	Recommended Buffer
Construction	110	35	35
Operation	110	35	35

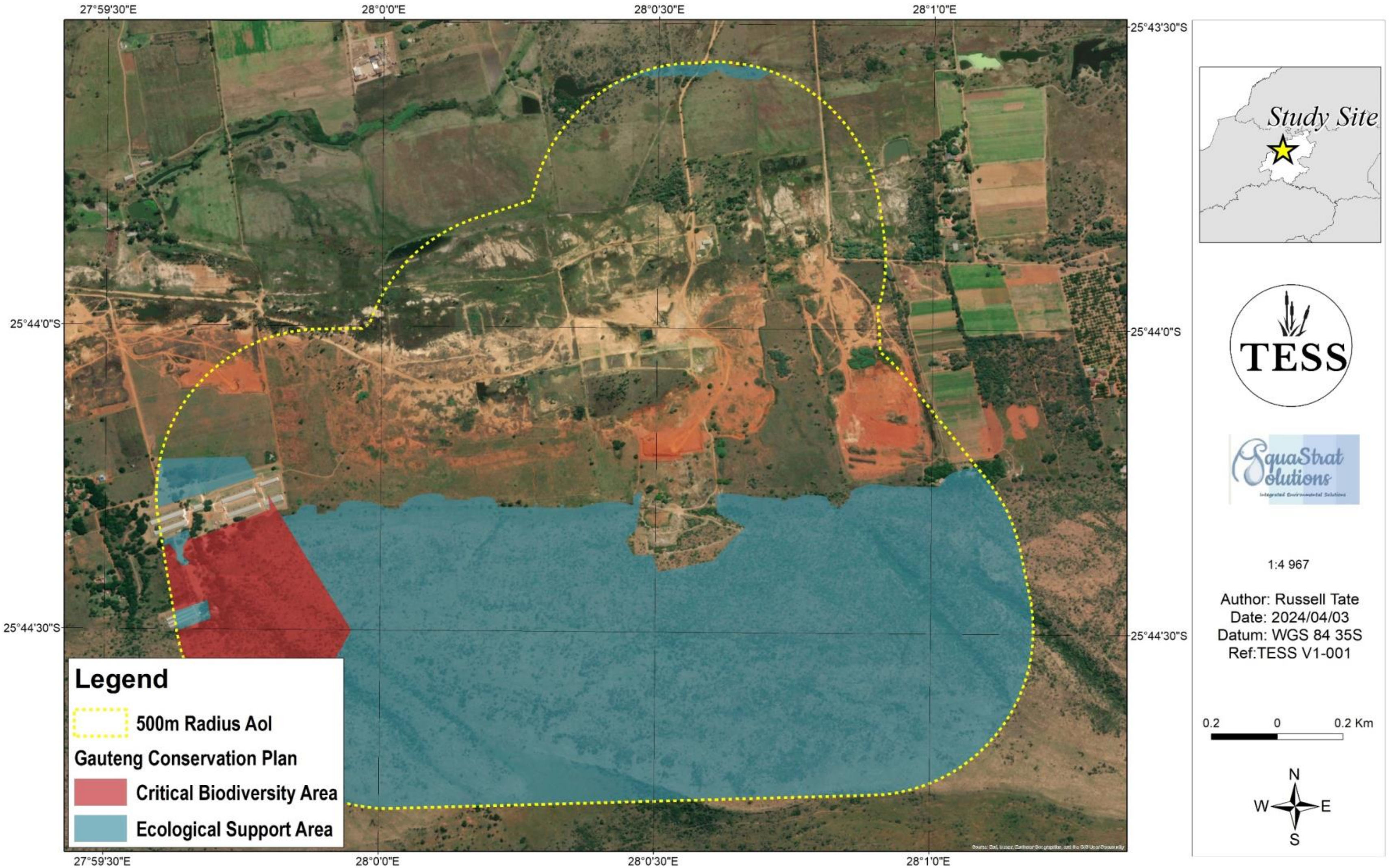

Figure 4-29: Gauteng Conservation Plan

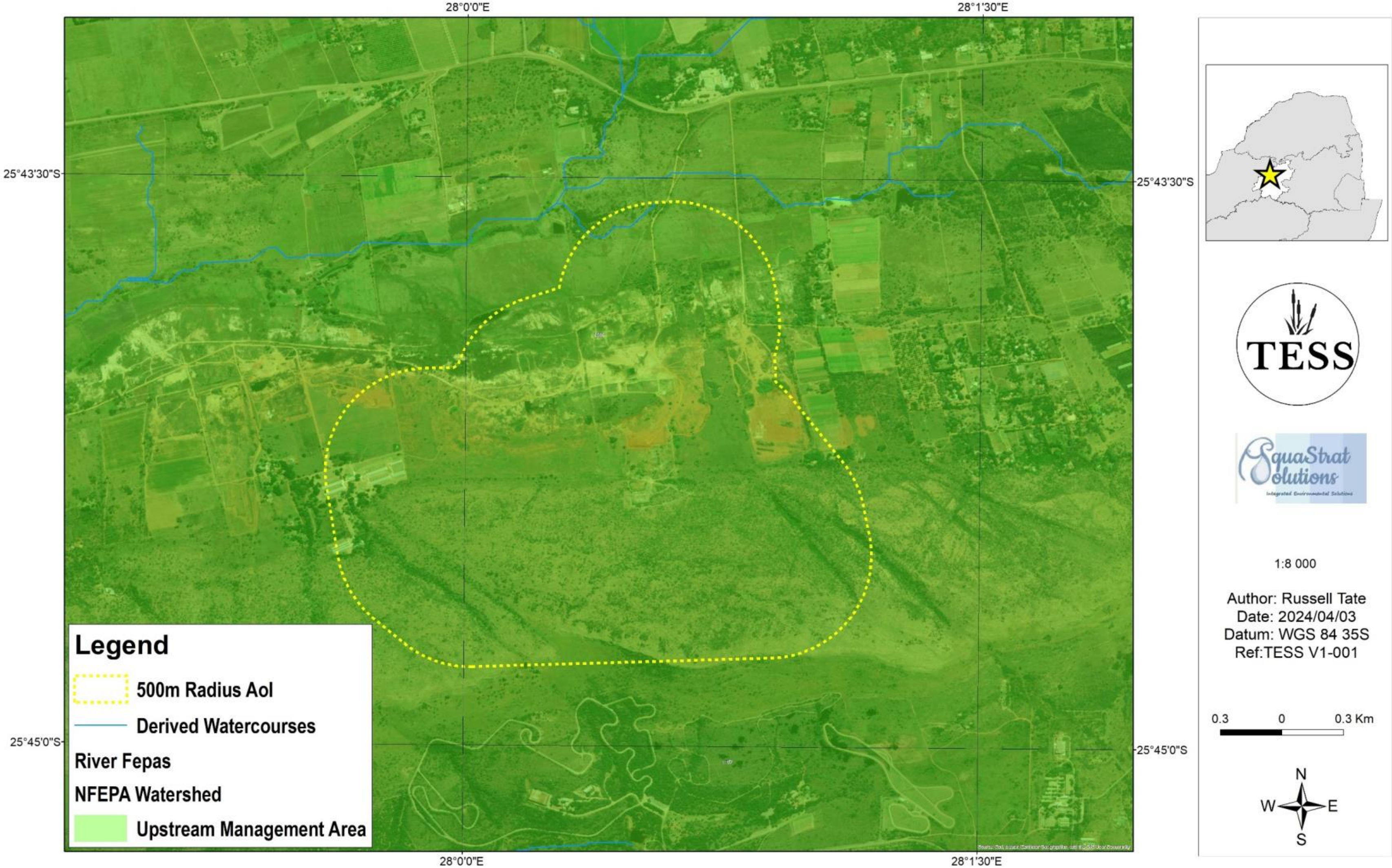

Figure 4-30: NFEPA Watersheds

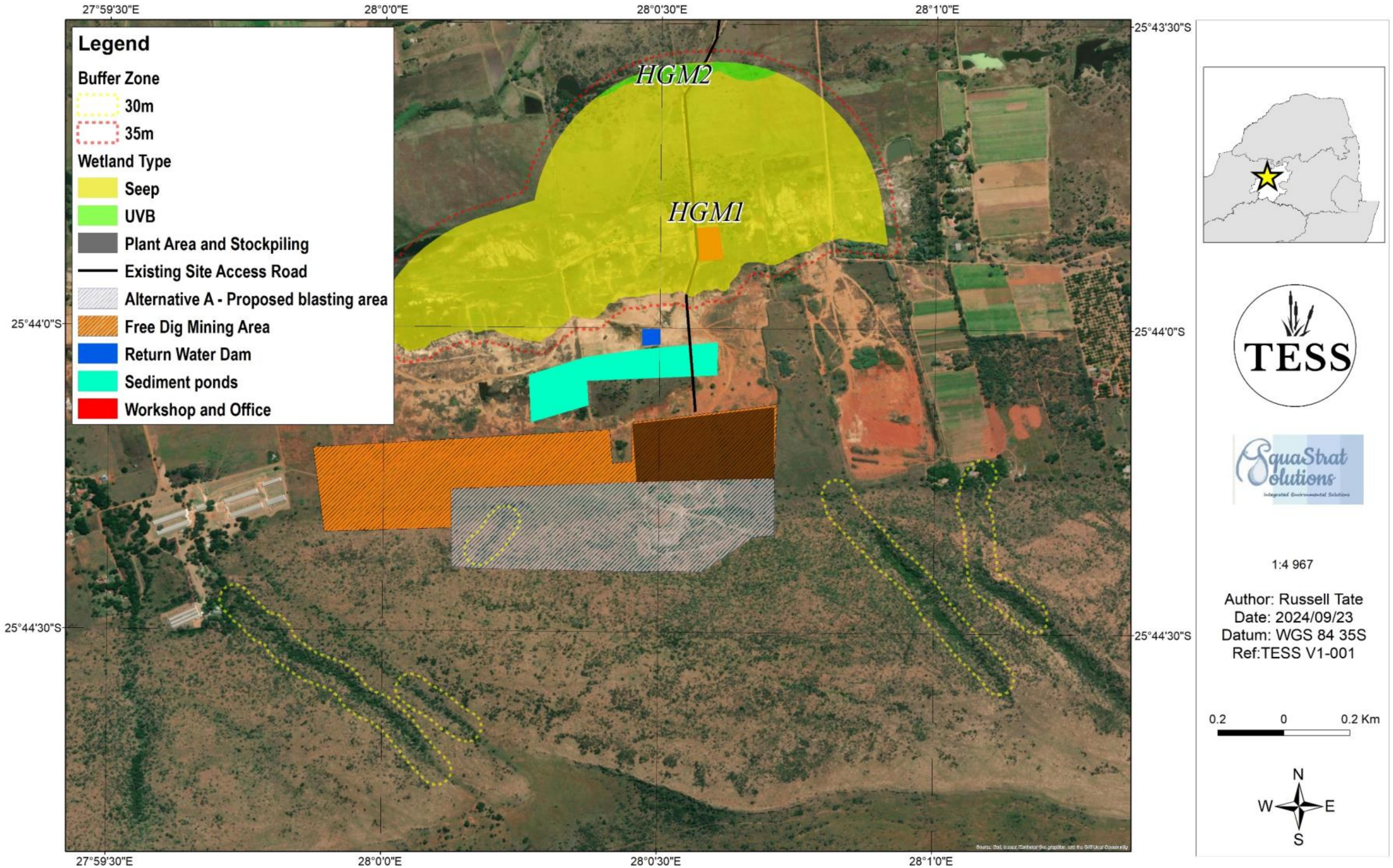

Figure 4-31: Buffer zones recommended for the watercourses in the project area

5 Anticipated Impacts

5.1 Risk Assessment Methodology

Two risk assessment approaches were utilised in this assessment, the first was to address the minimum requirements of the DWS, whilst the second risk assessment was applicable to the National Environmental Management Act (NEMA) standards. And aligns with standard approaches to determine impact in a similar manner to other ecological standards. The DWS risk assessment was conducted in accordance with the requirements of the DWS General Authorisation (GA) legislation in terms of Section 39 of the NWA for water uses as defined in Section 21(c) or Section 21(i) (GN 49833 of 2023).

Table 5-1: Risk Assessment Matrix Interpretation

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 29	**(L) Low Risk OR (+) Positive (+ +) Highly positive**	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.

Once a potential impact has been determined it is necessary to identify which project activity will cause the impact, the probability of occurrence of the impact, and its magnitude and extent (spatial and temporal). This information is important for evaluating the significance of the impact, and for defining mitigation and monitoring strategies. Direct and indirect impacts of the impacts identified during the specialist investigations were assessed in terms of five standard rating scales to determine their significance.

The rating system used for assessing impacts (or when specific impacts cannot be identified, the broader term issue should apply) is based on six criteria, namely:

- Status of impacts (Table 5-2) – determines whether the potential impact is positive (positive gain to the environment), negative (negative impact on the environment), or neutral (i.e. no perceived cost or benefit to the environment). Take note that a positive impact will have a low score value as the impact is considered favourable to the environment;
- Spatial extent of impacts (Table 5-3) – determines the spatial scale of the impact on a scale of localised to global effect. Many impacts are significant only within the immediate vicinity of the site or within the surrounding

community, whilst others may be significant at a local or regional level. Potential impact is expressed numerically on a scale of 1 (site-specific) to 5 (global);

- Duration of impacts (Table 5-4) – refers to the length of time that the aspect may cause a change either positively or negatively on the environment. Potential impact is expressed numerically on a scale of 1 (project duration) to 5 (permanent);
- Frequency of the activity (Table 5-5)– The frequency of the activity refers to how regularly the activity takes place. The more frequent an activity, the more potential there is for a related impact to occur.
- Severity of impacts (Table 5-6) – quantifies the impact in terms of the magnitude of the effect on the baseline environment, and includes consideration of the following factors:
    - The reversibility of the impact;
    - The sensitivity of the receptor to the stressor;
    - The impact duration, its permanency and whether it increases or decreases with time;
    - Whether the aspect is controversial or would set a precedent;
    - The threat to environmental and health standards and objectives;
- Probability of impacts (Table 5-7) –quantifies the impact in terms of the likelihood of the impact occurring on a percentage scale of <5% (improbable) to >95% (definite).
- Confidence – The degree of confidence in predictions based on available information and specialist knowledge:
    - Low;
    - Medium; or
    - High.

In addition, each impact needs to be assessed in terms of reversibility and irreplaceability as indicated below:

- Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):
    - High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);
    - Moderate reversibility of impacts;
    - Low reversibility of impacts; or
    - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).
- Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):

- High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);
- Moderate irreplaceability of resources;
- Low irreplaceability of resources; or
- Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Table 5-2: Status of Impacts

Rating	Description	Quantitative Rating
Positive	A benefit to the receiving environment (positive impact)	+
Neutral	No determined cost or benefit to the receiving environment	N
Negative	At cost to the receiving environment (negative impact)	-

Table 5-3: Extent of Impacts

Rating	Description	Quantitative Rating
Very Low	**Site Specific** – impacts confined within the project site boundary	1
Low	**Proximal** – impacts extend to within 1 km of the project site boundary	2
Medium	**Local** – impacts extend beyond to within 5 km of the project site boundary	3
High	**Regional** – impacts extend beyond the site boundary and have a widespread effect - i.e. > 5 km from project site boundary	4
Very High	**Global** – impacts extend beyond the site boundary and have a national or global effect	5

Table 5-4: Duration of Impacts

Rating	Description	Quantitative Rating
Very Low	**Project duration** – impacts expected for the duration of the project or not greater than 1 year	1
Low	**Short term** – impacts expected on a duration timescale of 1 to 2 years	2
Medium	**Medium term** – impacts expected on a duration timescale of 2-5 years	3
High	**Long term** – impacts expected on a duration timescale of 5-15 years	4
Very High	**Permanent** – impacts expected on a duration timescale exceeding 15 years	5

Table 5-5: Frequency of impacts

Rating	Frequency	Quantitative Rating
Very Low	Annually or less	1
Low	6 monthly	2
Medium	Monthly	3
High	Weekly	4
Very High	Daily / Permanent	5

Table 5-6: Severity of Impacts

Rating	Description	Quantitative Rating
Very Low	Negligible – zero or very low impact	1
Low	Small / potentially harmful	2
Medium	Significant / slightly harmful	3
High	Great / harmful	4
Very High	Disastrous / extremely harmful	5

Table 5-7: Probability of Impacts

Rating	Description	Quantitative Rating
Highly Improbable	Likelihood of the impact arising is estimated to be negligible; <5%.	1

Rating	Description	Quantitative Rating
Improbable	Likelihood of the impact arising is estimated to be 5-35%.	2
Possible	Likelihood of the impact arising is estimated to be 35-65%	3
Probable	Likelihood of the impact arising is estimated to be 65-95%.	4
Highly Probable	Likelihood of the impact arising is estimated to be > 95%.	5

5.2 Determination of Impact Significance

The information presented above in terms of identifying and describing the aspects and impacts is summarised in below in Table 5-8 and significance is assigned with supporting rationale.

Table 5-8: Consolidated Table of Aspects and Impacts Scoring

Spatial Scale	**Rating**	**Duration**	**Rating**	**Severity**	**Rating**
Activity specific	1	One day to one month	1	Insignificant/non-harmful	1
Area specific	2	One month to one year	2	Small/potentially harmful	2
Whole site/plant/mine	3	One year to ten years	3	Significant/slightly harmful	3
Regional/neighbouring areas	4	Life of operation	4	Great/harmful	4
National	5	Post closure	5	Disastrous/extremely harmful	5
Frequency of Activity		Rating	Probability of Impact		Rating
Annually / Once-off		1	Almost never/almost impossible (<5%)		1
6 monthly		2	Very seldom/highly unlikely (5-35%)		2
Monthly		3	Infrequent/unlikely/seldom (35-65%)		3
Weekly		4	Often/regularly/likely/possible (65-95%)		4
Daily / Regularly		5	Daily/highly likely/definitely (> 95%)		5
Significance Rating of Impacts			Timing		
Very Low (1-25) Low (26-50) Low – Medium (51-75) Medium – High (76-100) High (101-125) Very High (126-150)			Pre-construction Construction Operation Decommissioning		

The environmental significance rating is an attempt to evaluate the importance of a particular impact, the consequence and likelihood of which is assessed by the relevant specialist. The description and assessment of the aspects and impacts is presented in a consolidated table with the significance of the impact assigned using the process and matrix detailed below.

The sum of the first three criteria (spatial scope, duration and severity) provides a collective score for the consequence of each impact. The sum of the last two criteria (frequency of activity and frequency of impact) determines the likelihood of the impact occurring. The product of consequence and likelihood leads to the assessment of the significance of the impact (Significance = Consequence X Likelihood), shown in the significance matrix below in Table 5-9.

Table 5-9: Significance Assessment Matrix

	Consequence (Severity + Spatial Scope + Duration)														
Likelihood (Frequency of Activity + Probability of Impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	08	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 5-10: Positive and Negative Impact Mitigation Ratings

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very High	126-150	Avoidance – consider alternatives	Optimal contribution from Project
	High	101-125	Avoidance as far as possible; implement strict mitigation measures to account for residual impacts	Positive contribution from Project with scope to improve
	Medium-High	76-100	Where avoidance is not possible, consider strict mitigation measures	Moderate contribution from Project with scope to improve
	Low-Medium	51-75	Mitigation measures to lower impacts and manage the project impacts appropriately	Improve on mitigation measures
	Low	26-50	Appropriate mitigation measures to manage the project impacts	Improve on mitigation measures; consider alternatives to improve on
	Very Low	1-25	Ensure impacts remain very low	Consider alternatives to improve on

The model outcome is then assessed in terms of impact certainty and consideration of available information. Where a particular variable rationally requires weighting or an additional variable requires consideration the model outcome is adjusted accordingly.

5.3 Risk Assessment Results

5.3.1 Existing Activities – No Go Situation

Existing activities within the project area include active sand mining activities, processing, livestock agriculture and road infrastructure.

The historical activities have had a significant impact on the condition of the wetland system. The no-go situation is therefore identified as the continuation of the poor condition of the assessed watercourses.

5.3.2 Project Description

The following project description was obtained from the Background Information Document (BID).

Bundu Mining has applied for a Mining Right and intends to restart operations at an old aggregate quarry by expanding the existing pit through opencast methods, and the processing of weathered quartzite to make aggregate and sand products, including the washing of certain products. Proposed activities will include:

- Site clearance/preparation
- Placement of mobile equipment
- Construction of stormwater controls
- Construction of infrastructure such as roads, weighbridge, processing plant and settling ponds.
- Clearing of vegetation and topsoil ahead of the excavation areas
- Loosening of weathered quartzite material through mechanical and blasting means.
- Haulage of material.
- Processing will occur via crushing, screening and washing.
- Supporting services which are to take place include the use of an existing workshop and admin buildings.
- Water for the project will be sourced from groundwater.
- Decomissioning activities will include the sloping of benches to a suitable angle as well as the control of invasive vegetation and establishment of native flora.

5.3.3 Linear Infrastructure

The existing road infrastructure on the site will be utilised for all ongoing and proposed activities where slight upgrades are expected.

5.3.3.1 Avoidance

It is noted that the watercourses delineated in this study have already been effectively crossed and no avoidance will be applicable for linear infrastructure.

5.3.3.2 Construction Phase

The construction phase of linear infrastructure will involve the minor active clearing of vegetation, minor alteration of slope as well as general catchment drainage modification. Only indirect impacts are anticipated from this infrastructure type.

5.3.3.2.1 Mitigation Actions

- The use of culverts or the implementation of road berms and facilitated seepage to cross the existing seep wetland should be investigated by a suitable engineer and where required implemented.
- Where culverts are required it is recommended that these are spread across the wetland unit and not directed through single culverts.
- All contractors and staff are to be familiarised with the method statement and have undergone an induction / training on the location of sensitive No-Go

areas and basic environmental awareness using the mitigation provided in this report.

- Areas where construction is to take place must be clearly demarcated. Any areas not demarcated must be avoided.
- Storm-water generated from roadways must be captured and buffered, where flow velocities are to be significantly reduced before discharge into the environment.
- Storm-water verges as well as other denuded areas must be grassed (re-vegetated) with local indigenous grasses to protect against erosion.
- Any materials excavated must not be deposited in the wetlands or areas where it is prone to being washed downstream or impeding natural flow.
- Stockpiling or storage of materials and/or waste must be placed beyond the defined buffers in this report for each respective activity.
- No vehicles shall enter watercourse buffer zones outside of construction footprints.
- Hydrocarbons for refuelling purposes must be stored in a suitable storage device on an impermeable surface outside of the delineated wetland buffer zone.
- Disturbed areas must be re-vegetated after completion of the phase:
  - A six-month timeframe for the initiation of this action.
  - Ripping of the soils should occur in two directions.
  - Removed vegetation and topsoil can be harvested and applied here.
- Drainage channels constructed for the access roads must be constructed so as not to result in erosion.
- An alien vegetation removal and management plan must be implemented along the verges of the roads and the existing wetland crossing point.
- General storm-water management practices should be included in the design phase and implemented during the construction phase of this project.
- Following the completion of the phase, all construction materials and debris should be removed and disposed of in a suitable area. An inspection should be completed within a 8 week period after the phase is completed.

5.3.3.3 Operation Phase

Drainage off the hardened surfaces created by the roadways structures are anticipated to be silt laden and of a higher runoff velocity during rainfall events. This can result in the erosion and sedimentation of downslope watercourses. The subsequent effect of this would be water and habitat quality deterioration in downslope waterbodies leading to a decreased ecological status of associated watercourses.

5.3.3.3.1 <u>Mitigation Actions</u>

The following mitigation is recommended for the operational phase

- The implementation of a suitable storm-water management plan for the disturbance footprint must be in place and implemented by this phase.
- An annual audit of the road areas for signs of environmental disturbance outside and within the footprint area must be conducted.
- Alien invasive management programmes should continue throughout the duration of the activity.
- Watercourse monitoring should take place at least every three years as part of the environmental management plan.

5.3.3.4 Decomissioning Phase Phase

The impacts expected to be taking place during the decommissioning phase would likely be similar to that of the construction phase where disturbed areas are likely to generate sediment which may impact downslope waterbodies.

5.3.3.4.1 Mitigation Actions

- An overarching rehabilitation plan should be developed, implemented and adapted throughout the life of the project.
- An alien invasive management plan should be developed.
- Areas where decommissioning is to take place must be clearly demarcated. Any areas not demarcated must be avoided.

5.3.4 Mining Activities

5.3.4.1 Avoidance

The mining activities are avoiding the established buffer zone and therefore no direct impacts to watercourses are expected from the mining activities.

5.3.4.2 Construction Phase

The construction phase of the mining activities will involve the clearing of vegetation ahead of the excavations as well as the use of explosives. This can present a risk to water quality of downslope waterbodies and the effective management of pit water and clean runoff would be important.

5.3.4.2.1 Mitigation Actions

- The implementation of the buffer zone stipulated in this report.
- Clean and dirty surface water separation and a storm-water management plan must be put into place via standard best practice methods.
- A clear storm-water management plan for hardened surfaces must be implemented.

- The revegetation of disturbed non-active cleared areas must take place within the first growing season between following completion of the activity.
- The above must be audited within 3 months of completing the phase.
- No discharge of domestic water must occur if possible. Domestic water must be reused for dust suppression.
- All stockpiles and hazardous waste storage areas must be bunded by either a cut-off trench or berm directed to a Pollution Control Dam or alternative storage facility inline with best practice surface water management guidelines.

5.3.4.3 Operational Phase

The operation of the structures will include the continual expansion of the open pit and therefore similar impacts to the construction phase can be expected.

5.3.4.3.1 Mitigation Actions

- The implementation of the buffer zones provided in this report.
- Clean and dirty surface water separation and storm-water management plan must be put into place via standard best practice methods.
- An effective storm-water management plan for the project must be implemented.
- The revegetation of disturbed non-active cleared areas must take place within 6 month of completing the construction phase.
- The above must be audited within 3 months of completing the phase.
- No discharge of domestic water must occur if possible. Domestic water must be reused for dust suppression. Should domestic water be required to be discharge, the management of nitrogen concentrations is imperative.

5.3.4.4 Decomissioning Phase

Similar impacts as indicating in the construction phase are expected during the decommissioning phase of the open pit. Runoff from the open pit would likely contain elevated dissolved solids and suspended materials which could reduce the condition of the downslope waterbodies.

5.3.4.4.1 Mitigation Actions

- An overarching rehabilitation plan should be developed, implemented and adapted throughout the life of the project.
- The revegetation of disturbed non-active cleared areas must take place within the first growing season between following completion of the activity.
- The above must be audited within 3 months of completing the phase.
- An alien invasive flora management plan should be developed.

5.3.5 Processing Activities

5.3.5.1 Avoidance

The existing disturbed footprints where existing processing activities are taking place are recommended to be utilised to establish processing facilities for the proposed project. As presented in Figure 4-31, the processing activities are located outside the established buffer zone for this project.

5.3.5.2 Construction Phase

Very limited impacts can be expected during the construction phase given that the processing plant will consist of mobile equipment. Further, this equipment will be established within the existing disturbed footprints.

5.3.5.2.1 Mitigation Actions

- The implementation of the buffer zone provided in this study.
- The implementation of a stormwater management plan as well as the separation of clean and dirty water according to best practice methodologies.
- An alien invasive flora management plan should be developed.

5.3.5.3 Operation Phase

The processing activities will make use of the washing and stockpiling of materials. This presents some risk to downslope waterbodies where runoff/discharge or spillage events can occur.

5.3.5.3.1 Mitigation Actions

- The implementation of the buffer zone provided in this study.
- No discharge of untreated water is to occur.
- The monitoring of activities associated with the processing plant is recommended to occur.
- The implementation of sediment trapping ponds as proposed.
- The implementation of a stormwater management plan as well as the separation of clean and dirty water according to best practice methodologies.
- An alien invasive flora management plan should be developed.
- The active recycling of water to reduce the potential for spillages into the environment.
- Stockpiles should not be placed or constructed in a manner which results in sedimentation to downstream waterbodies.

5.3.5.4 Decomissioning Phase

Similarly to the construction phase, the processing plant will be removed from the project with limited anticipated impacts.

5.3.5.4.1 Mitigation Actions

- An overarching rehabilitation plan should be developed, implemented and adapted throughout the life of the project.
- An alien invasive flora management plan should be developed.

5.3.6 Supporting Services

5.3.6.1 Avoidance

The existing workshop is located within the defined extent of the wetland habitats. The existing workshop and administrative structures therefore cannot avoid wetland habitats. This is however not anticipated to be a significant issue given the fact that the structures are already in place.

5.3.6.2 Construction Phase

Limited construction activities will take place given the existing structures. Where construction will occur this will take place in an existing disturbance footprint.

5.3.6.2.1 Mitigation Actions

- The use of existing disturbance footprints is recommended.
- As provided in the BID, the use and storage of hydrocarbons will take place in accordance with best practice standards and within a bunded area.
- The implementation of an alien invasive flora management plan.

5.3.6.3 Operation Phase

Limited impacts to watercourses can be expected from supporting services during the operational phase where water is to be sourced from boreholes, existing domestic waste handling will occur and activities are to take place at existing structures on disturbed footprints.

5.3.6.3.1 Mitigation Actions

- The implementation of an alien flora management plan.
- No discharge of domestic water is recommended.

5.3.6.4 Decomissioning Phase

It is assumed that the decommissioning activities will remove all existing infrastructure. The decommissioning phase for supporting services therefore have the potential to negatively impact downslope waterbodies via indirect processes such as runoff alteration. However, overall it is anticipated that this will have a net positive effect following the rehabilitation of the disturbed footprint areas.

5.3.6.4.1 Mitigation Actions

- An overarching rehabilitation plan should be developed, implemented and adapted throughout the life of the project.
- The implementation of alien invasive flora management activities.

5.3.7 Risk Assessment Tables

Table 5-11: Summary Results of the standardised DWS Risk Assessment

CONSTRUCTION	Clearing of vegetation	Alteration of runoff velocity	L
		Production of sediment	L
		Increasing erosion downslope	L
	Excavating/shaping/Blasting landscape for development and expansion of mining activities	Alteration of runoff velocity	L
		Production of sediment	L
		Increasing erosion downslope	L
	Stockpiling and placement of construction materials and structures	Alteration of runoff velocity	L
		Production of fines and contaminants	L
		Increasing erosion downslope	L
OPERATIONAL	Active mining	Direct alteration of drainage	L
		Hydrological process and water quality alteration	L
		Establishment of alien plants on disturbed areas	L
	Processing/supporting activities	Alteration of surface drainage	L
		Alteration of surface water quality	L
		Establishment of alien plants on disturbed areas	L
	Linear infrastructure	Alteration of surface drainage	L
		Establishment of alien plants on disturbed areas	L
DECOMMISSIONING	Clearing of vegetation	Alteration of runoff velocity	L
		Production of sediment	L
		Increasing erosion downslope	L
	Excavating/shaping landscape for final decommissioning	Alteration of runoff velocity	L
		Production of sediment	L
		Increasing erosion downslope	L
	Stockpiling and placement of construction materials and structures	Alteration of runoff velocity	L
		Production of fines and contaminants	L
		Increasing erosion downslope	L

Table 5-12: NEMA Impact Assessment — Water and Habitat impacts – Pre-Mitigation

Phase	Construction				Operation				Decomissioning			
Activity	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services
Spatial Scale	1	2	2	1	1	2	2	1	1	2	2	1
Duration	2	2	2	2	3	3	3	3	2	2	2	2
Severity	3	3	3	1	3	3	3	1	1	1	1	1
Frequency	1	1	1	1	1	3	5	1	1	1	1	1
Probability	4	4	5	4	4	4	5	4	4	4	4	4
Significance Rating	30	35	42	20	35	56	80	25	20	25	25	20
Significance interpretation	Low	Low	Low	Low	Low	Low-Medium	Medium - High	Low	Low	Low	Low	Low

Table 5-13: NEMA Impact Assessment — Water and Habitat impacts – Post Mitigation

Phase	Construction				Operation				Decomissioning			
Activity	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services
Spatial Scale	1	2	2	1	1	2	2	1	1	2	2	1
Duration	2	2	2	2	3	3	3	3	2	2	2	2
Severity	3	3	3	1	3	3	3	1	1	1	1	1
Frequency	1	1	1	1	1	3	5	1	1	1	1	1
Probability	2	2	2	2	2	2	2	2	2	2	2	2
Significance Rating	18	21	21	12	21	40	56	15	12	15	15	12
Significance interpretation	Low	Low	Low	Low	Low	Low	Low-Medium	Low	Low	Low	Low	Low

Table 5-14: NEMA Impact Assessment –Cumulative – Water and Habitat impacts Pre-Mitigation

Activity	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services
Spatial Scale	1	1	1	1	1	1	1	1	1	1	1	1
Duration	3	3	3	3	3	3	3	3	3	3	3	3
Severity	1	1	2	1	1	1	2	1	1	1	1	1
Frequency	1	1	1	1	1	1	1	1	1	1	1	1
Probability	4	4	4	4	4	4	4	4	4	4	4	4
Significance Rating	25	25	30	25	25	25	30	25	25	25	25	25
Significance interpretation	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low

Table 5-15: NEMA Impact Assessment –Cumulative – Water and Habitat impacts Post Mitigation

Phase	Construction				Operation				Decomissioning			
Activity	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services	Site Clearance/Preparation	Mining	Processing and Stockpiling	Supporting services
Spatial Scale	1	1	1	1	1	1	1	1	1	1	1	1
Duration	3	3	3	3	3	3	3	3	3	3	3	3
Severity	1	1	2	1	1	1	2	1	1	1	1	1
Frequency	1	1	1	1	1	1	1	1	1	1	1	1
Probability	1	1	1	1	1	1	1	1	1	1	1	1
Significance Rating	10	10	12	10	10	10	12	10	10	10	10	10
Significance interpretation	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low

5.4 Unplanned Events

The planned activities of the development will have known impacts which were discussed; however, there is potential for unanticipated impacts on a watercourse which result from accidents or equipment failure. As a result, these risks are undefined as the size, volume, toxicity etc. are unknown making assessing the risk unfeasible; however, their potential for modification of a system should still be noted. Due to the unanticipated nature of these risks, capturing them all is impossible. Hydrocarbon spillages into riverine habitat has the potential to contaminate both sediments and water resources. As a result, spill kits must be always available on site with all incidents reported to the onsite Environmental Control Officer (ECO). During construction, unplanned erosion may occur from, for example bank collapse during construction which will result in the sedimentation of the watercourse downstream. Erosion control measures must therefore be considered.

Table 5-16 is a summary of the findings from a riverine ecology perspective. Please note not all potential unplanned events may be captured herein and this must therefore be managed throughout all phases.

Table 5-16: Unplanned Events and their Management Measures

Unplanned Event	Potential Impact	Mitigation
Hydrocarbon/process/sediment capture dam spill	Contamination of sediments and water resources associated with the spillage.	A spill response kit must be always available. The incident must be reported on and if necessary a wetland specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Uncontrolled erosion	Sedimentation of downstream river reach.	Erosion control measures must be put in place. Monitoring and active engagement with local land users is recommended to monitor for erosion in the long term.

5.5 Cumulative Impact Assessment

The results of the cumulative impact assessment are provided above Table 5-14 and Table 5-15.

5.5.1 Cumulative Impact Statement

The expected cumulative impacts for the proposed project on aquatic biodiversity are minimal where the avoidance and mitigation measures are to be implemented.

5.6 Irreplaceable Loss

Should the mitigation and avoidance actions as recommended in this study be implemented, no irreplaceable loss of aquatic biodiversity can be expected.

6 Aquatic Ecology Minimum Requirements Statements

The National Environmental Management Act (NEMA) has established minimum criteria that must be considered in aquatic biodiversity studies (RSA Government, 2020). Although these aspects were largely covered in this report, specific aspects relating to the anticipated impacts remain. The following table was compiled to directly address the remaining aspects not already covered by the impact and risk assessment (Table 6-1).

Table 6-1: Additional aspects required by the minimum report requirement notice

Condition	Response
2.5.1: Is the proposed development consistent with maintaining the priority aquatic ecosystems in its current state and according to the stated goal.	Project is within an upstream management area and no NFEPA wetland areas are to be impacted.
2.5.2: Is the proposed development consistent with maintaining the resource quality objectives.	It is not anticipated that the proposed project will have an effect on the established RQO's of the Crocodile River system located downstream.
2.5.3a: How will the project impact on the hydrological functioning at a landscape level.	The project will likely reduce infiltration rates and increase the catchment hardness.
2.5.3a: Will the proposed development change the sediment regime of the aquatic ecosystem.	An increase in sediment yields can be expected from the project.
2.5.3c: What will the extent of the modification in relation to the overall aquatic ecosystem be.	Should avoidance be implemented limited impacts to watercourse extents can be expected.
2.5.3d: To what extent will the risks associated with water uses and related activities change.	There will be a minimal impact to water users associated with the project.
2.5.4a: How will the proposed development effect base flows.	Minimal impacts to baseflow are anticipated.
2.5.4b: How will the proposed development effect the quantity of water.	A limited change in baseflow can be expected.
2.5.4b: How will the proposed development effect the hydrogeomorphic characteristics of the watercourse.	There are no likely impacts to the hydrogeomorphic features.
2.5.4b: How will the proposed development effect the quality of water.	Should effective water recycling and no spillages occur, no impacts to water quality can be expected.
2.5.4b: How will the proposed development effect habitat fragmentation.	There is unlikely to be habitat fragmentation in the watercourses considered.
2.5.4f: How will the proposed development effect unique or important aquatic features.	No unique or important features are likely to be impacted.
2.5.5a: How will the proposed development impact on flood attenuation.	No impact to flood attenuation can be expected.
2.5.5b: How will the proposed development impact on streamflow regulation.	Limited impacts to streamflow are anticipated.
2.5.5c: How will the proposed development impact on sediment trapping.	Sediment trapping of natural vegetation will be reduced by the project. The project will have a limited impact on sediment trapping.
2.5.5d: How will the proposed development impact on phosphate assimilation.	Phosphate assimilation is expected to be retained where limited impacts to assimilation processes can be expected.
2.5.5e: How will the proposed development impact on nitrate assimilation.	Nitrate assimilation is expected to be retained where limited impacts to assimilation processes can be expected.
2.5.5f: How will the proposed development impact on toxicant assimilation.	Toxicant assimilation is expected to be retained where limited impacts to assimilation processes can be expected.
2.5.5g: How will the proposed development impact on erosion control.	The proposed project will implement erosion/surface water controls and will therefore minimise erosion risk.
2.5.5h: How will the proposed development impact on carbon storage	Carbon storage in watercourses is unlikely to be impacted.

Condition	Response
2.5.6: How will the proposed development impact on freshwater ecology with regards to the community composition	The proposed project is unlikely to affect freshwater ecology.

7 Recommendations and Monitoring

The following monitoring plan is provided Table 7-1.

Table 7-1: Monitoring plan for the project

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored
Seep wetland associated with processing activities	Determine if alien invasive species are being managed, effective stormwater management implemented and the maintenance of wetland condition.	Once every 2 years	Wetland PES

8 Conclusion

The outcome of this assessment delineated 2 watercourse HGM units within the AoI. The summarised information is presented in Table 8-1. These watercourses were derived to range from seriously modified (class E) to largely modified (class D) PES. The watercourses were classified as having Very High and High EIS ratings. A scientific buffer was calculated for the watercourses, where a 35m buffer for wetlands and a 30m buffer for drainage lines was utilised to protect these sensitive environments.

Table 8-1: PES and EIS Summaries

Watercourse Unit	PES	EIS	Buffer
HGM1	**Class E**	Very High	35m
HGM2	**Class D**	High	35m

8.1 Impact Statement

The outcomes of the risk assessment indicate minor impacts from the proposed activities. The minor impacts can be attributed to the use of the existing disturbed areas as well as the relative small scale of the project. Should sediment and stormwater controls be in place limited impacts to wetlands can be expected.

In the view of the proposed new activities, should the proposed mitigation actions be implemented, no fatal flaw was identified. In line with the recommendations, avoidance must be implemented.

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