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TECHNICAL NOTE

To:	Johann van Wyk	**Date:**	30 June 2023
Company:	Sasol South Africa (Pty) Ltd	**From:**	Kathy Taggart
Copies to:	Suyen Van Zyl	**Reviewed:**	Jacqui Hex
		J&W ref:	TN154/23/K420-Rev0
File ref:	K420_r0_Ekandustria-Wetland Risk Assessment		

PROJECT: EKANDUSTRIA MAGAZINES AND SHOOTING BAY

WETLAND RISK ASSESSMENT

1. INTRODUCTION

Sasol South Africa (Pty) Ltd (Sasol) operates an existing magazine storage facility and associated shooting bay at their Ekandustria Operations in Bronkhorstspruit, Gauteng Province (**Figure 1-1**). Sasol intends to expand these facilities by constructing six (6) new magazines (5 X 100 ton and 1 x 50 ton). The construction of the new magazines will be in the area of the existing shooting bay, which will need to be re-located as part of the project.

The proposed new magazine storage facilities and shooting bay will be located within the 500 m Regulated Area[1] of a wetland and a Wetland Risk Assessment (RA) is therefore required to determine the sensitivity of watercourses within 500 m of the proposed activities. Depending on the outcome of the RA, either a General Authorisation (GA) or Water Use Licence (WUL), in terms of the National Water Act (Act 36 of 1998) (NWA) for Section 21(c) and (i) water uses, will be required.

Jones & Wagener (Pty) Ltd Engineering and Environmental Consultants (J&W) was appointed to undertake the Wetland Risk Assessment in terms of Government Notice (GN) 509 and assist in the application for the Section 21(c) and/or (i) water uses, dependant on the level of risk identified. This report details the findings of the wetland risk assessment undertaken.

[1] For section 21(c) or (i) of the National Water Act, 1998 (Act 36 of 1998) water uses in terms of GN 509 (2016), the Regulated Area means:
(a) 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;
(b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or
(c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

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Sasol South Africa (Pty) Ltd

Ekandustria Magazines and Shooting Bay - Wetland Risk Assessment

Locality map

Job No: K420-00

Figure 1-1

1.1 Project Team

The wetland risk assessment has been managed and undertaken by J&W. Ecology International undertook the desktop assessment of the potential risks to the aquatic ecosystems. The key personnel listed in **Table 1-1** have been responsible for the project.

Table 1-1: Project Team

RESPONSIBILITY	NAME	QUALIFICATIONS
Project Director & Reviewer	Jacqui Hex	MSc Environmental Science PrSciNat (Environmental Science) Registered EAP (EAPASA); EAPASA board and EXCO member
Project Manager and Wetland Ecologist	Kathy Taggart	MSc. Conservation Biology PrSciNat (Ecological & Environmental Science)
Wetland Ecologist	Sashin Pillay	BSc Hons Biological Science CandSciNat (Ecological Science)
Aquatic Specialist	Byron Grant	MSc Aquatic Health PrSciNat (Ecological, Aquatic & Zoological Science)
Drafting	Chrisan Nienaber	

Please see attached the CVs and relevant SACNASP and Environmental Assessment Practitioner (EAP) qualifications (**Appendix A**), together with the specialist Declaration of Independence (**Appendix B**).

2. ENVIRONMENTAL SETTING

2.1 Site Locality

The Ekandustria operations are located approximately 2.5 km west of the town of Ekandustria, on the Farm WITBLITS 613 JR, in the Gauteng Province (**Figure 1-1**). Administrative boundaries are highlighted in **Table 2-1** and **Table 2-2**.

Table 2-1: Administrative boundaries of Ekandustria Operations

PROVINCE	Gauteng
DISTRICT MUNICIPALITY	Metsweding
LOCAL MUNICIPALITY	Kungwini Local Municipality
PRIMARY CATCHMENT	Olifants
WATER MANAGEMENT AREA	Olifants Water Management Area (WMA)
QUATERNARY CATCHMENTS	B31A

Table 2-2: Property details for proposed magazine and shooting bay

FARM PORTION	Portion 1 of WITBLITS 613 JR
21 DIGIT CODE	T0JR00000000061300001

2.2 Climate

The Bronkhorstspruit region has a temperate highland tropical climate with very dry winters and wet summers. The average annual temperature is 17°C, with the warmest month being January (average high of 29.1°C) and the coldest month July (average low of 7.83°C). The average annual rainfall is 691 mm, with more rain falling in summer than in winter.

2.3 Regional Vegetation

The Ekandustria operations are located within Grassland Biome, Mesic Highveld Grassland Bioregion and at a finer scale the Rand Highveld Grassland. Mucina & Rutherford (2006) describes this vegetation type as being characterised by a highly variable landscape with extensive sloping plains and a series of ridges slightly elevated over undulating surrounding plains. The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrubland on rocky outcrops and steeper slopes. Most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus*. High diversity of herbs, many which belong to the Asteraceae, is also a typical feature.

The vegetation type is listed as *Vulnerable* in the National List of Ecosystems that are Threatened and in Need of Protection (GN2747 of 2022). In the most recent National Biodiversity Assessment (NBA, 2018) the vegetation type is listed also listed as Vulnerable and Poorly Protected.

2.4 Regional Geology and Soils

As described by Mucina & Rutherford (2006) the geology of the Rand Highveld Grassland includes quartzite ridges of the Witwatersrand Supergroup and the Pretoria Group as well as the Selons River Formation of the Rooiberg Group (last two are of the Transvaal Supergroup), supporting soils of various quality (shallow Glenrosa and Mispah especially on rocky ridges).

2.5 Surface Water

The Ekandustria operations are located within the Olifants River catchment, and within quaternary catchments B31A of the Olifants Water Management Area (WMA4) (**Figure 2-1**). The proposed magazine storage facilities and shooting bay are located adjacent to an un-named tributary of the Masokololo River which flows in a north-west direction downstream of the proposed activities. The Masokololo River drains into the Elands River, which is a tributary of the Olifants River.

The ecological categorisation of the Elands River is provided in **Table 2-3**.

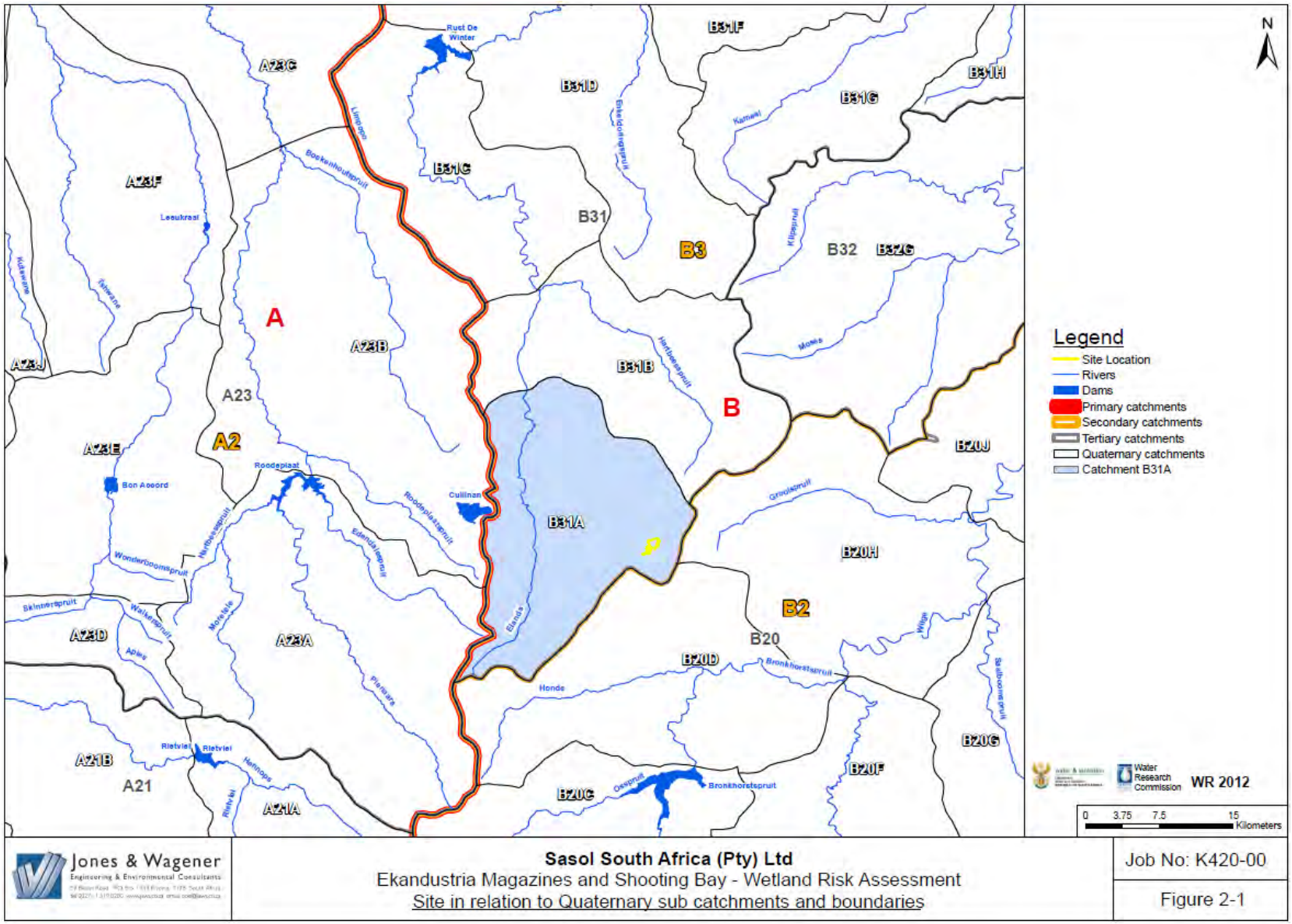


Figure 2-1: Quaternary Catchment

Table 2-3: Elands River Ecological Categorisation (DWS, 2018)

Quaternary Catchment	Water Resource	Present Ecological State	Ecological importance	Ecological Sensitivity	Recommended Ecological Category
B31A	Elands	C	High	High	C

The quaternary catchment characteristics are summarised in **Table 2-4**.

Table 2-4: Quaternary Catchment Characteristics (WRC, 2012)

Quaternary Catchment	Catchment Surface Area (km^2)	Mean Annual Precipitation (MAP) (mm)	Mean Annual Runoff (MAR) (mcm)
B31A	387	677	14.44

2.6 Wetlands

The wetlands associated with the expansion of the Ekandustria operations have been discussed below in terms of national importance and the field verified wetlands assessed by AIM 360 Environmental (AIM, 2023).

2.6.1 Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Area (NFEPA) project (Driver *et al.*, 2011) provides strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources in South Africa. Freshwater Ecosystem Priority Areas (FEPAs) were identified using a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands and estuaries. The NFEPA guidelines indicate that FEPAs should be regarded as ecologically important and as generally sensitive to changes in water quality and quantity, owing to their role in protecting freshwater ecosystems and supporting sustainable use of water resources. FEPAs that are in a good condition should remain so, and FEPAs that are not in a good condition should be rehabilitated to their best attainable ecological condition. Land-use practices or activities that will lead to deterioration in the current condition of a FEPA are considered unacceptable, and land-use practices or activities that will make rehabilitation of a FEPA difficult or impossible, are also considered unacceptable.

No wetland FEPAs were identified in the 500 m Regulated area of the proposed activities, nor is the study area located in a FEPA classified sub-quaternary catchment.

2.6.2 Ekandustria Wetlands

AIM (2023) undertook a wetland assessment for the proposed Ekandustria operations (**Appendix C**). The wetland assessment undertaken by AIM included the following:

- Identify and delineate any wetlands within the property in terms of DWS's practical field procedure for identification and delineation of wetlands and riparian habitats (DWAF, 2005).
- Classify the delineated wetlands in terms of the National Wetland Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis et al., 2013).

- Determine the Present Ecological State (PES) through evaluation of wetland hydrology, geomorphology and vegetation as per the WET-Health methodology (MacFarlane et al. 2007).
- Determine the Ecological Importance and Sensitivity (EIS) of wetlands.
- Assess ecosystem services/benefits provided by wetlands using the Level 2 WET-EcoServices assessment tool (Kotze et al., 2007).

2.6.2.1 Wetland HGM Units

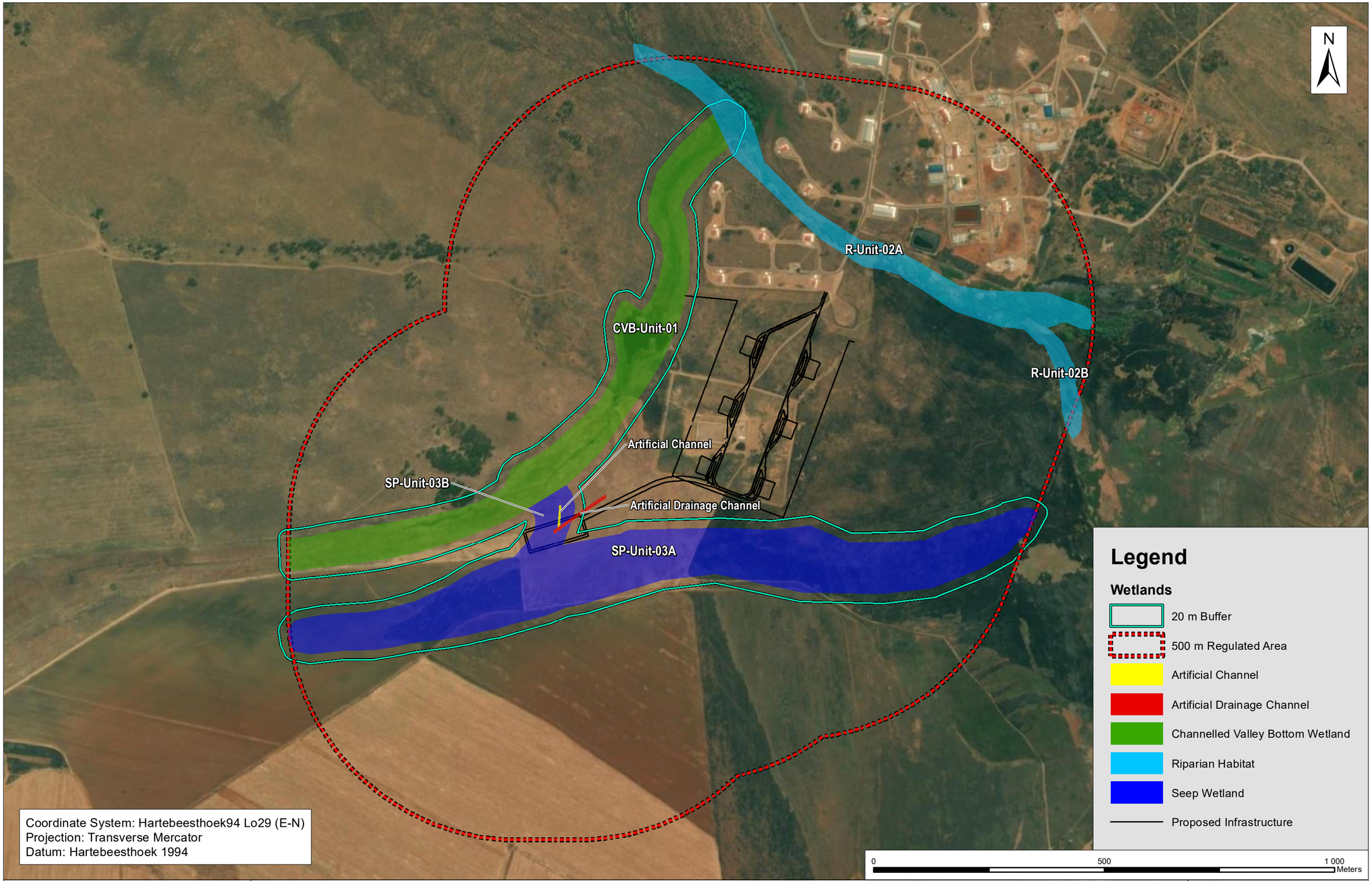
The wetland HGM units identified within the 500 m Regulated Area include an channelled valley bottom wetland (with sections that were unchannelled) and a seep wetland (**Figure 2-2** and **Figure 2-3**). These HGM units, as described by Ollis *et al*, (2013), include:

- Valley Bottom Wetlands. A mostly flat wetland area located along a valley floor, often connected to an upstream or adjoining river channel.
    - *Channelled valley-bottom*. Valley-bottom wetland with a river channel running through it. Channelled valley-bottom wetlands are characterised by their location on valley floors, the absence of characteristic floodplain features and the presence of a river channel flowing through the wetland. The wetland plants were found to be dominated primarily by species such as: *Imperata cylindrica*, *Typha capensis*, *Cyperus* spp, *Schoenoplectus brachyceras*, *Cynodon dactylon* and *Sporobolus pyramidalis*.
    - *Un-channelled valley-bottom*. A valley-bottom wetland without a river channel running through it. Unchannelled valley-bottom wetlands are characterised by their location on valley floors, an absence of distinct channel banks, and the prevalence of diffuse flows.
- Seep. Wetland area located on gently to steeply sloping land and dominated by colluvial (i.e., gravity-driven), unidirectional movement of water and material down-slope. Seeps are often located on the side-slopes of a valley, but they do not, typically, extend onto a valley floor. Seeps are characterised by their association with geological formations (lithologies) and topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to 'seep' down-slope as subsurface interflow. For the hillslope seep within this study area the main water input is subsurface flow. The wetland vegetation in the seep wetlands was identified by AIM (AIM, 2023) as being dominated by the following: *Imperata cylindrica*, *Schoenoplectus brachyceras*, *Cynodon dactylon*, *Kyllinga* spp and *Sporobolus pyramidalis*.

Valley Bottom Wetland

Seep Wetland

Figure 2-2: Ekandustria Operations - Wetlands



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Ekandustria Wetlands (AIM, 2023)

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Figure 2-3

2.6.2.2 Present Ecological State

The PES of the HGM units was assessed by AIM (2023) with the findings summarised below:

- The Channelled Valley Bottom Wetland CVB-01 was evaluated as having a moderately modified (PES Class of C), which implies a moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact. The key impacts identified by AIM (2023) included:
  - Presence of instream artificial dams resulting in impoundment of natural flow;
  - Proliferation of alien plants; and
  - Streamflow altering activity such as timber plantations located within the catchment of the wetland.
- The PES condition of the Seep Wetland SP-Unit 03 A and 3 B was evaluated as largely natural (PES Class of B), which implies that the wetland is 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. The key impacts identified by AIM (2023) included:
  - proliferation of alien plants;
  - informal access roads passing through the wetland; and
  - Artificial channels (furrows) draining the wetland, possibly created as part of previous agricultural activates within the farm.

2.6.2.3 Importance and Sensitivity

The overall Importance and Sensitivity (IS) of the HGM units was assessed by AIM (2023) with the findings summarised below:

- The overall IS of the Channelled Valley Bottom Wetland CVB-01 was assessed as Moderate, with the EIS and hydrological functional importance scoring Moderate and the direct human benefits scoring Low.
- The overall IS of the Seep Wetland SP-Unit 03A and B was assessed as Moderate, with the EIS and hydrological functional importance scoring Moderate and the direct human benefits scoring Low.

2.6.2.4 Ecosystem Services

The ecosystem services of the HGM units were assessed by AIM (2023) with the findings summarised below:

- The most noticeable ecosystem services provided by the Channelled Valley Bottom Wetland CVB-01 included flood attenuation, sediment trapping, nitrate removal, erosion control, maintenance of biodiversity and water supply for human use. Nitrate removal and erosion control scored the highest – moderately high.
- The most noticeable ecosystem services provided by the Seep Wetland SP-Unit 03A and B included flood attenuation, sediment trapping, nitrate removal, phosphate trapping, erosion control, maintenance of biodiversity, water supply for human use and cultivated food. Nitrate removal, phosphate trapping, and erosion control scored the highest.

2.6.2.5 Wetland Buffers

AIM (AIM, 360) has determined a recommended 20 m buffer on all wetlands.

2.7 Biodiversity

2.7.1 Gauteng C- Plan

In accordance with the Gauteng C-Plan version 3.3 the proposed shooting bay is located within a Critical Biodiversity Area (CBA), with the magazines located in both a CBA and an Ecological Support area (ESA):

- Critical Biodiversity Area. CBAs are those areas (outside of Protected Areas) that are required to meet biodiversity targets for biodiversity pattern (species and ecosystems) and ecological processes. They should remain in a natural state that is maintained in good ecological condition. CBAs are areas of high biodiversity value but are often also at risk of being lost through biodiversity-incompatible land-use practices. The CBAs in the vicinity of the proposed magazine storage facilities and the shooting bay have been identified as CBAs based on plant and bird habitat for Red Listed species, being located within a priority quaternary catchment and having primary grassland present.
- Ecological Support Areas. ESAs are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of critical biodiversity areas or for generating or delivering important ecosystem services. They support landscape connectivity and resilience to climate change adaptation. ESAs need to be maintained in at least an ecologically functional state.

2.7.2 Aquatic Biodiversity

Based on biomonitoring reports made available at the time of writing, only a single biomonitoring site located in a farm dam is associated with the current shooting bay facility. Assessment of the diatom assemblage during December 2022 (WSP Group Africa, 2022), reflected high ecological water quality with low levels of organic pollution, and with limited percentage of pollution tolerant values relative to other sites assessed at the time. The dominant diatom taxa at the site further pointed to well-oxygenated, oligo- to mesotrophic waters with low electrolyte content, while the presence of some taxa pointed to slightly acidic conditions prevailing. Moreover, the dominant taxa sampled were considered tolerant to moderate pollution levels. Nevertheless, the water stemming from the Farm Dam (Site SNBM3.1) aids in diluting the contaminated water from the Masokololo River (Site SNBM3), resulting in an improvement in ecological water quality along the longitudinal profile of the river (WSP Group Africa, 2022) (**Figure 2-4**).

According to aquatic macroinvertebrate data obtained for the site during December 2022, the aquatic macroinvertebrate assemblage following application of the SASS5 approach was classified as seriously to critically modified (Ecological Category E/F) based on the biological banding approach of Dallas (2007). It should however be noted that the SASS5 protocol was not developed for use in wetland systems such as those associated with the present study area where it is expected, given the generally low habitat diversity generally encountered within valley-bottom wetlands such as that associated with the present study area, that aquatic macroinvertebrate diversity would be naturally lower than that present within mainstem rivers where hydraulic diversity would be greater as a result of interaction with more diverse geological features as well as the relative catchment sizes of the respective watercourses. For example, according to a study conducted by Bird (2010), the SASS index appeared to be unable to reliably distinguish impairment levels among sites in comparison to the precision witnessed when using this index in rivers. It was further concluded that a certain degree of inferential power is lost when transferring the SASS index from rivers to valley bottom wetlands (and even more so when assessing an impoundment which serves as the sole biomonitoring location within the reach). However, application of the SASS5 protocol does nevertheless provide a useful tool for monitoring purposes given that sampling protocol and data analysis is standardised between surveys

and implementing agents, on condition that it is applied and interpreted within the context of the associated system.

Moreover, the application of the Dallas (2007) biological banding approach utilised during current biomonitoring studies has significant limitations in its determination of PES determination, and results obtained following this approach should be interpreted with extreme caution.

While no fish collection records could be located for the watercourse adjacent to the study area, collection records downstream as well as some similar upland systems within the larger catchment coupled with available information pertaining to instream habitats within the system suggest that the fish assemblage would be similarly limited, with an estimated four (4) indigenous species present within the associated reach upstream and downstream of the impoundment. The impoundment adjacent to the site is also expected to support some indigenous fish species but may also support additional limnophilic species such as the listed alien *Micropterus salmoides* (Largemouth Bass).

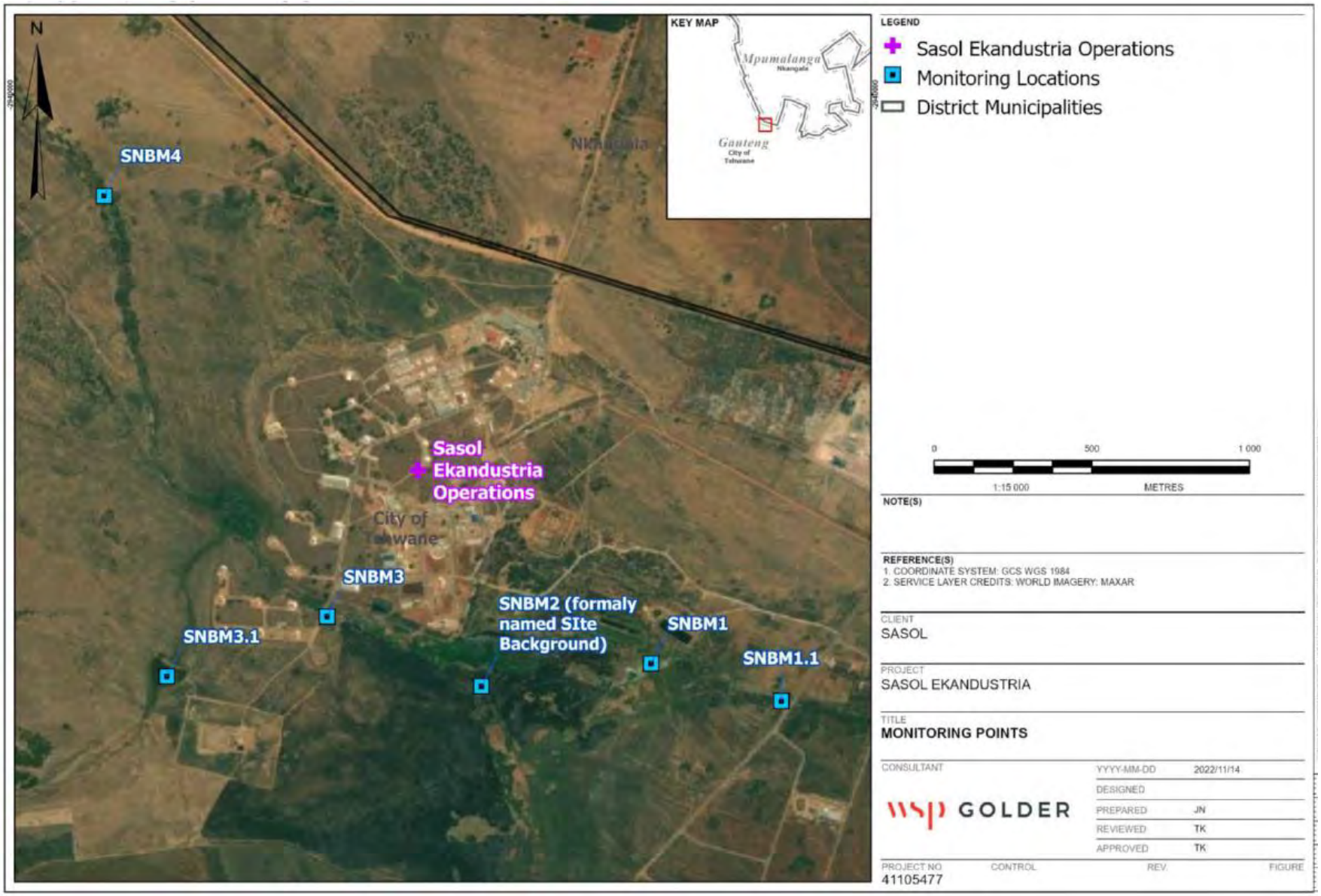


Figure 2-4: Location of aquatic monitoring points (WSP Group Africa, 2022)

3. DETAILED PROJECT DESCRIPTION

Sasol Ekandustria are looking at expanding trinitrotoluene (TNT) storage within the Ekandustria site. This will require the addition of six (6) storage magazines and associated civil and electrical infrastructure. The biggest challenge for the site is the lack of suitable TNT storage facilities that support the explosives production. Currently the Ekandustria site utilizes the Sasol Secunda site for storage of TNT, and this presents both operational and transportation constraints. The addition of TNT magazine storage facilities is therefore necessary from a logistical and economic perspective. A site selection process was undertaken by Sharpshell Engineering (Sharpshell, 2021) with the preferred locations resulting in the need to move the existing shooting bay to be outside of the blast circle safety distances. The project therefore also includes the construction of a new shooting bay. The proposed site layout is provided in **Figure 3-2**.

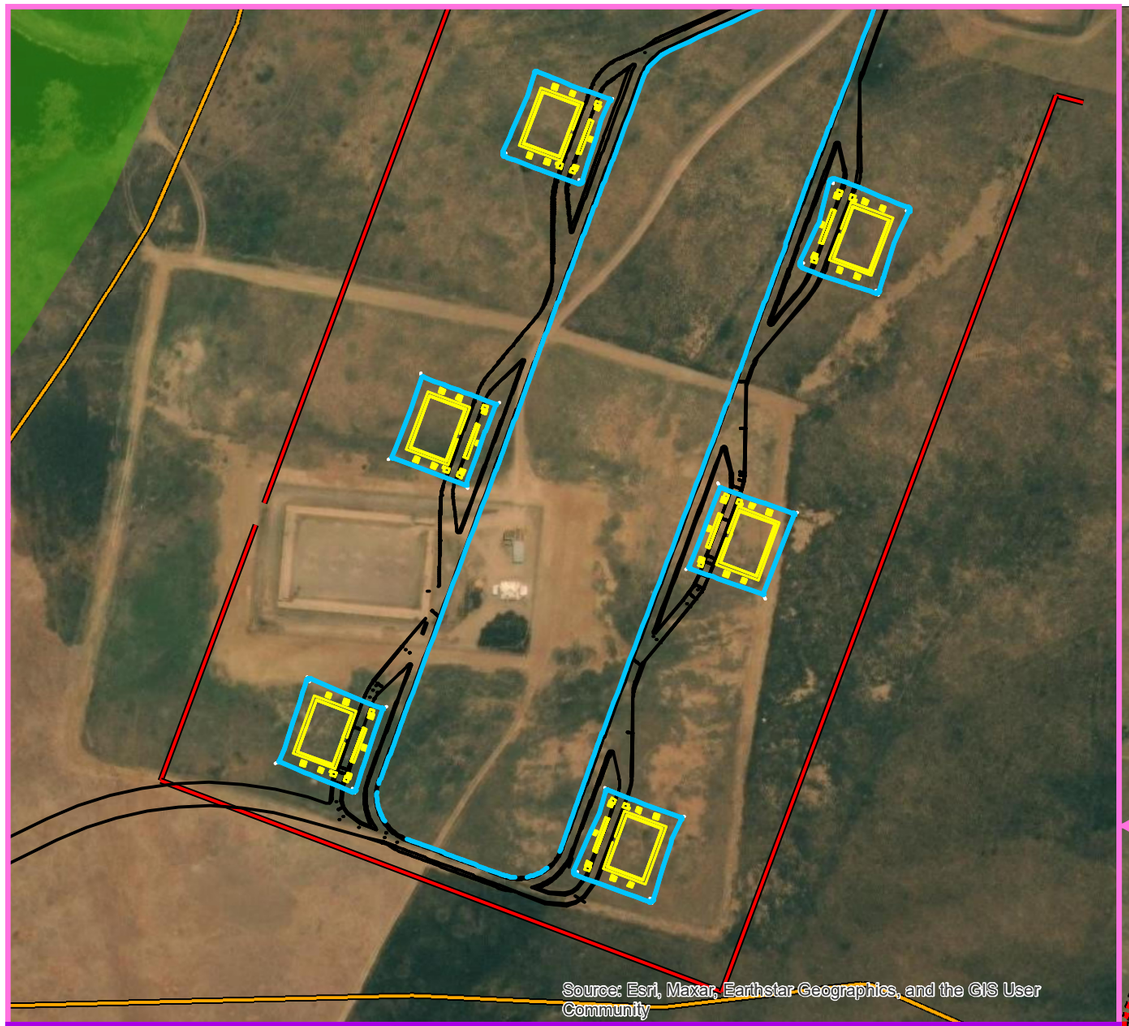
Information from the Sharpshell Engineering feasibility study (Sharpshell, 2021) has been utilised to provide the detailed project description given below.

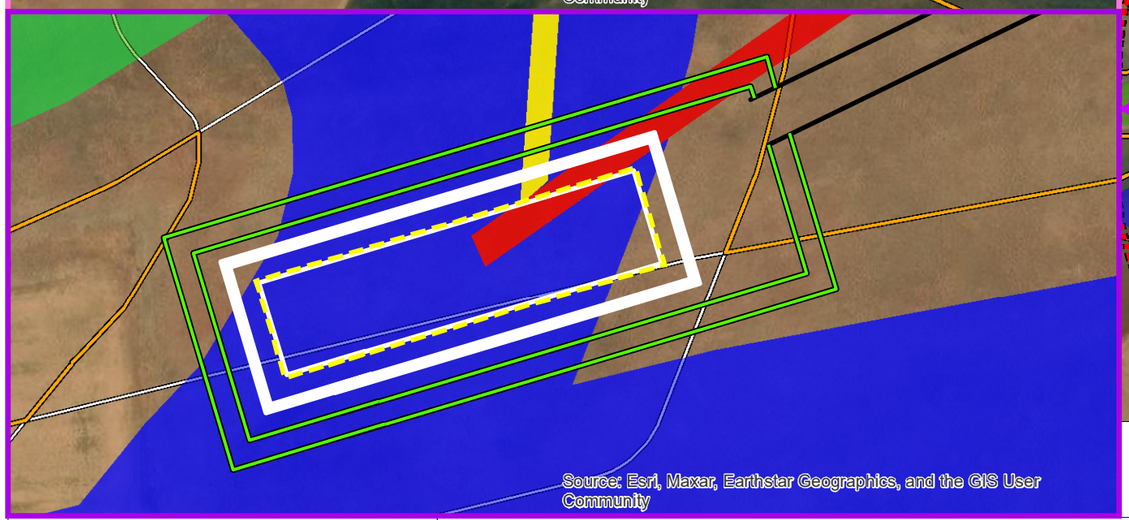
3.1 Magazine Storage Facilities

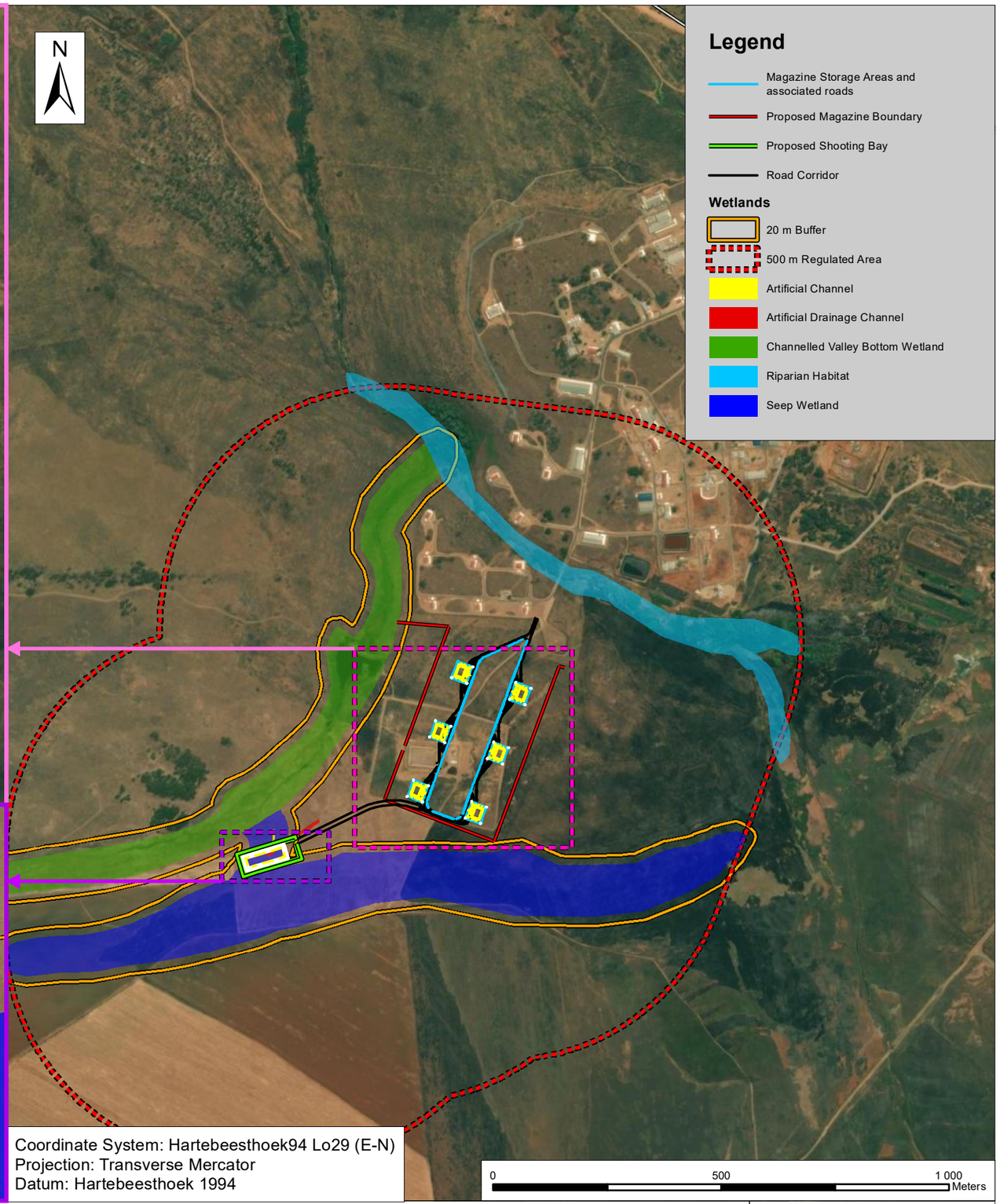
As mentioned, the proposed magazine storage facilities will include 5 x 100-ton facilities and 1 x 50-ton facility. The magazine site placement and the storage capacity of the facilities was selected in accordance with the explosives blast circle safety distances as required in the Explosives Act, 2003 (Act No.15 of 2003).

Although the design will be slightly different **Figure 3-1** is an example of the existing magazine storage facilities at the Ekandustria operations.

Figure 3-1: Existing magazine storage facilities – Ekandustria







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Site Layout

Job No: K420-00

Figure 3-2

The 50-ton and 100-ton storage facilities will be identical with the only difference being the licensing of the facilities in terms of the Explosives Act (Act 15 of 2003), with each facility being licensed for its respective capacity.

Each magazine storage facility consists of a length of 29 m x width of 22 m outside dimensions and inside total area of 414m^2 for total TNT pallet storage of 160. The magazine consists of only one access point used for both entrance and exit. The blast walls are to be 2.7 m wide at the bottom and reduces to 1.5m wide at the wall top level. All wall top level should be 4 m high from the ground level. This wall height is to accommodate a 3 m high door opening for the roller shutter door which is to allow easier forklift access carrying TNT pallets in the building.

The magazines walls can either be from backfill compacted C4/G5 material or fibre reinforced ashcrete infill or similar approved material, the material to be used will be confirmed during the detailed design phase. The inside phase wall of the magazine shall be made of 320 mm load bearing masonry wall or similar appropriate wall material capable of resisting earth pressure from the backfill expected infill material.

The magazines outside perimeter wall shall be sloped and suitable layer (100 mm thick) of concrete to be used for erosion control or similar approved. Stormwater gutter system and V drain to be used to direct storm water away from the building and foundations.

3.1.1 Magazine Storage Facility Method Statement

As described by Sharpshell Engineering (2021), together with information supplied by the client, and the stormwater management plan (LochRoux, 2021) the following will be undertaken for the construction of the magazine storage facilities:

- Site clearance of existing vegetation and topsoil to a depth of 150 mm
- Concrete works for all foundations. Water required for concrete mixing will be supplied by tanker.
- Excavation for the road infrastructure and electrical trenching.
- 4 m high and 2.7 m wide wall berms for the magazines which includes the backfill C4 material embedded in the wall.
- Installation of lightning mast for both magazines and associated foundations.
- Installation of roof trusses (17 m span) for the magazines' roofs.
- IBR sheeting to be installed as per Sasol's requirements.
- Concrete slab, erosion control on the walls and V drains to be casted in and around the magazines.
- Installation of subbase, base and paving layers for the road surface.
- Fabrication and installation of steel platforms for the storage of TNT inside the magazines.
- Plastering and painting of the internal walls as per OSH act requirements.
- Electrical installation of lighting and associated plugs (if required) inside the magazine.
- Painting of the outside magazines' walls as per OSH act requirements.

For the design of the magazine storage facilities, it was assumed that shallow groundwater would not be a problem at the proposed construction sites.

As per the Stormwater Plan (LochRoux, 2021) the following is proposed:

- All roads have been designed such that the gradients are no less than 0.5 % with a slope of 2.5 % crossfall. This will serve as an interceptor, which will also channel the stormwater runoff to the lowest points which will then be discharged into the existing open areas, existing stream, and the existing dam.
- All roads have been designed with a gravel surface, compacted to 98 % Mod AASHTO, which will decrease the likelihood of erosion and the roads still remains permeable to some degree.

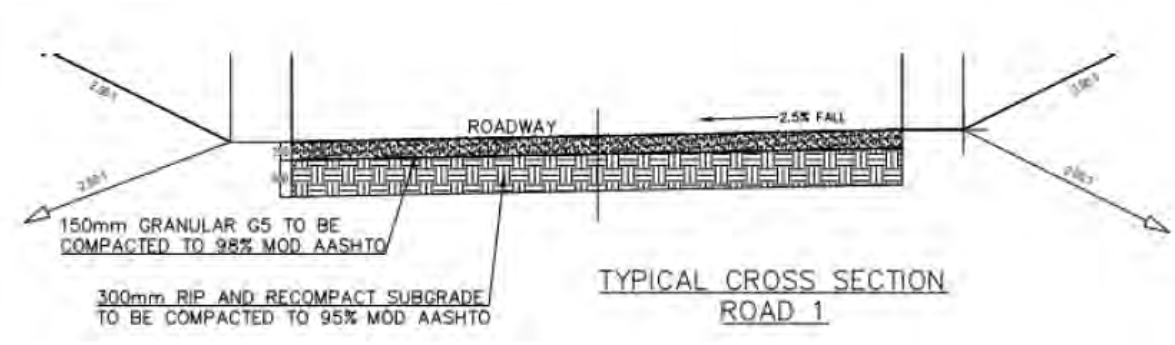

Figure 3-3: Proposed typical road cross-section (LochRoux, 2021)

- The Roads would be 4 m in width and designed with a minimum gradient of 0.5 % and a maximum gradient of 6 %. This indicates that the velocity of surface flow at these gradients would be minimal, therefore side drains, drop structures, or lined channels are not required.
- The platforms are designed with a 2 % crossfall towards the roads and away from the buildings.
- In addition, each magazine has earth lined channels (V drains) covering the perimeter around it and also draining away from the building and towards the roads.

3.2 Shooting Bay

3.2.1 Shooting Bay Method Statement

- The shooting bay will consist of blast mounds constructed from sandbags and a masonry wall with length of 96 m x width of 33 m outside dimensions and inside total area of 3082.85 m^2 for a total of eight (8) blasting test areas. The shooting bay consists of only one access point used for both entrance and exit. This will be access controlled with a gate and a fence surrounding the proposed development.
- The shooting bay outside perimeter wall shall be sloped and will consist of a fire break that will be cleared and maintained around the proposed shooting bay. The firebreak will be 3 m wide on all edges.
- There will also be a masonry control room constructed inside the fence and adjacent to the shooting bay. Additionally, there will be a carpark area that will be covered and protected with roof sheeting.
- The storm water plan, discussed in Section 3.1.1, will apply to the roads associated with the shooting bay. In terms of the shallow groundwater, likely to be encountered on site, the shallow groundwater will be intercepted upslope of the shooting bay and diverted around the shooting bay to the downstream wetlands. The flow will be dissipated prior to entering the wetland.

4. RISK ASSESSMENT

4.1 Methodology

The wetland risk assessment methodology has been based on the DWS (2014) "*Risk based water use: authorisation approach and delegation protocol for Section 21(c) and (i) water uses*." A risk assessment refers to the documented risk of environmental impact(s) due to a change in the receiving environment by an activity either intentionally or unintentionally. For section 21(c) and (i) water uses it will refer to changes in the water resource quality characteristics of all watercourses. The formula used to determine risk is indicated hereunder and explained below.

RISK = CONSEQUENCE x LIKELIHOOD

CONSEQUENCE = SEVERITY + SPATIAL SCALE + DURATION
LIKELIHOOD = FREQUENCY OF THE ACTIVITY + FREQUENCY OF THE IMPACT + LEGAL ISSUES + DETECTION

Risk is based on the likelihood of occurrence and the consequence it poses to the characteristics of a watercourse. The likelihood is a factor of the mechanisms in place to **detect** failure, the **frequency** that the activity is undertaken, **legal implications** of failure and the **frequency of impact occurrence** on the watercourse(s). The consequence is measured in terms of **severity**, **duration** and **spatial scale**. The amount of risk involved will trigger the requirement of certain measures to be implemented in order to reduce the risk with a subsequent re-scoring of the risk assessed. The process is based on the International Organization for Standardization (ISO) standard ISO14001 (2004).

The estimation of the risk is based on the ratings highlighted in **Table 4-1.** Results from the risk assessment are discussed to provide a reasoned opinion of whether the proposed construction and operation activities, and the associated impacts with mitigation will have a LOW-risk class as determined through the DWS's risk matrix for a GA regarding Section 21 (c) and (i) water use activities. Risk is determined after considering all listed control / mitigation measures. Borderline LOW/MODERATE risk scores can be **manually** adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures considered.

Table 4-1: Risk Rating Methodology

Severity

How severe do the aspects impact on the environment and resource quality characteristics (flow regime, water quality, geomorphology, biota, habitat)?

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5

Spatial Scale

How big is the area that the aspect is impacting on?

Area specific	1
Whole site	2
Regional / neighbouring areas	3
National	4
Global	5

Duration

How long does the aspect impact on the environment and resource quality?

One day to one month, PES, EIS and REC not impacted	1
One month to one year, PES, EIS and REC impacted but no change in status	2
One year to 10 years, PES, EIS and REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores an E or F	5

Add severity, spatial scale and duration figures to obtain the total Consequence.

CONSEQUENCE

Frequency of the Activity

How often do you do the specific activity?

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Frequency of the Incident/Impact

How often does the activity impact on the environment?

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Legal Issues

How is the activity governed by legislation?

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5

Detection

How easily is the activity's impact on the environment observed?

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

LIKELIHOOD

4.2 Limitations and Assumptions

Several assumptions have been made in undertaking the risk assessment:

- The construction activities for all infrastructure will be undertaken in less than six (6) months;

- The wetland systems identified, assessed and delineated by AIM (2023) are a true representation of the wetlands on site. During the site visit undertaken by J&W, on 18 May 2023, additional areas displaying wetland characteristics were identified. J&W highlighted these areas to AIM 360 who updated their wetland delineation and assessment.;
- The aquatic impact/risk assessment was undertaken at a desktop level. Being a desktop exercise, extensive use was made of available literature, existing biomonitoring studies and the latest spatial databases associated with the area of interest in order to identify threats and opportunities regarding aquatic ecosystem features relating to the proposed prospecting activities. Such databases included (but not limited to) the National Freshwater Ecosystem Priority Areas project (NFEPA), latest provincial conservation plan, as well as any other recent academic studies or national/provincial assessments associated with the area of interest; and
- Sasol will adhere to all mitigation measures proposed.

4.3 Potential Impacts

The potential impacts associated with the construction and operation of the magazine storage facilities and the shooting bay are discussed below with mitigation measures discussed in Section 4.4 and monitoring and maintenance requirements discussed in Section 4.5:

- Pollution of surface water resources. The removal of vegetation and soil for the excavation of the magazine storage facilities, the shooting bay and associated roads, will result in the temporary exposure of bare areas until such time that the vegetation can re-establish. These bare areas may result in erosion and an increase in sediment in the downstream wetlands. Other potential impacts include spillage of hydrocarbons by construction vehicles, littering on site and contamination by biological waste produced during the construction activities. All of which may accumulate in the downstream wetlands through runoff, if un-mitigated. During the operational phase the pollution of surface water resources may occur due to the stormwater being discharged into the downstream wetlands. This impact is discussed further under the Biota section below.
- Compaction of soils. Compaction of soil may occur along the access routes due to the use of heavy machinery. The compaction of soils may lead to secondary impacts on both surface and groundwater. Surface water flow may be altered on a local scale, and groundwater infiltration will be minimised on a local scale in compacted areas, if not mitigated.
- Establishment of alien and invasive vegetation. The disturbance of the soil profile may result in the establishment of alien and invasive species.
- Impedance or diversion of flow. During the construction phase there may be temporary diversion or impedance of flow, for example while digging the foundations for the facilities and associated infrastructure. The operation of the shooting bay will result in a permanent impedance and diversion of flow within the seep wetland.
- Altering the bed, banks and characteristics of a watercourse. The construction of the shooting bay within the seep wetland, together with the stormwater management measures, will result in an alteration of the flows within the wetlands. The proposed infrastructure will result in an increase in hardened surfaces and therefore an increase in stormwater entering the downstream wetlands. The discharge of stormwater may also result in the creation of preferential flow paths if not appropriately mitigated.
- Biota

- Vegetation. The construction of the shooting bay will result in a direct loss of wetland vegetation due to the construction of the shooting bay within the seep wetland. The construction of the roads and the magazine storage areas has the potential to disturb the adjacent wetland vegetation (edge effects).
- Aquatic biota. It is understood that the explosive stored within the area will be 2,4,6-trinitrotoluene, or TNT. According to Sims & Steevens (2008), this compound degrades to various other compounds, all of which may have an adverse environmental effect on the biota of the area. Furthermore, TNT is biodegraded in water, soil, and sediment by fungi and bacteria species under both aerobic and anaerobic conditions (Preuss et al., 1993; Stahl and Aust, 1993; cited in Sims & Steevens, 2008). The products formed during this degradation process include, 2-amino-4,6-dinitroto- luene (2-ADNT), 4-amino-2,6-dinitrotoluene (4-ADNT), hydroxyaminodinitrotoluenes, 2,4-diamino-6-nitrotoluene (2,4-DANT), 2,6-diamino-4-nitrotoluene, 2,4,6-triaminoto- luene, and tetranitroazotoluene (Sims & Steevens, 2008). Another common contaminant at facilities manufacturing military explosives includes 1,3,5-trinitrobenzene (TNB) that is produced during the manufacture as well as photolytic degradation of TNT (Sims & Steevens, 2008).

  The toxicity of TNT has been evaluated in aquatic organisms including freshwater fish (e.g., Pearson et al., 1979; Bailey et al., 1985; Burton et al., 1993; cited in Lotufo, 2017), aquatic macroinvertebrates (e.g., Liu et al., 1983; Burton et al., 1993; Conder et al., 2004; cited in Lotufo, 2017), and tadpoles (e.g., Paden et al., 2003; Saka, 2004; Stanley et al, 2005; ; cited in Lotufo, 2017). However, several studies have reported greater toxicity of TNT degradation products as compared to the parent compound (Smock et al., 1976; Griest et al., 1998; Liu et al., 1983), while others report no change or lesser toxicity of TNT degradation products (Won et al., 1976; Dodard et al., 1998; Honeycutt et al., 1996; Steevens et al., 2002; cited in Sims & Steevens, 2008). These trends appear to be specific to the organism studied and contribute a significant amount of variability in deriving concentration-effect values that could be used to predict or estimate effects within an ecological risk assessment. Factors that may control the toxicity of TNT and its degradation products may include bioavailability in water and sediments, exposure route, and duration of exposure. An additional, yet unexplored reason is the capacity for the organism to either bioactivate TNT to a more toxic product or eliminate the chemical without receiving any toxicological impairment. Sims & Steevens (2008) does however acknowledge the presence of other contaminants may play a significant role in the toxicity of these compounds.

4.4 Mitigation Measures

Mitigation measures, relevant to this risk assessment and the activities associated with the construction and operation of the Storage Magazines and Shooting Bay, are discussed below. In terms of the design Sharpshell Engineering (2021) have indicated that all designs will adhere to all OHS Act & safety standards (Act 85 of 1993, as amended), Sasol design and construction relevant specifications as well as South African statutory code requirements.

4.4.1 General site management

General site management mitigation measures include:

- Prior to the carrying out of any works, Sasol must ensure that all persons entering the construction site must undergo the necessary health & Safety induction. The

induction must include the mitigation measures specified in this risk assessment and specifically the sensitivity of the wetland systems.

- Vehicle movement to and from the construction sites must be restricted to one access road and existing road networks must be utilised as far as possible. For the shooting bay the proposed new access road must be used for access during the construction period. The access routes must avoid the delineated wetland boundaries.
- Check vehicles regularly for oil leaks and only refuel in designated areas 50 m outside of the delineated wetland boundaries or the 1:100-year floodline whichever is greatest. Drip trays to be used where necessary. Oils and other potential pollutants must be disposed of at an appropriate licensed waste disposal facility. Should any spillages occur they should be cleaned up immediately.
- No washing of machinery in the watercourse.
- Provide clearly marked bins for litter and the discard of other waste materials.
- A chemical spill kit must be present onsite at all times and once used it must be disposed of at a registered hazardous landfill site.
- Provide and maintain portable toilets during the construction phase. Portable toilets should be located outside the 1:100-year floodline or 100 m from the delineated wetland boundaries, whichever is greater.
- Any fences constructed should ensure the movement of smaller wildlife species.
- No water to be abstracted from the adjacent watercourses or boreholes unless the necessary authorisations are in place.
- All water required for construction must be supplied by tanker to the site.
- Dust suppression to take place during the construction activities.
- The contractors camp and laydown area must be rehabilitated post-construction and all pollutants and waste will need to be removed and disposed of at an approved waste disposal facility.

4.4.2 Wetland avoidance

The construction of the Shooting Bay is located within the delineated wetland boundary and the following mitigation measures are therefore proposed:

- The construction activities will be undertaken in less than six (6) months and should be undertaken in the dry season;
- The contractor camp and associated laydown areas and parking must be located outside of the delineated wetland and associated buffer.;
- Any temporary stockpiles required for the construction activities, including topsoil stockpiles, are to be located outside of the delineated wetland footprint and associated buffer;
- Any storage of waste, prior to removal off site must be located outside of the 1:100-year floodline or 100 m from the delineated wetland boundary, whichever is greater;
- The maximum impact footprint is to be established, clearly demarcated, and no vegetation must be cleared or damaged beyond this demarcation, and equipment and machinery can only be operated within the delineated impact footprint.

For the construction activities associated with the magazine storage facilities and the shooting bay access road, the delineated wetlands, and associated buffers, should be

treated as sensitive no-go areas. No unauthorised access should be allowed within these areas.

4.4.3 Soil compaction

Compaction of soil may occur during the construction phase by the movement of heavy vehicles and machinery. This impact will be temporary and mitigation measures to reduce this impact include:

- Where available, the existing road networks and compacted areas will be utilised by heavy machinery for both transport of material and parking;
- Any areas where soil is compacted due to the construction activities, excluding where infrastructure will be placed, will be loosened prior to re-vegetation. The methodology for rehabilitating compacted areas is discussed further below:
  - The compacted areas will be ripped to a depth of 300 mm along the contour (i.e., at right angles to the slope; perpendicular to the direction of surface runoff and flow) to loosen up the existing ground and prevent erosion;
  - After the ripping process has been satisfactorily completed a 250 mm layer of topsoil is to be placed over the area. Topsoil should not be placed during the high rainfall season to reduce soil erosion and soil loss;
  - Topsoil must be uncontaminated (no pollution generating potential) and free of alien invasive species and ruderal weeds. Topsoil used should ideally be from the existing soil in the area. The soil removed for the construction of the magazine storage facilities and for the shooting bay, if uncontaminated, could be used for this purpose;
  - The topsoil will be placed on the loosened areas and levelled to be free draining. Care will be taken to ensure that no excessive slopes or directed water flow may lead to erosion ditches forming;
  - The topsoil shall then be scarified to a depth of 150 mm by means of hand-raking or light rotavators;
  - Final profiling – dozing/grading to ensure that the area is free-draining.

4.4.4 Erosion

- Ideally the construction activities should be scheduled to take place during the dry season;
- Topsoil stockpiles must be protected with silt fences that will be maintained during the entire construction phase on site;
- Utilise temporary erosion protection measures, for example sandbags, to prevent erosion and a resultant increase in sedimentation in downstream wetlands;

4.4.5 Revegetation

- Revegetation of disposed areas to take place during spring. For disturbed wetland areas a combination of natural succession and transplanting vegetation sods collected from adjacent wetland areas is recommended or alternatively the use of a seed mix similar to the Highveld Wetland mix (available from Diverse Ecological Solutions). The establishment of indigenous pioneer grasses will be encouraged and accelerated by picking mature seeds of such grasses from immediately adjacent areas and broadcasting them onto the rehabilitated area. Collection areas, species

to be collected and seeds to be collected must be identified by a wetland ecologist or botanist.

4.4.6 Stormwater management

In addition to the stormwater management measures proposed in the stormwater management plan (LouchRoux, 2021), Section 3.1.1 and Section 3.2.1, the following measures are to be implemented:

- Stormwater must be managed in such a manner as to disperse runoff and to prevent the concentration of stormwater flow.
- All stormwater discharges into watercourses must be attenuated at discharge points and the flow dissipated prior to entering the watercourse.
- The shooting bay will be constructed within the seep wetland. It is important that the surface flow and shallow groundwater is intercepted upstream of the shooting bay and diverted into the downstream wetlands. The discharge of this water must be attenuated, with the flow dissipated prior to entering the downstream wetland.
- The contractors camp and laydown area must be bound by a 0.5 m high stormwater berm that will contain any runoff emanating from the contractors' camp.
- Washbays and oil separator areas (if applicable) will need to be underlain with a concrete slab with concrete bund walls (250 mm high) to prevent any pollutants from discharging into the receiving environment.
- Stormwater leaving the site must in no way be contaminated by any substance which is produced, used, stored, dumped or spilled on the premises.

4.5 Monitoring and Maintenance

A number of monitoring requirements must be undertaken during the construction phase and the operational phase, these are discussed in detail below.

4.5.1 Water Quality

4.5.1.1 Construction Phase

For the construction activities up- and downstream monitoring of instream water quality must be taken on a weekly basis. The samples are to be taken as grab samples and analysed for pH, EC/TDS, TSS/Turbidity, suspended solids and Dissolved Oxygen.

4.5.1.2 Operational Phase

Surface Water

During the operational phase the current quarterly surface water quality sampling must be expanded to include an additional sampling point, upstream of the shooting bay and a second point downstream of the Farm Dam, before the confluence with the Masokololo River.

Groundwater

During the operational phase the current biannual groundwater quality sampling must be expanded to include additional boreholes up and downslope of the proposed new facilities. The placement of the boreholes is to be done in consultation with a hydrogeologist.

4.5.2 Aquatic Ecology

Based on the potential aquatic toxicity associated with TNT and its various compounds, the following biomonitoring approaches are the be established and implemented prior to and following construction of the additional magazine storage facility and of the shooting bay:

- Expand the existing bio-monitoring network and programme to include monitoring points upstream and downstream of the proposed facilities. These new points are to tie in with the locations of the new surface water sampling points (refer to Section 4.5.1.2 for the requirement of additional surface water sampling locations). The bio-monitoring at these new sampling locations must include:
  - A diatom assessment, including determination of SPI, PTV and valve deformities;
  - Where aquatic macroinvertebrates are assessed, determination of PES is to be determined following the Macro-Invertebrate Response Assessment Index (MIRAI). Such an approach will also need to be expanded to application at other existing biomonitoring sites;
  - Toxicity testing utilising four (4) levels of biological hierarchy is to be conducted within surface water ecosystems on a biannual basis upstream and downstream of the study area (sites to coincide with biomonitoring sites).
  - Toxicity testing utilising four (4) levels of biological hierarchy is to be conducted on groundwater on a biannual basis upslope and downslope of the study area. Refer to Section 4.5.1.2 for the requirement of additional groundwater sampling locations.
- Assessment of nitrates, nitrites ammonia and ammonium within the watercourse and groundwater upstream/upslope and downstream/downslope is to be conducted quarterly on surface water samples and bi-annually on groundwater samples.

4.5.3 Vegetation Establishment

The establishment of indigenous vegetation cover within areas disturbed by the construction activities must be monitored annually, by a suitably qualified PrSciNat registered scientist, for a period of one (1) year after the rehabilitation work has been undertaken. Should the scientist identify that additional rehabilitation is required, Sasol will be required to undertake the necessary measures and monitoring must continue annually for an additional year.

4.5.4 Structural Stability and Erosion

Monitoring for the presence or absence of erosion features, must be undertaken bi-annually for the first year after construction and then on an annual basis (at least once during the rainy season) for the following year and thereafter, only if erosion was identified in the second year, on an annual basis until erosion features are not present.

Concomitant remedial and maintenance actions must be implemented.

4.5.5 Photographic Evidence

During the construction activities, GN509 stipulates that photographs must be taken daily, starting one (1) week prior to the commencement of any works, and continuing for one (1) month after the completion of such works. Although GN 509 recommends that photographic evidence must be taken, the requirements have been adapted slightly to be more suitable to the project:

- one or more photographs or video -recordings of the watercourse and its banks at least 20 m upstream from the construction area;
- one or more photographs or video -recordings of the watercourse and its banks at least 20 m downstream from the construction area; and
- two or more photographs or video -recordings of the bed and banks at the construction area, one of each taken from each opposite bank (if applicable).

4.5.6 Alien Invasive Plant Control

Active alien invasive plant control measures must be implemented to prevent the colonisation of the disturbed area by alien and invasive species. The current alien invasive plan must be extended to cover the proposed magazine storage facilities and the new shooting bay. The control of alien invasive plants on the Sasol Ekandustria site is currently managed by Rothe Landscapers. The management of alien invasive plants is being undertaken on a monthly basis. The management is undertaken per management unit identified with target dates set for each management unit. These management units must be expanded to include the new project area.

4.5.7 Wetland Assessment

Upon completion of the construction works, a wetland assessment must be undertaken annually for three (3) years. The wetland assessment must include:

- An assessment of the PES provided by the wetland systems affected.

If the monitoring highlights that the PES has dropped the cause must be investigated and if related to this project rehabilitative actions taken. If additional rehabilitative actions are required then the PES must be monitored for an additional year.

The above monitoring reports are to be submitted to the DWS as part of the conditions of the WUL.

4.6 Risk Assessment Rating

The detailed risk assessment for the activities associated with the construction and operation of the additional magazine storage facilities and the shooting bay are provided in **Table 4-2** and **Table 4-3** respectively.

The outcome of the risk assessment for the Shooting Bay was a MODERATE negative rating for the potential impacts on the channelled valley bottom wetland and associated seep wetland. These activities are located within the delineated wetland system. The impacts of the additional magazine storage facilities were rated as LOW due to their location outside of the wetland and associated wetland buffer.

Based on the MODERATE rating associated with the shooting bay a GA cannot be undertaken and Sasol will be required to undertake a WULA.

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Table 4-2: Wetland Risk Assessment – Magazine Storage Facilities

No.	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures	PES AND EIS OF WATERCOURSE
1	Construction and operation of six (5 x 100T and 1 X 50 T) Magazine Storage Areas (outside of the delineated wetland and associated buffer)	Construction of roads for access to Magazine Storage areas	Increased surface runoff due to compacted and hardened surfaces Increased sediment movement into wetlands Water quality deterioration in adjacent wetlands and resultant impact on aquatic biota Creation of preferential flow paths Increase in alien vegetation Edge disturbances due to proximity of activities to wetland	2	2	2	1	1.75	1	1	3.75	1	2	5	2	10	37.5	LR	Refer to Section 4.4 and Section 4.5	Seep - PES B; IS - Moderate Valley Bottom - PES C; IS - Moderate
		Vehicle/machine access to Magazine Storage areas		2	2	1	1	1.5	1	2	4.5	3	2	5	2	12	54	LR		
		Set up and operation of temporary construction camp and laydown areas		2	2	1	1	1.5	1	1	3.5	1	2	5	1	9	31.5	LR		
		Clearing and disturbance of vegetation		2	2	1	1	1.5	1	1	3.5	1	2	5	1	9	31.5	LR		
		Stripping and stockpiling of topsoil		2	2	2	1	1.75	1	2	4.75	1	2	5	1	9	42.75	LR		
		Earthworks to prepare site		2	2	1	1	1.5	1	2	4.5	1	2	5	1	9	40.5	LR		
		Mixing and use of concrete		1	3	1	1	1.5	1	2	4.5	1	2	5	2	10	45	LR		
		Construction of magazine storage areas		2	2	1	1	1.5	1	2	4.5	1	2	5	2	10	45	LR		
		Stormwater management measures		3	3	1	2	2.25	3	2	7.25	3	3	5	2	13	94.25	MR		
		Operation of magazine storage areas		2	3	1	1	1.75	1	2	4.75	5	3	5	2	15	71.25	MR		

Table 4-3: Wetland Risk Assessment – Shooting Bay

No.	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures	PES AND EIS OF WATERCOURSE
2	Construction and operation of a Shooting Bay (including associated roads and firebreaks)	Construction of roads for access to Shooting Bay	Loss of wetland vegetation Disturbance of wetland vegetation Compaction of wetland soils	5	5	5	5	5	1	1	7	1	4	5	2	12	84	MR	Refer to Section 4.4 and Section 4.5	Seep - PES B; IS - Moderate Valley Bottom - PES C; IS - Moderate
		Vehicle/machine access to Shooting Bay	Increased surface runoff due to compacted and hardened surfaces. Increased sediment movement into wetlands. Water quality deterioration in adjacent wetlands and resultant impact on aquatic biota	5	5	5	5	5	1	2	8	3	2	5	2	12	96	MR		
		Set up and operation of temporary construction camp and laydown areas (outside of delineated wetland)		2	2	1	1	1.5	1	2	4.5	1	2	5	1	9	40.5	LR		
		Clearing and disturbance of vegetation		5	5	5	5	5	1	2	8	1	4	5	1	11	88	MR		
		Stripping and stockpiling of topsoil	Flow impedance Flow diversion Creation of preferential flow paths Increased risk of erosion Increase in alien vegetation	5	5	5	5	5	1	2	8	1	4	5	1	11	88	MR		
		Earthworks to prepare site		5	5	5	5	5	1	1	7	1	4	5	1	11	77	MR		
		Mixing and use of concrete		5	5	5	5	5	1	2	8	1	2	5	2	10	80	MR		
		Construction of Shooting Bay		5	5	5	5	5	1	2	8	1	4	5	1	11	88	MR		
		Stormwater management measures		5	5	5	5	5	3	3	11	3	4	5	2	14	154	MR		
		Clearing and maintenance of firebreak		5	5	5	5	5	1	4	10	3	4	5	2	14	140	MR		
		Operation of Shooting Bay		5	5	5	5	5	1	4	10	5	4	5	2	16	160	MR		

5. WAY FORWARD

The activities associated with the magazine storage facilities were assessed as a Low risk, with those associated with the shooting bay a Moderate risk. Based on the Moderate risk rating for the shooting bay a WULA will be required for the project.

Yours faithfully

pp
Kathy Taggart
for Jones & Wagener

Jacqui Hex

LOCATION: Lat: -25.689356
(Decimal Degrees) Long: 28.679745

6. REFERENCES

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Attached:

1. Appendix A SACNASP / EAPASA Certificate and CV
2. Appendix B Declaration of Independence
3. Appendix C Biodiversity Report (AIM 360, 2023)

Appendix A SACNASP / EAPASA Certificate and CV

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Katherine Taggart

Registration Number: 400225/08

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)
Environmental Science (Professional Natural Scientist)

Effective **12 November 2008** Expires **31 March 2024**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

Kathy Taggart

Environmental Scientist & Ecologist - PrSciNat

Kathy Taggart holds a MSc in Resource Conservation Biology from the University of the Witwatersrand. She is a Wetland Ecologist and Environmental Scientist working within the Environmental Management division at Jones & Wagener. Kathy has been practising in her field for over 20 years. She is registered as a professional Natural Scientist (PrSciNat) in the fields of ecology and environmental science and is also on the board of trustees of the South African Wetland Society. Email: kathy@jaws.co.za

KEY SKILLS

Wetland Assessments

Environmental Auditing and ECO

Remediation and Rehabilitation

EDUCATION

MSc, Univ Witwatersrand, 2001

BSc (Hon), Univ Witwatersand, 1999

BSc, Univ Witwatersrand, 1998

PROF. REGISTRATION STATUS

PrSciNat (Reg No. 400225/08)

EMPLOYMENT HISTORY

Jones & Wagener (2018 to date)

Monsoon Irrigation (2018-2016)

Natural Scientific Serv (2016-2003)

Jones & Wagener (2003-2000)

INDUSTRY INVOLVEMENT

South African Wetland Society
Board of Trustees and Member (556140)

IAIAsa
Member (6181)

SACNASP
Member (400225/08)

Relevant Experience

Wetland Assessments

Kathy's experience in wetland assessments started in 2007, she has experience with managing and conducting wetland assessments and integrating these assessments with mine planning, rehabilitation and mine closure. Her skills include wetland delineations and assessments, predictive modeling for mine closure, risk assessments, wetland monitoring, integrated river catchment management plans, hydropedology and reserve determinations. Six major projects in SA that involve various aspects of the above: Sasol, Syferfontein wetland management and rehabilitation plan, 2020. Enertrag, Delineation and assessment of wetlands for proposed renewable energy project, current. Seriti Power, Hydropedological Assessment, 2022. Sasol Mining, Emergency protocol application for the mitigation of areas of subsidence posing a drowning risk, 2020. Sasol, Wetland Risk Assessment for geotechnical investigations, 2020. Sasol Mining, Alexander Mining Ecological Reserve Determination, current.

Environmental Auditing

Kathy ' s experience in Environmental Auditing and Environmental Control Officer (ECO) work started in 2001. Since then he/she has gained significant experience with conducting audits on Water Use Licences, Environmental Authorisations and Environmental management Programmes. The following list of 4 major projects in the last few years in Kathy's professional career involves various aspects of the above mentioned:

Eskom, Wetland Audit for Kendal ADF Project, South Africa - in progress
Chlorchem Properties, Annual Environmental Autorisation Audits, 2018-2021
Chlorchem Properties, Annual Water Use Licence Audits, 2018-2022
Sasol, Sasolkraal Wetland Rehabilitation ECO, 2022

Remediation and Rehabilitation

Kathy ' s experience in remediation and rehabilitation started in 2003. Since then she has gained significant experience with managing remediation projects, compiling rehabilitation plans and undertaking phytoremediation desktop investigations and field trials. The following list of 4 major projects in the last few years in Kathy's professional career involves various aspects of the above mentioned:

Union Carbide, Bon Accord Phytoremediation project, South Africa, in progress
Eskom, Camden Wetland rehabilitation and monitoring programme, 2019
Enviroserv, Desktop investigation into the use oh phytohydraulics to drop groundwater levels in the vicinity of a Hazardous Disposal facility, South Africa
DOW South Africa, DOW representative on the joint remediation technical team for the Klondike valley clean up, 2004-2007

Signature

10/06/2022

Date

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Byron Grant

Registration Number: 400275/08

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)
Zoological Science (Professional Natural Scientist)
Aquatic Science (Professional Natural Scientist)

Effective **29 January 2014** Expires **31 March 2024**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

CURRICULUM VITAE

Name:	**Byron Grant Pr.Sci.Nat.**
Company:	Ecology International (Pty) Ltd
Years of Experience:	18 years
Nationality:	South African
Languages:	English (mother tongue), Afrikaans
SACNASP Status:	Professional Natural Scientist (Reg. No. 400275/08)
Email address:	byron@ecologyinternational.net
Contact Number:	(+27) 82 863 0769

EDUCATIONAL QUALIFICATIONS

- B. Sc. (Botany & Zoology), Rand Afrikaans University (1997 - 1999);
- B. Sc. (Honours) Zoology, Rand Afrikaans University (2000);
- M. Sc. (Aquatic Health) *cum laude,* Rand Afrikaans University (2001 – 2004);
- Introduction to quantitative research using sample surveys, Rand Afrikaans University (2004);
- SASS5 Field Assessment Accreditation in terms of the River Health Programme, Department of Water Affairs (2005 – present);
- Monitoring Contaminant Levels: Freshwater Fish (*awarded Best Practice*), University of Johannesburg (2005);
- EcoStatus Determination training workshop, Department of Water Affairs and Forestry (2006);
- Multi-disciplinary roles in defining EcoStatus and setting flow requirements during an ecological reserve study, Department of Water Affairs (2008);
- Water Use Licence Applications: Section 21 (c) and (i) training workshop, Department of Water Affairs (2009);
- Advanced Wetland Course, University of Pretoria (2010) (*awarded with Distinction*);
- Determination of the Present Ecological State within the EcoClassification process, University of the Free State (2011);
- River Health Programme Training Workshop, Department of Water and Sanitation – Resource Quality Information Services (2014);
- Tools for Wetland Assessments, Rhodes University (2015);
- RHAM (Rapid Habitat Assessment Model) Training Workshop, Department of Water and Sanitation – Resource Quality Information Services (2015);
- Wetland, River and Estuary Buffer Determination Training Workshop, Institute for Natural Resources (2015);
- Fish Invertebrate Flow Habitat Assessment Model (FIFHA), Department of Water and Sanitation – Resource Quality Information Services (2015);
- Wetland Plant Taxonomy, Water Research Commission (2017);
- Vegetation Response Assessment Index (VEGRAI), Mr. James MacKenzie (co-developer of index) (2018);
- Wetland Soils, Agricultural Research Council in association with the University of the Free State (2018);

- Hydropedology and Wetland Functioning (Short course), Terrasoil Science in association with the Water Business Academy (2018).
- HCV (High Conservation Value) Assessor Training Course, Astra-Academy (2019)

KEY QUALIFICATIONS

- **Project Management:**

Project management and co-ordination of specialist-related projects, including:

- Aquatic assessments (see below);
- Floral and Faunal assessments:
  - Design and implementation of monitoring programmes;
  - Baseline ecological assessments
  - Ecological impact and mitigation assessments;
  - Rescue and relocation assessments;
  - Alien and invasive vegetation management plans;
- Wetland assessments:
  - Design and implementation of wetland monitoring programmes;
  - Wetland delineation studies;
  - Wetland Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) determination assessments;
  - Wetland management plans;
  - Wetland impact and mitigation assessments;
  - Wetland offset strategies and assessments;
  - Wetland Reserve Determinations;
- Water quality studies;
- Dust monitoring studies;
- Ecological Risk Assessments;
- Biodiversity Action Plans (BAP);
- Biodiversity Management Strategies;
- Water Research Commission projects.

- **Specialist Assessments:**

Extensive experience in conducting specialist aquatic assessments and providing specialist ecological input, including:

- Baseline aquatic biodiversity assessments, including the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) according to latest methodology;
- Aquatic impact and mitigation assessments;
- Design, management and implementation of biological monitoring programmes for the aquatic environment;
- Protocol development;
- Fish kill investigations;
- Ecological Flow Requirements;
- Reserve Determinations;

- Aquatic toxicity assessments;
- Bioaccumulation studies;
- Human health risk assessments for the consumption of freshwater fish;
- Surface water quality studies;
- Application of various monitoring indices, including the South African Scoring System version 5 (SASS5), the Macro-Invertebrate Response Assessment Index (MIRAI), the Invertebrate Habitat Assessment System (IHAS), the Index for Habitat Integrity (IHI), the Rapid Habitat Assessment Model (RHAM), the Fish Assemblage Integrity Index (FAII), the Fish Response Assessment Index (FRAI), the Physico-chemical Assessment Index (PAI), Riparian Vegetation Response Index (VEGRAI), Fish Invertebrate Flow Habitat Assessment Model (FIFHA), determination of EcoStatus, etc.;
- Eco-Conditional Requirement (Eco-0) assessments for Green Star Accreditation;
- Watercourse Protection Plans relating to Eco-Conditional Requirement (Eco-0) for Green Star Accreditation.

- **Specialist Review:**

Specialist and independent review of impact assessment and management reports for all sectors of government, civil society and the scientific and legal fraternity:

- Member of Technical Advisory Group for the Green Building Council of South Africa;
- Member of Reference Groups for Water Research Commission;
- Peer review of specialist biodiversity reports;
- Peer reviewer for African Journal of Aquatic Science.

PROFESSIONAL REGISTRATIONS

- South African Council for Natural Scientific Professions (SACNASP):
  - Professional Natural Scientist (Reg. No. 400275/08): Aquatic Science, Ecological Science & Zoological Science
  - Professional Advisory Committee (Deputy Chair): Aquatic Science Field of Practice
  - Professional Advisory Committee (Member): Wetland Science Sub-Field of Practice

Other Society Memberships

- South African Society of Aquatic Scientists
- South African Wetland Society (Founding Member)
- Zoological Society of Southern Africa

Other Memberships

- Aquatox Forum
- Gauteng Wetland Forum
- Klipriviersberg Sustainability Association – Development Integration Team
- Yellowfish Working Group

COUNTRIES OF EXPERIENCE

- South Africa
- Lesotho
- Swaziland
- Mozambique
- Ghana
- Namibia
- Cameroon

SPECIALIST WORKSHOP PARTICIPATION

- Wetland and Watercourse Buffers Determination workshop. Project for the Department of Water Affairs, Sub-directorate: Water Abstraction and Instream Use;
- NEMBA category 2 alien fish species mapping for Gauteng, Limpopo and Northwest Provinces and a national review workshop, South African Institute for Aquatic Biodiversity (SAIAB);
- National Freshwater Ecosystem Priority Areas project – Specialist Input Workshop, South African National Biodiversity Institute (SANBI);
- Biodiversity Offsets Strategy workshop, Gauteng Department of Agriculture, Conservation and Environment (GDACE);
- Minimum Requirements for Biodiversity Assessments (Version 2) workshop, Gauteng Department of Agriculture, Conservation and Environment (GDACE);
- Gauteng Nature Conservation Bill, Gauteng Department of Agriculture and Rural Development (GDARD);
- Mainstreaming Biodiversity in Mining Training Workshop, SANBI's Grasslands Programme (in partnership with the South African Mining and Biodiversity Forum and the Departments of Environmental Affairs and Mineral Resources);
- National Biodiversity Offset Workshop, Department of Environmental Affairs (DEA), Endangered Wildlife Trust (EWT);
- Accreditation/certification of Wetland Practitioners Workshop, South African Wetland Society.

PRESENTATIONS AND PUBLICATIONS

Brink, K., Gough, P., Royte, J.J., Schollema, P.P. & Wanningen, H. (eds). (2018). From Sea to Source 2.0. Protection and restoration of fish migration in rivers worldwide. World Fish Migration Foundation. *Contributing author.*

Grant, B., Huchzermeyer, D. & Hohls, B. (2014). *A Manual for Fish Kill Investigations in South Africa.* WRC Report No. TT 589/14. Water Research Commission, Pretoria.

Grant, B., Hohls, B. & Huchzermeyer, D. (2013). Development of a Fish Kill Protocol for South Africa. South African Society for Aquatic Scientists - 2013 Conference, Arniston. Oral presentation.

Mlambo, S.S., van Vuren, J.H.J., Basson, R. & Grant, B. (2010). Accumulation of hepatic HSP70 and plasma cortisol in *Oreochromis mossambicus* following sub-lethal metal and DDT exposure. *African Journal of Aquatic Science* 35(1): 47-53.

Grant, B., van Vuren, J.H.J. & Cronjé, M.J. (2004). HSP 70 response of *Oreochromis mossambicus* to Cu^{2+} exposure in two different types of exposure media. South African Society for Aquatic Scientists – 2004 Conference, Cape Town. Poster presentation.

EMPLOYMENT EXPERIENCE

- **Ecology International:** Date: June 2017 - Present

  Role: Director & Principal Biodiversity Specialist
  - Management and co-ordination of staff members and specialists
  - Project management on various scales for environmental and biodiversity specialist-related services;
  - Co-ordinating, implementing and conducting specialist studies for various types of projects, including:
    - Protocol development;
    - Monitoring programmes;
    - Environmental Impact Assessments;
    - Strategic-level assessments (e.g. Strategic Environmental Assessments, Environmental Management Frameworks, State of the Environment Reports, etc.);
    - Biodiversity Management Plans, Biodiversity Action Plans, etc.;
  - Acting as an information source concerning environmental legislation;
  - Development of terms of reference and project proposals;
  - Quality control of specialist reports; and
  - Interfacing with clients in the consulting, mining, and government industries.

- **Independent Specialist:** Date: February 2017 – May 2017

  Role: Principal Biodiversity Specialist
  - Project management on various scales for biodiversity specialist-related services;
  - Co-ordinating, implementing and conducting specialist studies for various types of projects, including:
    - Protocol development;
    - Monitoring programmes;
    - Environmental Impact Assessments;
    - Strategic-level assessments (e.g. Strategic Environmental Assessments, Environmental Management Frameworks, State of the Environment Reports, etc.);
    - Biodiversity Management Plans, Biodiversity Action Plans, etc.;

- Acting as an information source concerning environmental legislation;
- Development of terms of reference and project proposals;
- Quality control of specialist reports; and
- Interfacing with clients in the consulting, mining, and government industries.

- **GIBB** (June 2015 – January 2017)

  Role: Principal Specialist

  - Project management on various scales for specialist-related services;
  - Co-ordinating, implementing and conducting studies for various types of projects, including:
    - Monitoring programmes;
    - Environmental Impact Assessments;
    - Strategic-level assessments (e.g. Strategic Environmental Assessments, Environmental Management Frameworks, State of the Environment Reports, etc.);
    - Biodiversity Management Plans, Biodiversity Action Plans, etc.;
  - Acting as an information source concerning environmental legislation;
  - Development of terms of reference and project proposals;
  - Quality control of specialist reports; and
  - Interfacing with clients in the consulting, mining, and government industries.

- **Strategic Environmental Focus** (August 2009 – June 2015)

  Role: Principal: Specialist Services

  - Management and co-ordination of staff members and specialists;
  - Project management on various scales for specialist-related services;
  - Co-ordinating, implementing and conducting studies for various types of projects, including:
    - Monitoring programmes;
    - Environmental Impact Assessments;
    - Strategic-level assessments (e.g. Strategic Environmental Assessments, Environmental Management Frameworks, State of the Environment Reports, etc.);
    - Biodiversity Management Plans, Biodiversity Action Plans, etc.;
  - Acting as an information source concerning environmental legislation;
  - Development of terms of reference and project proposals;
  - Quality control of specialist reports; and
  - Interfacing with clients in the consulting, mining, and government industries.

- **Strategic Environmental Focus** (March 2009 – July 2009)

  Role: Senior Natural Scientist

- Project management for water, aquatic and monitoring-related projects;
- Management and co-ordination of specialists;
- Co-ordinating, implementing and conducting studies for various water and monitoring-related projects;
- Acting as an information source concerning environmental legislation;
- Development of terms of reference and project proposals;
- Quality control of specialist reports; and
- Interfacing with clients in the consulting, mining, and government industries.

- **Strategic Environmental Focus** (July 2006 – February 2009)

  Role: Aquatic Specialist
  - Conducting specialist assessments in the field of aquatic ecology and water science.
  - Acting as an information source concerning environmental legislation.

- **ECOSUN cc.** (January 2005 – June 2006)

  Role: Aquatic Scientist
  - Conducting specialist assessments in the field of aquatic ecology and water science.
  - Acting as an information source concerning environmental legislation.

- **Rand Afrikaans University** (January 2003 – December 2004).

  Role: Student Mentor / Post-Graduate Research Assistant
  - Validation of Antibodies for HSP70 Detection in the Freshwater Snail *Melanoides tuberculata* - B.Sc. (Honours) Student (January 2003 – December 2003);
  - The use of genotoxic and stress proteins in the active biomonitoring of the Rietvlei system, South Africa – M.Sc. Student (January 2003 – December 2003);
  - A comparison between Whole Effluent Toxicity (WET) testing and Active Biomonitoring (ABM) as indicators of in stream aquatic health – M.Sc. Student (January 2003 – December 2003);
  - The use of HSP70 and cortisol as biomarkers for heavy metal exposure - M.Sc. Student (January 2004 – December 2005).

- **Rand Afrikaans University** (January 2000 – December 2004)

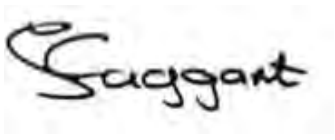
  Role: Practical Demonstrator
  - Field supervisor for B.Sc. Honours (Zoology);
  - Aquatic Ecology (3rd year);
  - Human Physiology (2nd year); and
  - Ecology and Conservation (for Vista University)

Appendix B Declaration of Independence

DECLARATION OF INDEPENDENCE BY SPECIALIST

I, **KATHY TAGGART**, in my capacity as a specialist consultant, hereby declare that I -

- act as an independent consultant;
- will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- declare that there are no circumstances that may compromise my objectivity in performing such work;
- do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- based on information provided to me by the project proponent and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional ability;
- undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study for which I am registered; and
- as a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member.



30 June 2023

Date

Kathy Taggart Pr.Sci.Nat.
Environmental Scientist & Ecologist
Jones & Wagener (Pty) Ltd
SACNASP Reg. No. 400225/08
(Ecological Science & Environmental Science)

DECLARATION OF INDEPENDENCE BY SPECIALIST

I, **BYRON GRANT**, in my capacity as a specialist consultant, hereby declare that I -

- act as an independent consultant;
- will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- declare that there are no circumstances that may compromise my objectivity in performing such work;
- do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- based on information provided to me by the project proponent and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional ability;
- undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study for which I am registered; and
- as a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member.

Byron Grant Pr.Sci.Nat.
Director & Principal Specialist
Ecology International (Pty) Ltd
SACNASP Reg. No. 400275/08
(Aquatic Science, Ecological Science & Zoological Science)

30 June 2023

Date

Appendix C Biodiversity Report (AIM 360, 2023)

BIODIVERSITY IMPACT ASSESSMENT REPORT:

Proposed 5x100T, 1x50T Magazine and Shooting Bay at SASOL Ekandustria Operations, Located in Bronkhorstspruit, Tshwane Metropolitan Municipality, Gauteng.

Report Prepared for

Sasol Ekandustria Operations

Report Reference Number: A3B23-02

February 2023

(Final Report: Version 2.0)

Prepared by:

AIM-360 Environmental Solutions (PTY) Ltd
Ecological, Wetland and Environmental Scientists
Tel: +27-78-861-7585
Fax: +27-86-433-7328
Email: info@aim360.co.za

In Association with:

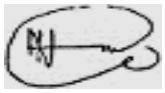
Robust Consulting Engineers (PTY) Ltd

Report Details

Report Title	Biodiversity Impact Assessment for the Proposed **5x1**00T, 1X50T Magazine and Shooting Bay at SASOL Ekandustria Operations Located in Bronkhorstspruit, Tshwane Metropolitan Municipality, Gauteng.
Recommended Report Citation	Aim360 Environmental Solutions. (2023). Biodiversity Impact Assessment Report for the Proposed 5x100T, 1x50T Magazine and Shooting Bay at SASOL Ekandustria Operations Located in Bronkhorstspruit, Tshwane Metropolitan Municipality, Gauteng. Unpublished report No. A3B23-02. Final Report Version 2.0.
Internal Report Reference Number	A3B23-02
Report Version	2.0 (Final)
Date of issue	20 February 2023
Author/s:	Ntando Kumalo, BSc (Hon) (Pr.Sci.Nat.)
Report prepared for:	Robust Consulting Engineers (PTY) Ltd Eton Office Park, West Harrison Ave, Johannesburg, 2021 Tel: 086 117 7726 Fax: 086 535 3817 Email: admin@robustengineers.co.za
Report prepared by:	AIM-360 Environmental Solutions (PTY) Ltd 97 Innes Road. Morningside Durban, 4001 Tel: +27-78-861-7585 Fax: +27-86-433-7328 Email: info@aim360.co.za

Declaration of Independence by Specialist

- I, **Ntando Kumalo**, hereby declare that I acted as the independent specialist in this application.
- I do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of NEMA and the Environmental Impact Assessment Regulations, 2017.
- I have and will not have a vested interest in the proposed activity proceeding.

Signed: ……..  **Date:** ……..20 February 2023

Details of Author

The relevant experience/s of specialist team members involved in the compilation of this report are briefly summarized in the table below. Detailed CVs of the specialist team can be made available on request.

Specialist	Role	Details
Ntando Kumalo Senior Environmental Specialist	Field work, author & project management	Ntando has more than 10 years' experience and is competent in data collection, analysis and report writing related to biodiversity assessments. Also has experience in conducting biodiversity rehabilitation plans, wetland assessment and rehabilitation plans. Ntando has a BSc (Hon) in Forest Resources and Wildlife Management and is a registered Professional Natural Scientist in the field of Environmental Science. He oversaw successful implementation of the project.

Executive Summary

Aim360 Environmental (Aim360) PTY Ltd was appointed by Robust Consulting Engineers (Robust) PTY Ltd on the behalf of SASOL Ekandustria Operations (SASOL) to undertake a specialist biodiversity impact assessment study (inclusive of faunal, avifauna, floral and wetland) to inform the environmental processes associated with the proposed construction of 5x100T, 1X50T Magazines for storage of Trinitrotoluene (TNT) and a Shooting Bay. The project is located at SASOL in Bronkhorstspruit, Tshwane Metropolitan Municipality, Gauteng.

The assessment initially commenced with a desktop study during which data related for the study area such as existing literature, maps, aerial photography and Geographical Information Systems (GIS) were collected and reviewed. Field investigation was conducted during the month of January 2023 to verify the desktop information.

The terms of reference for this study were as follows:

- Terrestrial Ecological Assessment:
  - Determine the ecological diversity in terms of plants, animals, birds and reptiles.
  - Identify and consider all sensitive ecological habitats or features.
  - Determine the present ecological condition and sensitivity of identified habitats.
  - Assess conservation status of plant, bird and animal species.
  - Compile a species inventory for species on site and to recommend necessary actions in case of occurrence of endangered, vulnerable or rare species or any species of conservation importance.
- Wetland Assessment:
  - Identify and delineate any wetlands within the property in terms of DWS's practical field procedure for identification and delineation of wetlands and riparian habitats (DWAF, 2005).
  - Classify the delineated wetlands in terms of the National Wetland Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis et al., 2013).
  - Determine the Present Ecological State (PES) through evaluation of wetland hydrology, geomorphology and vegetation as per the WET-Health methodology (MacFarlane et al. 2007).
  - Determine the Ecological Importance and Sensitivity (EIS) of wetlands.
  - Assess ecosystem services/benefits provided by wetlands using the Level 2 WET-EcoServices assessment tool (Kotze et al., 2007).
- Impact Assessment and Mitigation:
  - Identify and undertake a risk assessment of anticipated project-related impacts on the taxa and/or habitats.
  - Recommend feasible mitigation measures for implementation, including but not limited to the recommendation of minimum buffers.

Floral Assessment

At a broader spatial scale, the vegetation associated with the study area broadly falls within the Mesic Highveld Grassland Bio-region. The overlying vegetation types were determined as: Rand Highveld Grassland (Gm11). In terms of conservation status, the Rand Highveld Grassland is considered **Vulnerable**, similarly at a protection level, the vegetation type is allocated a **Poorly Protected** protection status**.**

At a local spatial scale, the vegetation communities were assessed and categorised according to disturbances into:

- Disturbed Highveld Grassland (DHG).
- Disturbed Wetland Vegetation (DWV).
- Rocky Outcrops (RO).

The Disturbed Highveld Grassland (DHG) vegetation community is widespread and particularly covers the south-western and eastern portion of the study site, whereas the Disturbed Wetland Vegetation (DWV) predominantly covers the edge of the southern border of the study site. The wetland vegetation is attributed to the presence of a Seep wetland (SW-Unit 03). A grassy rocky ridge characterised by moderate abundancy of shrubs is located at the

western boundary of the existing fence line that demarcates the site. **Figure 5-1** shows the spatial distribution of the delineated vegetation communities.

Key disturbances that were noted as resulting in negative impacts on the vegetation communities (and also the ecological habitat) include, but are not limited to: (i) proliferation of alien plants, particularly Verbena (ii) expansion of industrial operations within the area (iii) creation of informal access roads (iv) agricultural farming activities.

Despite the above notable disturbances on the vegetation and ecological habitat, the existing vegetation communities still provide foraging, breeding and roosting habitats for faunal species, albeit to a small degree. A summary of the ecological condition and sensitivity findings for the various vegetation/ecological habitat types is presented below as **Table A** below.

Table A: Summary of the ecological condition and sensitivity assessment for the various vegetation communities and habitat types.

Vegetation Community	Condition	Threat Status	Ecological Sensitivity
1. Disturbed Highveld Grassland	Fair	Vulnerable	Moderate
2. Disturbed Wetland Vegetation	Good	Least Threatened	Moderate
3. Rocky Outcrops	Fair	Least Threatened	Low

The ecological sensitivity of the vegetation community / ecological habitat is mapped as **Figure 7-2**. No areas were regarded as High in terms of terrestrial ecological sensitivity. None of the areas were considered as "no-go" areas. However, the Disturbed Wetland Vegetation should be regarded as relatively more ecological sensitive compared to other vegetation communities due to the interconnectedness of wetland vegetation to its hydrological functionality.

Faunal Assessment

Mammals

Infield investigation for faunal impact assessment focussed on the current status of threatened faunal species occurring or likely to occur within the proposed study site. Droppings encountered indicated the presence of small-rodents and mammals (likely a Scrub hare) residing specifically in the vicinity of the grassland. The rocky outcrops are particularly favourable for rodents due to high diversity of insects, bulbs and fruits. Termite mounds found within the grassland also provide food for rodents as well.

No threatened (Red Data species) mammals were recorded and the likelihood of any threatened mammal species potentially occurring within the area is considerably low due to habitat modifications resulting from intrusive anthropogenic disturbances associated with the establishment of industrial operation areas and farming activities within the surrounding project area. Smaller mammal species are susceptible to being driven away from the area due to heavy human traffic and noise.

Avifauna

According to desktop results obtained for pedants 2540_2840, a total of 199 bird species have been modelled as present within the study site, with only two (2) specie classified as a Red Data species. The desktop assessment did not model the occurrence of any Important Bird Areas (IBA) as occurring within the vicinity of the study area, however the Ithala Nature Reserve Park is located at the southern border of the 10km radius of the study area. During the site visit a total of thirty six (36) bird species were recorded within the study site (Table 5-8). The most commonly recorded species were species often associated with anthropogenically modified landscapes (c. 36.11%).

The watercourses proximal to the study site were observed to have the highest species richness and abundance of bird species within the study area; surrounding ecosystems and habitats closest to the industrial complexes and disturbed agricultural lands were noted to have the least. Avian species recorded closest to the watercourses included: Southern Red Bishop, Spur-winged Goose, Yellow Weaver, Laughing Dove, Southern Red Bishop, Grey-headed Bush-shrike, Long-tailed Paradise Whydah, Grey Heron and Dark-capped Bulbul. The disturbed grassland habitat were relatively less productive with a low avian species diversity and abundance.

No threatened species (Red Data species) were recorded within the study site during the survey. However, the potential of occurrence of Lanner Falcon (*Falco biarmicus)* were projected as moderate within the study area.

Reptiles

According to the SARCA (South African Reptile Conservation Assessment) database, only seven (7) reptiles have been recorded within the 2528DA Quarter Degree Grid Cell (SARCA, IUCN, 2014). No reptile species of conservation significance were modelled as occurring within the study area. Due to widespread habitat destruction, coupled with the elusive behavior of reptiles, the potential of occurrence of Red Data species is projected as low. Habitat modification and degradation have likely driven the species from the area.

Watercourses

Three (3) watercourse units were delineated within and around the study site located within the 500m DWS Regulated Zone and 32m of EIA Regulated Zone. Two (2) of the three (3) watercourse units were flagged as susceptible to proposed development and therefore at risk, whilst the remaining watercourse unit was determined to be located outside the zone of impact due to their position within the terrain (**See Figure 6-1)**.

The three (3) watercourse units were categorised and classified as:

1. **Watercourse Unit 1**: Channelled Valley Bottom Wetland (CVB-Unit 01)
2. **Watercourse Unit 2:** Riparian Habitat (R-Unit 02) not assessed further
3. **Watercourse Unit 3:** Seep Wetland (SP-Unit 03A and Unit 03B)

In terms of their Present Ecological States (PES), the Channelled Valley Bottom Wetland (CVB-Unit 01) was assessed and determined as having a Moderately Modified PES Condition (PES Class of C), which implies a moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact. Similarly, the Seep Wetland was assed and determined as having a Largely Natural PES Condition (PES Class of B), which implies that the wetland is largely natural with few modifications.

In terms of Ecological Importance and Sensitivity (EIS), both wetland units were assed and determined as having Moderate EIS scores due to their roles in regulating water quality and providing refugia for biota.

Impact Assessment & Mitigation

Impact assessment for the project was undertaken as part of the project scope and consideration of the current integrity and sensitivity of ecological habitats and watercourses with respects to the nature of the project.

Without mitigation, the proposed development will likely have **medium** to **high** impacts on the ecological habitats and watercourses. However, should the prescribed mitigation measures be implemented for the project, the associated risks are all expected to have **low** to **medium** impact significance. Provided an Environmental Authorisation and Water Use Authorisation is obtained prior to commencement of the project, there are no biodiversity constraints preventing the project from being implemented.

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Disclaimer

The accuracy of this Report is subject to the information provided to the specialist (Aim360 Pty Ltd) by its Client and site conditions existing during the time of assessment. Whilst Aim360 has undertaken due dliligence as practically possible in establishing the accuracy of the available information, we do not accept any material liability arising from commercial decisions or actions arisinig from the findings. Aim360 reserves the right to update findings based on the availabilty of new information.

1 Introduction and Project Overview

1.1 Introduction

AIM360 Environmental Solutions (PTY) Ltd (AIM360) has been appointed by Robust Consulting Engineers PTY Ltd (Robust) on the behalf of SASOL Ekandustria Operations (SASOL) to undertake a specialist biodiversity impact assessment study (inclusive of faunal, avifauna, floral and wetland) to inform the environmental processes associated with the proposed construction of 5x100T, 1X50T Magazines for storage of Trinitrotoluene (TNT) and a Shooting Bay. The project is located at SASOL Ekandustria Operations in Bronkhorstspruit, Tshwane Metropolitan Municipality, Gauteng. The location of the project is largely within Quarter Degree Grid Square 2528DA.

In terms of direction to the study site, the SASOL satellite offices can be easily accessed via Road 460 which veers in a westerly direction from the north bound R568. The central coordinates of the magazine storage facilities are provided as follows: 25°41'22.27"S, 28°40'47.06"E. In terms of the property description, the study site is found within the Surveyor General 21 (SG21) code T0JR00000000061300001.

A locality map showing the study site in relation to surrounding areas is provided as **Figure 1-1**, while an orthophoto aerial map showing the current site conditions is provided as **Figure 1-2** on the next page.

Figure 1-1: Site location of the study site in relation to the project area (Source: Google Earth™, January 2023).

Figure 1-2: Orthophoto aerial map showing the current condition of the study site and proposed design layout.

1.2 Project description

The project involves the construction of 5 x 100-ton and 1x50-ton magazines for Trinitrotoluene (TNT) storage and a shooting bay at Sasol Ekandustria Operations. The proposed site consists of numerous existing magazines used for different explosive products storage, explosive material storage, and process plant for manufacturing of explosives.

TNT is a chemical compound that is primarily used as a reagent in chemical synthesis, however it is best known as an explosive material with convenient handling properties. TNT is also used as a high explosive for military and industrial applications. In terms of its environmental attributes, TNT is regarded as a hazardous substance with moderate toxicity to aquatic biota, resulting in long-term aquatic effects. As such, the chemical compound must be correctly handled and stored as a hazardous chemical substance due to its high risk properties.

The proposed project shall entail the following:

i. Construction of new 5 x100 ton TNT storage magazines.
ii. Construction of new 1x 50 ton TNT storage magazine.
iii. Construction of a new shooting bay.
iv. Establishing of laydown areas associated with construction activities.
v. Creation of new access roads to the storage magazines and shooting bay.

Figure 1-3 below is the design layout drawing showing details of the proposed Storage Magazines and Shooting Bay.

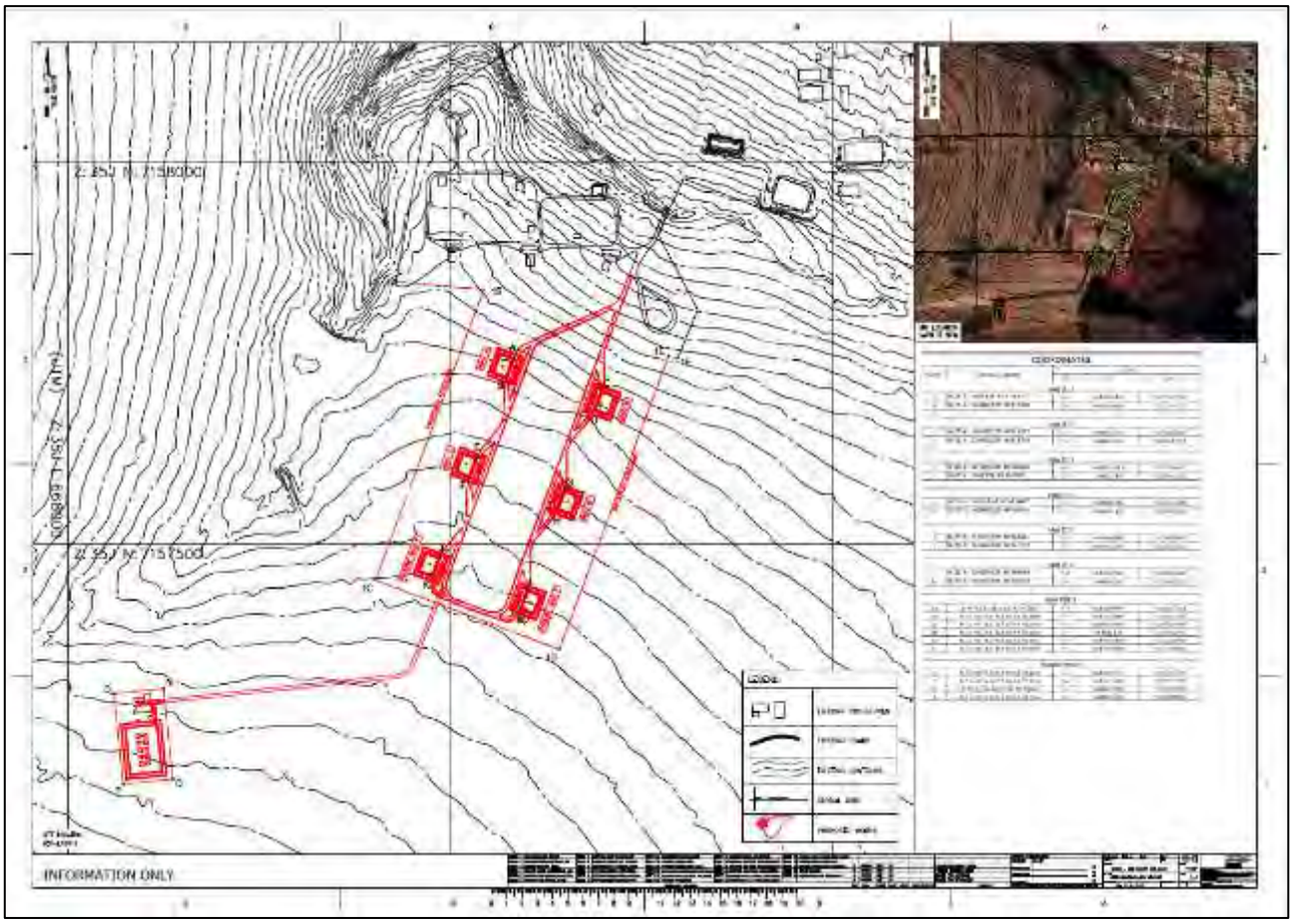


Figure 1-3 Design layout detailing the proposed Magazines and Shooting Bay area.

1.3 Terms of Reference of the study

The following Terms of Reference (ToR) for the biodiversity study have been outlined:

I. Compilation of a biodiversity report that assess the potential biodiversity impacts associated with the proposed development.
II. The biodiversity study must comply with the requirements for GDARD Biodiversity assessment Version 3, 2014.
III. Compile an Environmental Management Plan that includes the proposed mitigation measures relating to the biodiversity impacts must be included in the report.
IV. The EMPr for the specialist report must include colours showing the ratings of the impacts and mitigation measures as per request from GDARD.

2 Project Scope and Methodology

2.1 Scope of the project

The overarching objective of this study is to compile a Biodiversity Impact Assessment Report that includes a description of the biodiversity (flora, faunal, avifauna and wetland) within the project site. The report also provides for the identification of impacts on the above biodiversity that are anticipated from project-related activities and recommend appropriate mitigation measures as applicable. Specific intended outcomes of the study are outlined below:

- Terrestrial Ecological Assessment:
  - Determine the ecological diversity in terms of plants, animals, birds and reptiles.
  - Identify and consider all sensitive ecological habitats or features, including watercourses.
  - Determine the present ecological condition and sensitivity of identified habitats.
  - Assess conservation status of plant, bird and animal species.
  - Compile a species inventory for species on site and to recommend necessary actions in case of occurrence of endangered, vulnerable or rare species or any species of conservation importance.
- Wetland Assessment:
  - Identify and delineate any wetlands within a 500m radius of the project site in terms of DWS's practical field procedure for identification and delineation of wetlands and riparian habitats (DWAF, 2005).
  - Classify the delineated wetlands in terms of the National Wetland Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis et al.,2013).
  - Determine the Present Ecological State (PES) through evaluation of wetland hydrology, geomorphology and vegetation as per the WET-Health methodology (MacFarlane et al. 2007).
  - Determine the Ecological Importance and Sensitivity (EIS) of wetlands.
  - Assess ecosystem services/benefits provided by wetlands using the Level 2 WET-EcoServices assessment tool (Kotze et al., 2007).
- Impact Assessment and Mitigation:
  - Identify and undertake a risk assessment of anticipated project-related impacts on the taxa and/or habitats.
  - Recommend feasible mitigation measures for implementation, including but not limited to the recommendation of minimum buffers.

2.2 Methodology

The methodology carried out for this study is presented in **Appendix A** of this report.

2.3 Study limitations

Please note that the following assumptions and limitations are applicable to this assessment:

- The GPS device used is only accurate up to 5m. Therefore, the boundary of delineated features (which were subsequently plotted digitally) may be offset by at least five meters to either side.
- Vegetation descriptions provided are not comprehensive but an indication of dominant species of interest.
- Some plants species flower during specific seasons and are difficult to identify without inflorescence, therefore inconspicuous plant species may have been missed.
- The assessment was based on one day's wet season (late summer) survey only which was conducted in late January 2023, and information provided should be interpreted accordingly. Site visits should ideally be conducted over differing seasons in order to better understand the surrounding ecological habitat and faunal species.

- Ecology is dynamic and complex, certain aspect may have been overlooked. However, it is expected that the proposed road upgrade project has been accurately assessed and considered, based on consideration of existing studies and monitoring data.
- Conclusions of this report were based on experience of these and similar species in different parts of South Africa. Faunal behaviour cannot be entirely reduced to formulas that will hold true under all circumstances.
- Furthermore, many faunal species of conservation importance (Red Data Species) are secretive and difficult to observe even during intensive field surveys.
- Infield assessment for terrestrial ecology was only limited to the provided layout footprint of the proposed TNT Magazines and Shooting Bay area, including a 15m corridor from the boundary of the proposed site.
- Wetland assessment and delineation was conducted within the 500m Regulated Zone defined by the Department of Water and Sanitation (DWS).

3 Relevant legislation

3.1 National legislation

3.1.1 National Environmental Management Act (Act 107 of 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations (No R. 324, No R. 325 and No R. 326) as amended (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 type and location of the proposed activity.

3.1.2 National Environmental Management: Biodiversity Act (Act 10 of 2004)

The National Environmental Management: Biodiversity Act (10 of 2004), (NEMBA) provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities. Certain activities, known as Restricted Activities, are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the act are keeping, moving, having in possession, importing and exporting, and selling of listed species.

3.1.3 Conservation of Agricultural Resources Act (Act 43 of 1983)

The Act regulates the utilisation and protection of wetlands, soil conservation and all matters relating thereto; control and prevention of veld fires, control of weeds and invader plants, the prevention of water pollution resulting from farming practices and losses in biodiversity.

3.1.4 National Water Act (Act 36 of 1998)

The National Water Act (NWA) recognises that the protection of water resources, including not only the water itself but the entire aquatic ecosystem is necessary to achieve sustainable use of water for the benefit of all water users. In section 1 of the NWA a water resource is defined as being all water found in the various phases of the hydrological cycle, including that portion of water that is found underground. This definition ensures that the entire water resource is treated in an integrated fashion and as a resource that is common to all. The DWS has regulated that no activity may take place within a watercourse without authorisation from DWS. Therefore, no development activities may occur within any wetland or riparian zone unless authorisation is granted by DWS in terms of section 21 of the NWA.

A General Authorisation (GA) in terms of Section 39 of the NWA, which is an authorisation for water uses as defined in Section 21(c) and (i) without a license provided that the water use is within certain limits and complies with conditions as set out in the GA, was issued by DWS for prescribed water uses as contained in General Notice 509 of 2016 as published in the Government Gazette No. 40229 of 26 August 2016. However, according to section 3 of the Notice, it must be noted that the GA does not apply:

i. To the use of water in terms of section 21(c) or (i) of the Act for the rehabilitation of a wetland as contemplated in General Authorisation 1198 published in Government Gazette 32805 dated 18 December 2009.
ii. To the use of water in terms of section 21(c) or (i) of the Act within the regulated area of a watercourse where the Risk Class is Medium or High as determined by the Risk Matrix.
iii. In instances where an application must be made for a water use license for the authorisation of any other water use as defined in section 21 of the Act that may be associated with a new activity.
iv. Where storage of water results from the impeding or diverting of flow or altering the bed, banks, course or characteristics of a watercourse.

v. To any water use in terms of section 21(c) or (i) of the Act associated with construction, installation or maintenance of any sewerage pipelines, pipelines carrying hazardous materials and to raw water and wastewater treatment works.

3.1.5 Explosives Act (Act.15 of 2003)

This Act provides for the consolidation of the laws relating to the manufacture, storage, sale, transport, importation, exportation and the use of explosives. According to the Act, no person may keep, store or be in position of explosives on any premises other than an explosives manufacturing site or explosives magazines, unless the explosives are kept, stored or possessed in accordance with the conditions of a permit issued by an inspector and any other applicable regulations.

3.1.6 Critical Infrastructure Protection Act (Act 08 of 2019)

This Act repelled the National Key Points Act (Act.102 of 1980) and aims to, amongst other things:

- Provide for the identification and declaration of infrastructure as critical infrastructure.
- Provide for guidelines and factors to be taken into account to ensure transparent identification and declaration of critical infrastructure.
- Provide for measures to be put in place for the protection, safeguarding and resilience of critical infrastructure.

3.2 National and Provincial Conservation Guidelines

3.2.1 South African Inventory of Inland Aquatic Ecosystems (SAIIAE)

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (2018) is a collection of spatial data relating to the extent of river and wetland ecosystems types, as well as information on pressures, confidence and extent of protection. SAIIAE aims to provide comprehensive desktop data of both inland wetlands and rivers at a national level. These data layers were developed and used for the 2018 National Biodiversity Assessment (NBA 2018).

3.2.2 The White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997)

The policy comprises part of the broader context wherein national environmental policy has been formulated. It further sets the agenda for defining the strategy for conservation of South Africa's biodiversity.

3.2.3 Gauteng Nature Conservation Ordinance 12 of 1983

The ordinance was established to provide institutional structures for nature conservation and to consolidate the laws relating to nature conservation in Gauteng. Schedule 11 of the Ordinance lists plants that are protected subject to obtaining a permit for their disturbance.

3.2.4 The National Biodiversity Assessment

The purpose of the National Biodiversity Assessment (NBA) is to assess the state of South Africa's biodiversity based on best available science, with a view to understanding trends over time and informing policy and decision-making across a range of sectors. The NBA is central to fulfilling SANBI's mandate to monitor and report regularly on the status of the country's biodiversity, in terms of the National Environmental Management: Biodiversity Act (NEMBA, Act 10 of 2004). The NBA endeavours to capture the challenges and opportunities embedded in South Africa's rich natural heritage by looking at biodiversity in the context of social and economic change and recognising the relationship between people and their environment.

The NBA deals with all three components of biodiversity: genes, species and ecosystems; and assesses biodiversity and ecosystems across terrestrial, freshwater, estuarine and marine environments. The two headline indicators assessed in the NBA are Ecosystem Threat Status (ETS) and Ecosystem Protection Level (EPL) (Driver at al., 2012).

Ecosystem Threat Status (ETS)

Ecosystem threat status (ETS) outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the proportion of each ecosystem type that remains in good ecological condition (Driver et al., 2011).

Ecosystem Protection Level (EPL)

Ecosystem protection level (EPL) tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Driver at al., 2012).

3.2.5 Freshwater Ecosystem Priority Areas (NFEPA)

Examination of the National Freshwater Ecosystem Priority Areas (NFEPA) databases was undertaken for the proposed project. The NFEPA project aims to produce maps which provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs. FEPAs are determined through a process of systematic biodiversity planning and involved collaboration of over 100 freshwater researchers and practitioners. They are identified based on a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands and estuaries (Macfarlane *et al*., 2009).

4 Results of Desktop Investigation

This section contains dataset accessed as part of the desktop assessment and are presented below. It is important to note that although all datasets used provide useful and often verifiable high-quality data, the various databases used not always provide an entirely accurate indication of the proposed project and related activities, actual site characteristics at the scale required to inform the environmental authorisation process. However, this information is considered to be useful as background information to the study. Thus, this data was used as guideline to inform the assessment and to focus on areas and aspects of increased conservation importance.

4.1 Biophysical Setting

The results of the desktop investigation, carried out at a broader spatial scale of the study area, indicated that the study area is characterised by the biophysical conditions presented in the **Table 4-1** below.

Table 4-1: Desktop results of the biophysical attributes of the study area.

Biophysical Attributes	
Terrain	Variable landscape with sloping plains and ridges elevated over undulating surrounding plains. A mix of species rich sour grasslands and shrublands growing over rocky outcrops and steeper slopes.
Elevation	1 457–1502 m
MAP (Schulze, 1997)	800mm
Rainfall intensity	60.3 mm
Mean Annual Temperature	16 ^{0}C
Geology (Council of Geoscience, 2008)	Underlain by Quartzite bedrock.
Soil Erodibility Score (K-factor) (Schulze, 2007)	0.43
Soil (National Soils Layer)	Shallow Glenrosa and Mispah soils. Red, yellow and greyish soils that are freely draining and structureless.

4.2 Benchmark vegetation

The National South African Vegetation Map (Mucina & Rutherford, 2006) characterises the region as represented by both the Grassland Biome. The study area is considered as lying within the Mesic Highveld Grassland Bio-region. According to Mucina & Rutherford (2006), at a broader spatial scale, the Rand Highveld Grassland (Gm11) vegetation type is modelled as present with the study area. The characteristics of the above vegetation are further detailed in the following sub-section.

4.2.1 The Rand Highveld Grassland (Gm11)

The Rand Highveld Grassland is characterised by a mosaic of species rich sour grassland and shrubs that are growing on rocky outcrops and steeper slopes. Grasses are wiry, while shrubs (mostly Asteraceae) are sour. Where, savannoid woodlands are encountered, they are characteristically represented by *Protea caffra*, *Protea welwitschii*, *Acaccia caffra* and *Celtis Africana*, and these are sparsely distributed on rocky hills and Quartzite ridges. Scott-Shaw & Escott (2011).

Conservation Status

The Rand Highveld Grassland vegetation type has been assigned a provincial threat status of **Vulnerable** and is considered **Poorly Protected** in terms of protection status. More than 25% has been transformed for cultivation, plantations, urban sprawl, and dam building. Poor land management, coupled with proliferation of alien plants and moderate-high erosion level, have also resulted to degradation of significant portions of the grassland.

Figure 4-1: Extent of the vegetation type overlaying the project area.

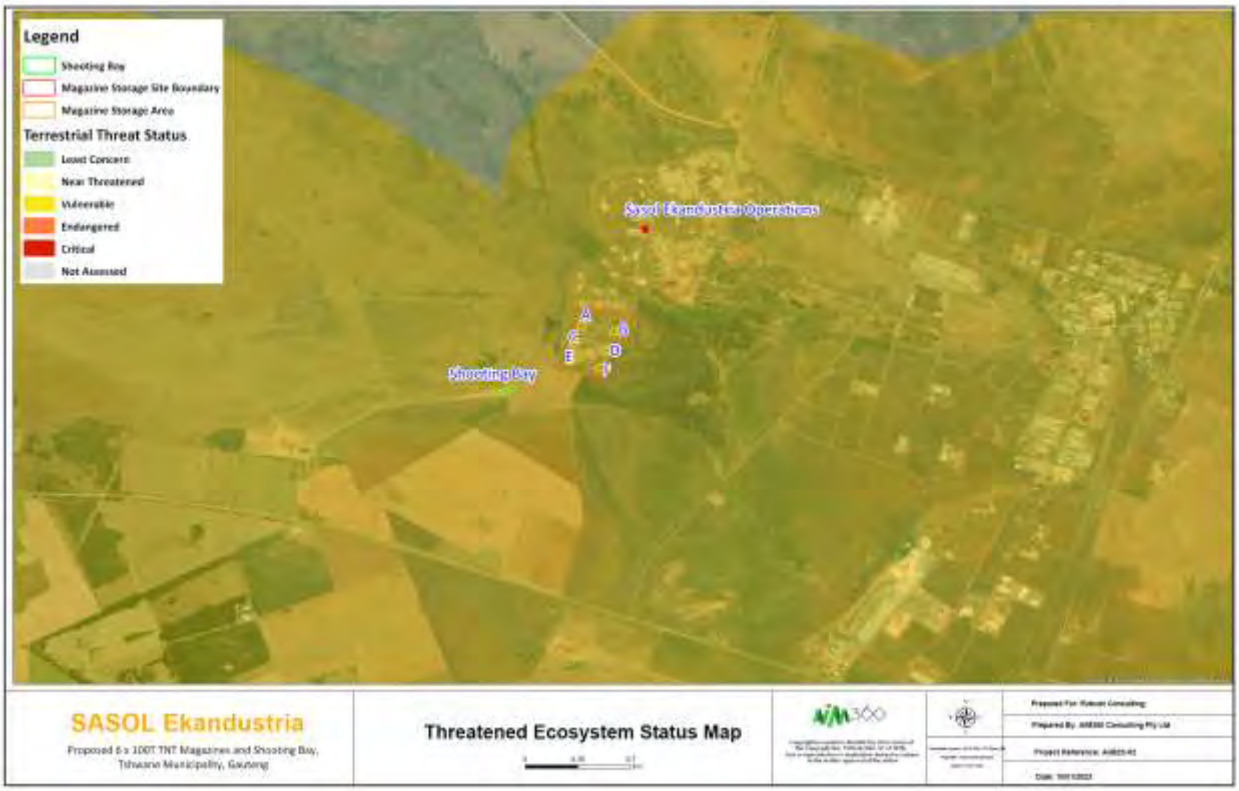


Figure 4-2: Threatened Ecosystem Status Map.

4.3 Biodiversity Conservation Context.

4.3.1 The Gauteng C-Plan

The Gauteng C-Plan version 3.3 was released in February 2012. The C-Plan delineates on a map, biodiversity priority areas called Critical Biodiversity Areas, Ecological Support Areas and Protected Areas. The tool is designed to be used at approximately as an integrated biodiversity input into land use planning and decision making. Gauteng C-Plan v3.3 should be used as the key biodiversity informant in the compilation of bioregional plans, Environmental Management Frameworks and Municipal Spatial Development Frameworks, and should be a primary biodiversity consideration in Environmental Impact Assessments. The Plan classifies the natural vegetation of the province according to conservation value in decreasing value, as follows:

1. **Protected Areas**
   Protected Areas are areas which have legal protection under relevant legislation or which are managed with a primary conservation objective. Importantly, the Protected Area definition used and the areas included in Gauteng C-Plan deviate from those typically used in other South African conservation plans, as the key criteria used to guide inclusion or exclusion is the type of conservation management applied in an area rather than its legal status. For example, World Heritage Sites and Protected Environments are not considered to be Protected Areas while certain undeclared conservation areas are included.

2. **Critical Biodiversity Areas (Irreplaceable or Important)**
   CBAs include natural or near-natural terrestrial and aquatic features that were selected based on an areas biodiversity characteristics, spatial configuration and requirement for meeting both biodiversity pattern and ecological process targets. CBAs include:

   Irreplaceable
   Sites where no other options exist for meeting targets for biodiversity features, as well as best-design sites which represent an efficient configuration of sites to meet targets in an ecologically sustainable way that is least conflicting with other land uses and activities. These areas need be maintained in the appropriate condition for their category.

   Important
   CBAs that are degraded or irreversibly modified but are still required for achieving specific targets, such as cultivated lands for threatened species

3. **Ecological Support Area**

   Natural, near-natural, degraded or heavily modified areas required to be maintained in an ecologically functional state to support Critical Biodiversity Areas and/or Protected Areas. ESAs maintain the ecological processes on which Critical Biodiversity Areas and Protected Areas depend. Some ESAs are irreversibly modified, but are still required as they still play an important role in supporting ecological processes.

Upon examination of the Gauteng C-Plan dataset in relation to the study site it was found that:

1. Three (3) CBAs regarded as Important Areas were modelled within the study site and its surrounding area. The implication is that the project has an impact on biodiversity conservation targets for the area, particularly with regards to the conservation of primary grasslands, Red Data Bird species and prioritised watercourses.
2. Four (4) ESAs were modelled within the study area. This implies that the project may have impacts on the ecological processes on which Critical Biodiversity Areas and Protected Areas depend.
3. No protected areas have been modelled within a 5km and 10km radius of the study site. However, the Ithala Game Reserve is located outside the 10km radius, south east of the study site.

This indicates that the vegetation within the study area is considered important for the conservation of biodiversity in the Province and for maintaining ecological patterns in the landscape.

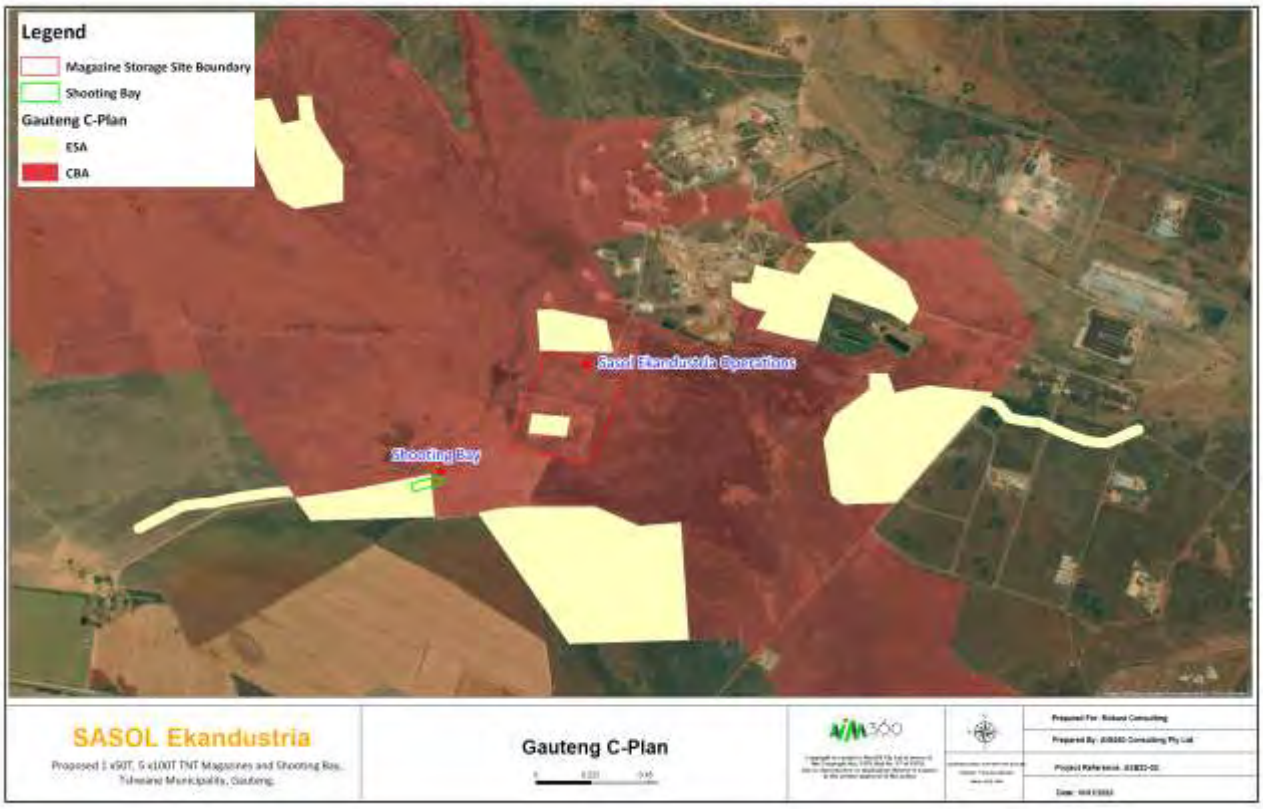


Figure 4-3: Critical Biodiversity Area (CBA) status of the study site.

Figure 4-4: Protected areas proximal to the study site.

5 INVESTIGATION RESULTS –Terrestrial Ecological

5.1 Flora

5.1.1 Desktop Study Results

The proposed project is located within 2528DA Quarter Degree Grid Square (QDGS) in South Africa. South African National Biodiversity Institute (SANBI) datasets were overlaid on the quarter degree square to determine the availability of potential Red Data plant species or species of conservation significance.

According to the South African Red data list categories done by SANBI, threatened species are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered, Endangered or Vulnerable is a threatened species whereas Species of conservation concern are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD). **Table 5-1** below shows the South African Red Data list categories according to SANBI.

Table 5-2 : Definitions of Red Data Status

Family	Species	Threat Status
CR/ PE	**Critically Endangered (Possibly Extinct)**	Critically Endangered (Possibly Extinct) taxa are those that are, on the balance of evidence, likely to be extinct, but for which there is a small chance that they may be extant. Hence they should not be listed as Extinct until adequate surveys have failed to record the taxon.
CR	**Critically Endangered**	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the five International Union for Conservation of Nature (IUCN) criteria for Critically Endangered, and is therefore facing an extremely high risk of extinction in the wild.
EN	**Endangered**	A taxon is Endangered when the best available evidence indicates that it meets any of the five IUCN criteria for Endangered, and is therefore facing an extremely high risk of extinction in the wild.
VU	**Vulnerable**	A taxon is Vulnerable when the best available evidence indicates that it meets any of the five IUCN criteria for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.
NT	**Near Threatened**	A taxon is Near Threatened when available evidence indicates that it is close to meeting any of the five IUCN criteria for Vulnerable and it is therefore likely to qualify for a threatened category in the near future.
D	**Declining**	A taxon is Declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population.

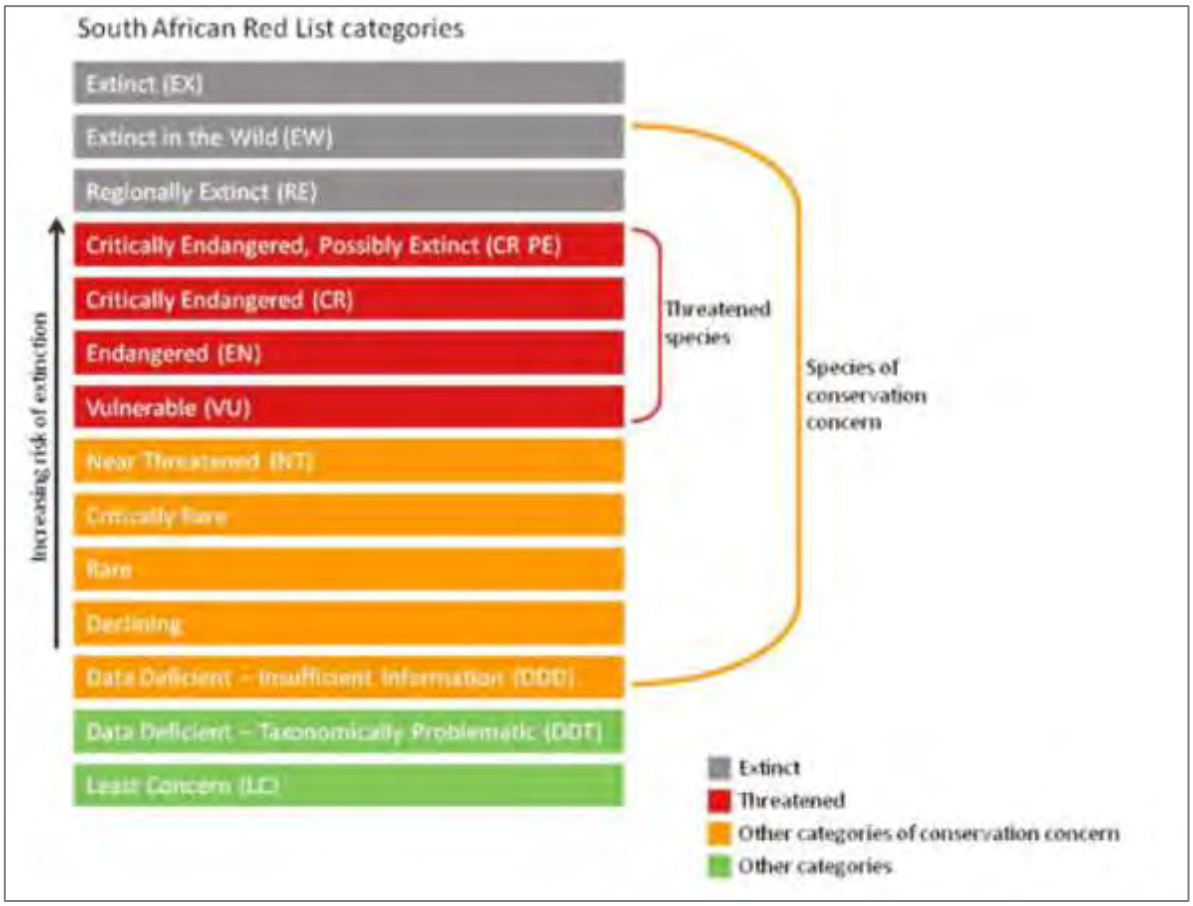


Figure 5-1 South African Red Data list categories according to SANBI Potential of Occurrence

To determine the likelihood of presence of Red Data plants species, a Potential of Occurrence (POC) was used. Habitat suitability was used as the determinant. POC was categorised according to **Table 5-2** below.

Table 5-3: Categorisation of Potential of Occurrence

Potential of Occurrence	Likelihood
Low	Unlikely to occur in such a habitat.
Moderate	May occur in the habitat albeit in limited population.
High	Most likely to occur in significant population as the habitat is conducive.

Table 5-3 below highlights all the Red Data plant species which were recorded on **2528DA** grid cells and their probability of occurrence.

Table 5-4: Threated plants species potentially occurring within grid cells 2528DA.

Species	Threat Stats	Suitable Habitat	Potential of Occurrence
Eucomis vandermerwei (Crinkle-leaf Pineapple Lily)	**VU**	It is endemic to high altitude summit hill slopes and plateaux from 2200-2500m. Its niche is well-drained, sandy soil amongst quarzitic stones and between crevices of quarzitic rocky ledges and in short grass tufts, mainly on south- and east-facing slopes.	**Low**

Anacampseros subnuda subsp. lubbersii	**VU**	It is a succulent subshrub and grows primarily in the desert or dry shrubland biome.	**Low**
Frithia humilis Burgoyne (Fairy Elephants Feet)	**VU**	Predominantly in shallow, sandy gravel on large, flat, rock plates of the coarse sandstone sediments. Grows in altitudes range from 1 368 m to 1 550 m and rainfall varies between 700 and 800 mm per annum.	**Moderate**
Crassula arborescens subsp. undulatifolia (Tree Crassula)	**CR**	Plants typically grow in sandstone and shale-derived soils in rocky to gravel-like conditions. Plants often occupy large areas on hills, slopes and sometimes cliffs but are also found in valleys but with a preference for sunny and exposed situations.	**Moderate**
Delosperma purpureum	**EN**	Grows in south-facing slopes, in shallow soils among crystalline or conglomerate quartzitic rocks, in sun or in partial shade, rarely in shade, in grassland with some trees.	**Moderate**
Encephalartos lanatus, E. middelburgensis (Middelburg Cycad)	**CR**	Open grasslands and in sheltered valleys on slightly acidic soils. It grows in steep slopes and rocky areas.	**Low**

5.1.2 Findings of the infield investigation

Infield investigation was conducted in January 2023 to verify the presence of Red Data Listed plant species and plants of conservation significance in terms of national and provincial legislation. A walk-over survey was conducted along random longitudinal transects and points of interests were earmarked using a Dakota 20 handheld GPS. The infield assessment was limited to the footprint of the proposed design layout and a 15m assessment corridor from the boundary of the site.

The investigation revealed the presence of a northeast-facing slopes, with a landscape characterised by farmlands and industrial complexes. The study site is underlain by Mispah soils that are red-yellowish in colour. The A-horizon layer of the soils is very shallow and characterised by a very low organic matter content. Onsite assessment of soils indicate that the soils are freely draining and structureless.

At a broad spatial level, vegetation is characteristically dominated by a mosaic of herbaceous plants and medium-tall sized sour grassland. Most common grasses on the plains belong to the genera *Themeda*, *Eragrostis*, *Heteropogon* and *Elionurus*. The herbaceous layer consists mainly of *Helichrysum* and *Asteraceaes.*

Photo 1 below show a representative view of the landscape and **Photo 2** shows a representative view of the soils.

Photo 1: Representative view of the landscape associated with the study site. Note the remnants of tree plantations (background of picture) and medium sized grassland with high diversity of forbs (foreground of picture).

Photo 2: Representative view of the soils found at the study site.

At a site based level, the development site is primarily represented by three (3) terrestrial habitats that can be categorsied in terms of structure, vegetation composition and condition. The following habitats (including their extent) were assessed:

- **Disturbed Highveld Grassland (DHG) - 17.74ha.**
- **Wetland Vegetation (DWV) - 4.10ha.**
- **Rocky Outcrops (RO) - 0.34ha.**

In general, the study site and its immediate surrounding area can be characterised as – widespread medium-tall sized Highveld Grasslands (on hillslope) mixed with high diversity of herbaceous forbs. Rocky outcrops and wetlands are encountered at the northern edge of the study site.

Disturbed Highveld Grassland

The Highveld Grassland (HG) vegetation community is generally widespread and accounts for the majority of the site, see **Figure 5-1** for the map showing the spatial distribution of the habitats. In terms of extent, the Highveld Grassland vegetation community accounts for 17.74 ha of the proposed study site (21.3ha), a coverage of almost 83.29%. Tree are noticeably absent and encounters limited to a few individual shrubs. The south-western portion of the site is characterised by grass composition with a high diversity of forbs. **Photo 3** shows a representative view of the Highveld Grassland.

Photo 3: Representative view of the Highveld Grassland at the study site. (South-west facing view)

Photo 4: Representative view of the grassland with high forb diversity. *Helichrysum nudifolium* var. *nudifolium and H. rugulosum* dominant (South-west facing view).

Photo 5: Representative view of the Highveld Grassland with high forb diversity. (South-east facing view).

Dominant plant species associated with the Highveld Grassland vegetation community are highlighted below:

Grass:
Graminoids recorded within the study site included: Aristidia congesta, *Heteropogon contortus*, *Loudetia simplex*, *Panicum natalense*, *Hyparrhenia hirta, Themeda triandra, Cynodon dactylon, Cymbopogon caesius, Eragrostis racemosa, Tristachya biseriata, Andropogon schirensis, A. junciformis* subsp. *Galpinii, Brachiaria serrata, Eragrostis plana, E. curvula, E. racemosa, Mirochloa Caffra, Sporobolus africanus, Melinis ripens and Brachiarria serrata.*

Herbs:
Herbaceous plants recorded with the grasses included: *H. nudifolium* var. *nudifolium, Helichrysum rugulosum, Ipomoea crassipes, Nidorella hottentotica, Selago densiflora* and *Vernonia oligocephala*.

Bulbs
Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia, Aloe greatheadii var. davyana

Disturbances on the vegetation community
Noticeable disturbances that were recorded on the grassland included: (i) installation of a perimeter fence (ii) informal access roads (iii) proliferation of alien plants such as *Verbena bonariensis* (Common Verberna).

Photo 6 and 8 below shows some of the disturbances noted within the study site.

Photo 6: Perimeter fence (left) and access routes (right) along the fenceline.

Photo 7: Acces routes through the grassland.

Photo 8: Proliferation of *Verbena bonariensis* (Common Verberna).

Wetland Vegetation

A wetland, which was classified as a Seep, is located south of the project site. The wetland habitat is approximately 4.10 ha in size and accounts for 23.11% and has a slope of approximately 0.88%. Vegetation within the wetland is characterised by hydrophytic sedges and water tolerant grasses.

Grasses:

The wetland vegetation was found to be dominated the following: *Imperata cylindrica, Schoenoplectus brachyceras, Cynodon dactylon, Kyllinga sps and Sporobolus pyramidalis*.

Common indigenous grasses recorded at the edge of the wetland included: *Eragrostis curvula*, *Melinis repens* (d), *Panicum maximum* (d), *Themeda triandra* (d) *Heteropogon contortus*, *Sporobolus fimbriatus*, *S. pyramidalis.*

Alien plants proliferating within the wetland included: *Verbena bonariensis, Chromolaena odorata, Bidens pilosa, Ageratum conyzoides* and *Tagetes minuta*.

Photo 8: Seep wetland located south of the study site and characterised by hygrophillous vegetation and hydric soils.

Rocky Outcrops

The Rocky outcrop was identified east of the project site and is approximately 0.34ha in extent, it accounts 1.95% of the study site. The vegetation overlaying the ridges was noted to have a relatively high abundancy and composition of shrubs in comparison to the rest of the study site.

Shrubs

Acacia Caffra, *Celtis Africana*

Herbs:

Herbaceous plants recorded with the grasses included: *H. nudifolium* var. *nudifolium, Helichrysum rugulosum, Ipomoea crassipes, Nidorella hottentotica, Selago densiflora* and *Vernonia oligocephala*.

Grass:

Graminoids recorded within the study site included: Aristidia congesta, *Heteropogon contortus*, *Loudetia simplex*, *Panicum natalense*, *Hyparrhenia hirta, Themeda triandra, Cynodon dactylon, Cymbopogon caesius, Eragrostis racemosa, Tristachya biseriata, Andropogon schirensis, A. junciformis* subsp. *Galpinii, Brachiaria serrata, Eragrostis plana, E. curvula, E. racemosa, Mirochloa Caffra, Sporobolus africanus, Mirochloa Caffra, Panicum natalense, Melinis ripens and Brachiarria serrata*

Photo 9 below shows a representative view of the rocky outcrops located east of the study site.

Photo 9: View of the rocky outcrops overlooking a wetland situated east of the study site. Note the presence of limited shrubs (foreground of the picture).

A Species Inventory of all the plant species recorded within the study site during the field investigation is presented in **Table 5-5** below.

Table 5-5: Plants species that were recorded within the study site.

Scientific name	Common name	Alien Plant	Form
Senegalia Caffra	Hook Thorn		Shrub
Celtis Africana	Stink Wood		Shrub
Bidens pilosa	Black Jack	X	Herb
Vernonia oligocephala	Bicoloured-leaved Vernonia		Herb
Nidorella hottentotica	Nidorella/ Vlei Weed		Herb
Ipomoea crassipes	Christmas Flower	X	Herb
Verbena bonariensis	Common Verbena	X	Herb
Lantana Camara	Lantana/ Tick Berry	X	Shrub
Solanum mauritianum	Bugweed	X	Shrub
Helichrysum nudifolium var. pilosellum	Hottentot's tea		Herb
Helichrysum rugulosum	Helichrysum		Herb
Helichrysum lepidissimum	Helichrysum		Herb
Psidium guajava	Common Guava	X	Tree
Asparagus virgata	Broom Asparagus		Herb
Tagetes minuta	Tall Khaki Weed	X	Herb
Vangueria macrocalyx	Forest Wild Melder		Herb
Xanthium strumarium	Large Cocklebur	X	Herb
Zinnia peruviana	Peruvian Zinnia	X	Herb
Aloe greatheadii var. davyana	Spotted Aloe		Succulent
Aristida congesta	Tassel Three-awn		grass
Aristida junciformis subsp. galpinii	Gongoni Grass		grass

Andropogon schirensis	Stab Grass		grass
Brachiaria serrata	Red Top Grass		grass
Eragrostis racemosa	Heart Love Grass		grass
Eragrostis plana	South African Love Grass		grass
Eragrostis curvula	Weeping Love Grass		grass
Eragrostis superba	Flat Seed Love Grass		grass
Heteropogon contortus	Spear Grass		grass
Hyparrhenia dregeana	Rooi Grass		grass
Hyparrhenia hirta	Common Thatching Grass		grass
Imperata cylindrica	Cotton Wool Grass		grass
Laudeta simplex	Russet Grass		grass
Melinis repens	Natal Red-top		grass
Microchloa caffra	Pincushion Grass		grass
Panicum natalense	Bitter Switch Grass		grass
Paspulum dilatatum	Paspalum		grass
Chloris gayana	Rhodes Grass		grass
Chloris virgata	Feathertop Chloris		grass
Cynodon dactylon	Couch Drass		grass
Cymbopogon caesius	Broad-leaved turpentine grass		grass
Panicum natalense	Natal Buffalo Grass		grass
Setaria megaphylla	Ribbon Bristle Grass		grass
Schoenoplectus brachyceras	Common Sedge		Sedge
Setaria sphacelata	Common Bristle Grass		grass
Sporobolus africananus	Rats tail Dropseed		grass
Sporobolus pyramidalis.	Giant's Rat Tail Grass		grass
Sporobolus pectinaus	Fringed Dropseed		grass
Themeda triandra	Red Grass		grass
Tristachya leucothrix	Hairy Trident Grass		grass
Tristachya biseriata	Trident Grass		grass
Hypoxis rigidula var. pilosissima	Star Leaved Star Lilly		Bulb
Ledebouria ovatifolia	Flat-leaved African hyacinth		Bulb

5.1.3 Species of conservation significance, Threatened Species and medicinal plants

The National Environmental Biodiversity Act (Act 10 of 2004) (as amended) and Gauteng Nature Conservation Ordinance 12 of 1983 place an emphasis on conserving biodiversity in each province and as such all indigenous resources must be sustainably utilised. Additionally, legislation exists at both national and provincial level for the conservation of plant species with medicinal properties.

Medicinal plants

Plants recorded within the study site with medicinal value include inter alia: *Helichrysum rugulosum, Helichrysum nudifolium (Hottentot's tea), Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia and Aloe greatheadii var. davyana*

Conservation significant plants and threatened species

Plants of conservation significance, as protected by the Gauteng Nature Conservation Ordinance 12 of 1983, that were encountered within the study site include: *Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia and Aloe greatheadii var. davyana*

5.1.4 Habitat associated with species of conservation significance

The main components of a habitat are shelter, water, food, and space. A habitat is said to have a suitable arrangement when it has the correct amount of all of these. Sometimes, a habitat can meet some components of a suitable arrangement. For a plant, a good habitat must provide the right combination of light, air, water, and soil. The following habitats are most likely to harbour species of conservation significance:

Grassland

Tall grasslands are usually associated with high plant diversity of bulbous plants due to inaccessibility. Bulbous plants were encountered in grasslands where disturbances were markedly lesser in comparison to other terrain within the study area. The southern portion of the study site (proximal to the fence line) has a very dense tall-medium sized grassland that is conducive for fire-adapted bulbs. Bulbs (and succulent) such as *Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia, aloe Aloe greatheadii var. davyana* were encountered during the field survey. **Photo 10-12** shows the bulbs (and succulent) recorded within the grassland community.

Photo 10: *Hypoxis rigidula var. pilosissima*

Photo 11: *Aloe greatheadii* var. *davyana*

Photo 12: *Ledebouria ovatifolia*

5.1.5 Alien Invasive Plants

Invasive alien plants are described as species which are 'non-indigenous' to an area and which have been introduced from other countries either intentionally (for domestic/ornamental or commercial use) or accidentally; furthermore, they have the ability to reproduce and spread without the direct assistance of people into natural or semi-natural habitats and are destructive to biodiversity and human interests (WESSA-KZN, 2008).

Notice 3 of the National Environmental Management: Biodiversity Act 2004 (Act No, 10 of 2004) lists 379 plant species that are legally declared invasive species (See **Table 5-6**). Each species is assigned to one of three categories based on the level of threat posed by the species and the legal status assigned to each:

Table 5-6: NEMBA Category for invasive plant species

Category 1a	Plant species that must be combatted or eradicated.
Category 1b	Plant species that must be controlled.
Category 2	Plant species that must not be allowed to spread outside any property.
Category 3	Plant species that when occurring in riparian areas must be considered to be category 1b Listed Invasive Species and must be managed according to regulation 3 of NEM:BA, 2014

Please see **Table 5-5** above for a list of Alien Invasive Plants that were identified on site. **Photos 13** below shows *Verbena bonariensis* plant is widespread at the study site.

Photo 13: Proliferation of *Verbena bonariensis* (Common Verberna).

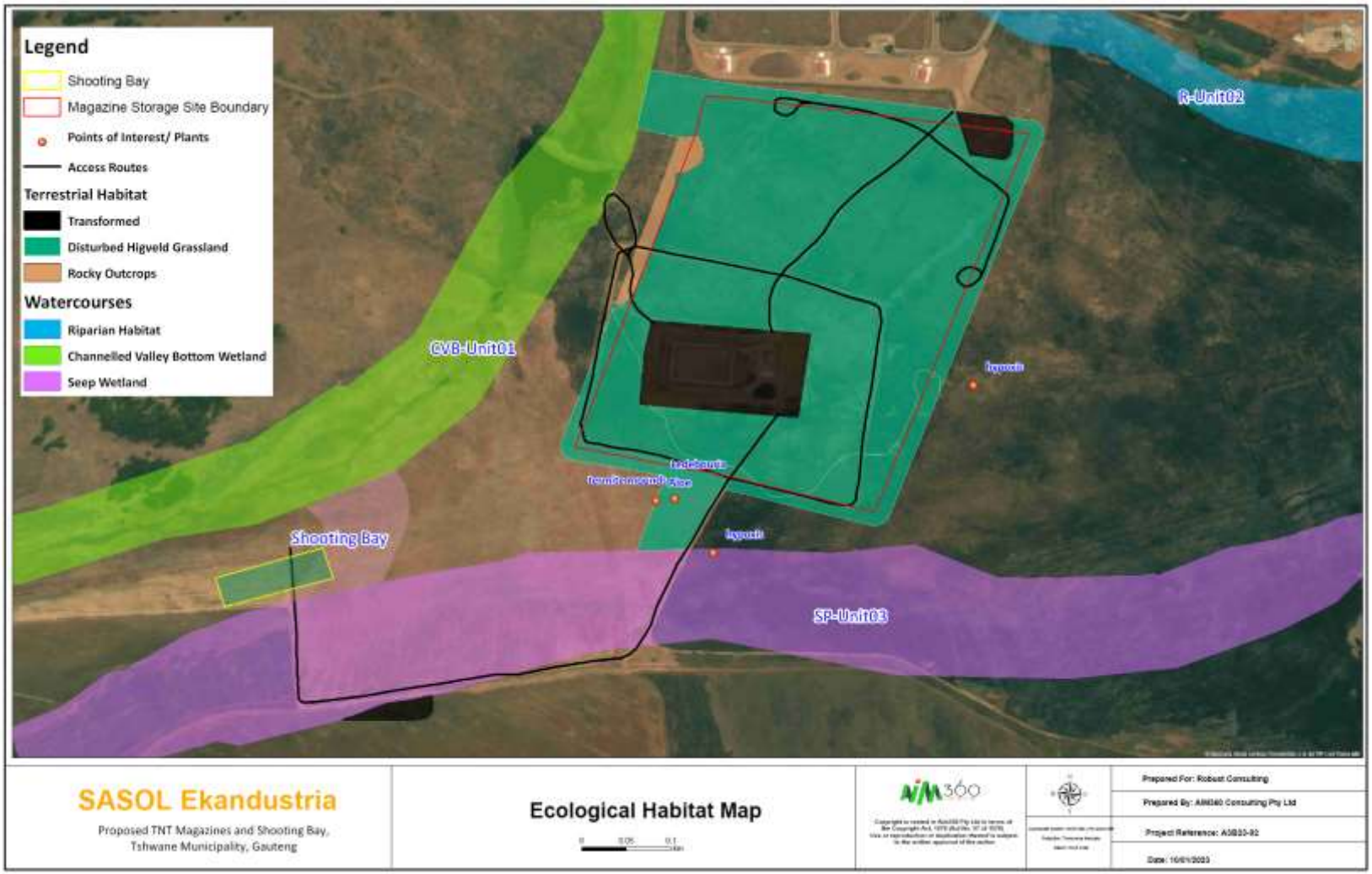


Figure 5-1: Findings of the field investigation (ecological habitats)

5.2 Fauna

The survey focused on the current status of threatened faunal species (mammals, birds and reptiles) with a potential of occurrence (POC) within the proposed study area. During the site visit faunal presence was largely verified by visual sightings and photographic images collected.

5.3 Mammals

5.3.1 Desktop Study Results

According to distribution maps, only fourteen (14) terrestrial mammal may potentially occur within the proposed study area (Skinner and Chimimba 2005). However, given the disturbed nature of the study area due to establishment of industrial complex and farmlands, the species may not have resident populations within the study area. **Table 5-7** below shows the mammal species potentially occurring within the grid cells **2528DA.**

Table 5-7: Mammal species potentially occurring within grid cells **2528DA**.

Species	Common name	Red List	Suitability of Habitat	Potential of Occurrence
Equus quagga	Burchell's Zebra	**LC**	Burchell's Zebra utilise open grasslands, as well as savanna woodland. They can also be found in open grassland habitats, with habitat preference showed by seasonal variability. The dietary flexibility and its tolerance for highly fibrous grass material are the factors considered to contribute to the Zebra's broad geographic range	**Low**
Alcelaphus buselaphus	Red hartebeest	**LC**	Red Hartebeest prefer open habitat and mainly occur in grasslands of various types (Skinner & Chimimba 2005). More tolerant of woodland areas and high grass than other alcelaphines, Hartebeest prefer the edge to the middle of open plains. They thus appear to be an edge or ecotone species, generally avoiding more closed woodland, and sometimes they occupy high-lying areas that are avoided by most other larger grazers. They occur on floodplain grassland, vleis, semi-desert savannah and open woodland	**Low**
Damaliscus pygargus phillipsi	Blesbok	**LC**	Grasslands are considered prime habitat for Blesbok, especially open plateau grasslands, characteristic of the South African Highveld, extending to altitudes of up to 2,000 m asl. Blesbok have a preference for short grass, and depend largely on the availability of drinking water.	**Low**
Mungos Mungo	Banded Mongoose	**LC**	Banded Mongooses occur in a wide range of habitats, but they are primarily found in savannah and woodland, usually close to water, and are absent from desert, semi-desert and montane regions. They are often found in habitats containing termitaria, which are used as den sites: with an average den density of 0.71 dens / ha on a beef and game farm in Natal. They have also been observed in towns and villages.	**Moderate**
Phacochoerus africanus	Common Warthog	**LC**	Common Warthog occupies in a wide range of habitats, especially open woodland, shrubland, short grassland and floodplains (Skinner & Chimimba 2005). Its natural distribution corresponds with the Savannah biome, which is demarcated by altitudes from sea level to 2000 m.	**Low**
Herpestes sanguineus	Slender Mongoose		Slender Mongooses are present in a wide variety of habitats, they occur in open habitats, as long as there is some cover, such as hollow logs, rocks, fallen trees or disused Aardvark holes. They have also been recorded among rocky outcrops.	**Low**

Tragelaphus strepsiceros	Greater Kudu	LC	Preferred habitat includes mixed scrub woodland, Acacia, and Mopane bush on lowlands, hills, and mountains. It is one of the few large mammals that can exist in settled areas, such as in the scrub woodland and bush that reclaims abandoned fields and degraded pastures.	**Low**
Hystrix africaeaustralis	Cape Porcupine	LC	They show seasonal changes in preference for habitats based on the habitat substrate, seasonal food availability and refuge capacity. They can also exist in human-modified areas, such as croplands and suburban gardens.	**Moderate**
Taurotragus oryx	Common Eland	LC	Eland extensively utilise forb-rich montane grasslands of the South African Highveld. Seasonal habitat use by Eland is, therefore, supposedly driven by changes in forage quality and abundance conditions, and a number of studies suggested that Eland in savannah areas move from woodland to open grassland during the early wet season to forage on new growing grasses.	**Low**
Cynictis penicillata	Yellow Mongoose	LC	The Yellow Mongoose is widespread and adaptable to many habitats, including human-transformed landscapes. It appears to prefer areas with short grass and/or shrub, with soft to medium-hard sand. Generally, this species is found on a borrow-able substrate in savannah, shrubland, grassland and arid environments at various altitudes. Rocky substrate and heavy clay soils are likely to be avoided due to reliance on boltholes/sleeping burrows with multiple entrances.	**Low**
Canis mesomelas	Black-backed Jackal	LC	Black-backed Jackals are relatively unspecialised and well-suited for an opportunistic lifestyle in a wide variety of habitats. They have a wide habitat tolerance, occupying habitats including Highveld grassland, montane grassland, scrubland, savannah, woodland savannah mosaics and farmland. The Black-backed Jackal has long been perceived as an arid-adapted species. However, it also occurs in more mesic areas with recent expansions into the more mesic South Coast area, where it was previously absent. It shows a preference for open habitats, but will occupy dense vegetation.	**Moderate**
Sylvicapra grimmia	Bush Duiker	LC	The Common Duiker is one of the most widely distributed, occurring within savannah woodland habitats. They avoid open grasslands where tree cover is limited, aside from the very long grassland habitats. They are considerably adaptable to land transformation, as it is known to persist in peri-urban and urban areas, and on the fringes of agricultural areas, where natural vegetation remains predominantly undisturbed.	**Moderate**
Aepyceros melampus	Impala	LC	While the natural range of the subspecies comprises predominantly savannah communities, the Common Impala is a generalist and adapts well to other vegetation types. The Common Impala is an edge (ecotone) species which throughout its distribution range is associated with woodland which, preferring light woodland with little undergrowth and grassland of low to medium height. While the subspecies generally avoids open grassland and floodplains, it occurs on the ecotone between the two and will graze on open grassland with a flush of fresh green grass.	**Low**
Hippotragus niger	Sable Antelope	LC	The Sable Antelope is an edge species that frequents the woodland/grassland ecotone. *Panicum maximum* is a key resource grass species in certain areas; *Themeda triandra* is a highly sought after species too. However, they show a broad dietary acceptance for other grass species such as *Brachiaria*	**Low**

			nigropedata, Heteropogon contortus, Digitaria spp. and *Eragrostis* spp.	

No mammal species of conservation significance were modelled as present within the study area.

5.3.2 Mammals recorded along the study site

The study site has undergone significant habitat alteration and transformation as a result of widespread agricultural and industrial complex expansion. Disturbances related to historic crop cultivation, surrounding industrial parks and remnants of forest plantations in particular have resulted in loss of optimal habitat and subsequently in diminished mammal pollutions.

Spoor and dung encountered at the eastern boundary fence of the site indicated the presence of a rodent sized mammal and antelope. There is a likelihood of Mongoose residing in the vicinity of the rocky outcrops and boundary of the disturbed grasslands, most likely using the area for foraging and habitat. The rocky outcrops and disturbed grasslands are particularly favourable for rodents due to high diversity of insects, bulbs and fruits. Watercourses (stream and wetland) located proximal to the site are also likely to provide an abundancy of food for small sized mammals as wells.

It is anticipated that the droppings indicating the presence of possibly a scrub hare (*Lepus saxatilis*) (See **Photo 14**) are possibly remnants of Impala that were previously kept at the study site, which have been subsequently relocated to more suitable habitat.

Photo 14: Droppings indicating the presence of a small sized mammal possibly a *Lepus saxatilis.*

5.3.3 Mammal species of conservation significance

No Red Data listed mammals were recorded within the study area associated with the study site and the likelihood of any threatened mammal species being encountered within the area is considerably low. The majority of large mammals are likely to have been eradicated or have moved away from the area because of increased levels of anthropogenic disturbances such as hunting, as well as habitat modification and degradation. Smaller mammal species are susceptible to predation by feral cats and dogs.

5.3.4 Habitats available for species conservation

To establish the suitability of the study area in relation to the availability of faunal species, it is necessary to look at the habitats available. The habitat is determined by a combination of vegetation type, topography, land use, food sources and other various intrinsic factors.

Rocky outcrops

The rocky outcrops situated east of the study site are not anticipated to shelter species of conservation significance, because of human relayed disturbances such as farming and expansion of industrial activities currently taking place at the study area. However, it is still noteworthy that the rock outcrops provide important ecological corridors for vegetation, as well as cover and migratory opportunities for small faunal species.

Watercourses

The watercourses (stream and wetlands) recorded with the study site are noteworthy as movement corridors for terrestrial faunal species, especially those with a preference for temperate conditions such as small rodent species and may be connected to other more suitable areas for foraging and roosting. The watercourses could also provide suitable habitat for sensitive and non-sensitive fauna species including amphibians. Furthermore the wetlands could provide breeding, foraging and roosting areas for a variety of fauna species.

5.4 Avifaunal

5.4.1 Desktop study results

According to results obtained within pentad 2540_2840 a combined total of 199 bird species have been recorded within the study area, with only two (2) classified as a Red Data species.

Red Data species with a reporting rate of ≤ 1% were not included in the study as the likelihood of being present within the study site is very low. Reporting rates are an indication of the relative density of a species on the ground in that it reflects the number of times that a species was recorded relative to the total amount of cards that were completed for the pentad.

There are no Important Bird Areas (IBA) within the study area, however the Ithala Game Reserve is located marginally outside of the 10km radius of the study area, towards a south easterly direction. he reserve is known to support more than 300 bird species, including raptors such as White-backed Vulture *Gyps africanus*, Lappet-faced Vulture *Torgos tracheliotos*, Martial Eagle *Polemaetus bellicosus*, Bateleur *Terathopius ecaudatus* and Tawny Eagle *Aquila rapax*.The distribution of the Important Bird Area is shown in **Figure 5-3** below.

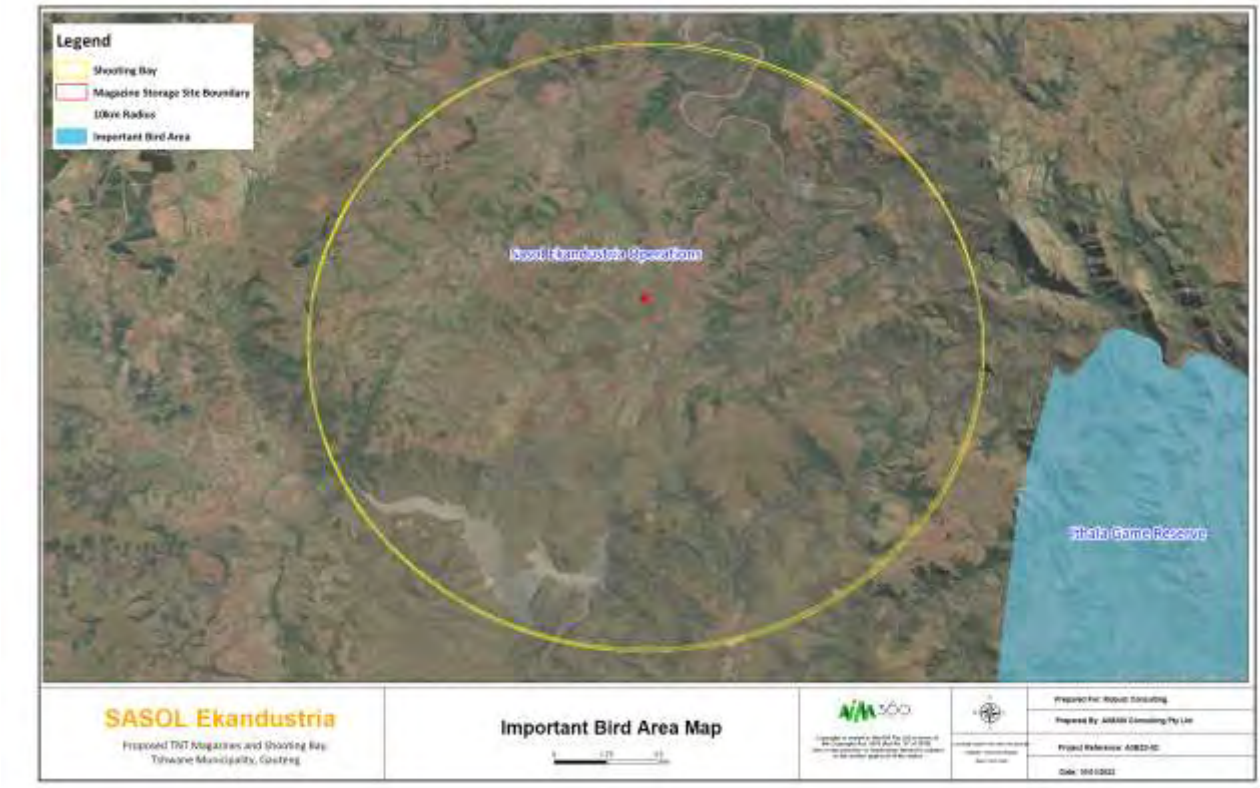


Figure 5-6: Important Bird Areas (IBA) in relation to the study area.

Table 5-8 below highlights Red Data bird species potentially found within the study area and the suitable habitat that is predominantly associated with Red Data bird species. However it is worth noting that the movement of the Red Data bird species is not limited to such habitat, but may be encountered throughout the study area.

Table 5-8: Red Data bird species potentially occurring within 2540_2840 pentad (SABAP 1) (Harrison et al. (1997), Barnes (2000), SABAP2, and Tarboton et al. 1987).

Common Name	Red List Category	Suitable Habitat	Potential of occurrence
Lanner Falcon (Falco biarmicus)	Vulnerable	It generally favours open grassland, cleared or open woodland and agricultural land. While breeding it is most common around cliffs used as nesting and roost sites, although it may also use buildings, electricity pylons and trees.	Moderate
Secretarybird (Sagittarius serpentarius)	Endangered	While they prefer the savannah biome with scattered thorn trees (*Senegalia* and *Vachellia* spp.) and short grasses, which allow them to easily see whilst walking and feeding. Secretarybirds can also be found in semi-deserts and areas that have shrubs. They are frequently found in agricultural areas that offer hunting opportunities.	Low

5.4.2 Fieldwork results

During the site visit a total of 36 bird species were recorded within the study site (Table 5-9). The most commonly recorded species were species often associated with anthropogenically modified landscapes (c. 36.11%). Thirteen (13) of the recorded bird species are common residents around settlements and have a generalist diet. This coupled with their generalist habitat requirements facilitates their presence within this

disturbed environment. Approximately twelve (12) bird species (c.33%) are associated with disturbed grasslands. Approximately 25% of the bird species showed an affinity for freshwater habitat.

Photo 15: The wetland habitat observed to have the highest species richness and abundance of bird species within the study site.

Photo 16: Sparrow Weaver nests encountered within the Seep wetland located south of the project site.

Photo 17: Feather of *Numida meleagris* (Helmeted Gunieafowl) encountered within the grassland vegetation community.

Photo 18: Common Swallows perched on the fence associated with the study site.

Table 5-9 below lists the birds that were recorded at the study site during the assessment.

Table 5-9 : Bird species recorded along the study site.

Scientific name	Common name
Apus apus	Common Swift
Apus affinis	Little Swift
Cisticola juncidis	Zitting Cisticola
Dicrurus adsimilis	Fork-tailed Drongo
Corvus albus	Pied Crow
Euplectes orix	Southern Red Bishop
Numida meleagris	Helmeted Guineafowl
Hirundo cucullata	Greater Striped Swallow
Cecropis abyssinica	Lesser Striped Swallow
Lagonosticta senegala	Red-billed Firefinch
Plectropterus gambensis	Spur-winged Goose
Colius striatus	Speckled Mousebird
Columbia guinea	Speckled Pigeon
Anthus cinnamomeus	African Pitpit

Anthus nicholsoni	Nicholson's Pipit
Lamprotornis bicolor	Pied Starling
Phylloscopus trochilus	Willow warbler
Ploceus subaureus	Yellow Weaver
Bubulcus Ibis	Cattle Egret
Streptopelia capicola	Cape Turtle-Dove
Trochocercus cyanomelas	Blue-mantled Crested-flycatcher
Myrmecocichla formicivora	Ant-eating Chat
Streptopelia semitorquata	Red-eyed Dove
Streptopelia senegalensis	Laughing Dove
Passer domesticus	House Sparrow
Ploceus velatus	Southern Masked Weaver
Malaconotus blanchoti	Grey-headed Bush-shrike
Lybius torquatus	Black-collared Barbet
Vidua paradisaea	Long-tailed Paradise-whydah
Vidua macroura	Pinned-tailed Whydah
Ardea cinerea	Grey Heron
Passer Diffussus	Southern Grey-headed Sparrow
Pycnonotus tricolor	Dark-capped Bulbul
Bubulcus ibis	Western Cattle Egret
Quelea queluea	Red Billed Quelea

5.4.3 Habitat Associated with Red Data bird species

It must be emphasised that avifauna will, by virtue of their mobility, utilise almost any area in a landscape from time to time. However, certain habitats (such as the riparian area of a watercourse) may present foraging opportunities and therefore are likely to harbour a high avian species diversity.

Watercourses

The watercourses (stream and wetland) proximal to the study site were observed to have the highest species richness and abundance of bird species within the study area; surrounding ecosystems and habitats closest to the industrial complexes and disturbed agricultural lands were noted to be least productive. Avian species recorded closest to the riparian zone included: Southern Red Bishop, Spur-winged Goose, Yellow Weaver, Laughing Dove, Southern Red Bishop, Grey-headed Bush-shrike, Long-tailed Paradise Whydah, Grey Heron and Dark-capped Bulbul.

No threatened species (Red Data species) were recorded within the study site during the survey. The increased levels of anthropogenic disturbance and associated habitat transformation and degradation, has likely resulted in the displacement of specialist avian species as well as threatened species. In most cases these are species sensitive to habitat disturbances and display secretive behaviour characteristics. However, the occurrence of Lanner Falcon (*Falco biarmicus)* were projected as moderate within the Highveld Grassland vegetation community.

5.5 Reptiles

All reptilian species are sensitive to habitat modification and fragmentation. Due to the site being used as pasture lands, and its close proximity to rural settlements and coupled with high levels of historic disturbances (road development activities), it is predicted that substantial mortalities of reptilian populations within the study area have already occurred.

5.5.1 Results of Desktop Study

According to the SARCA (South African Reptile Conservation Assessment) database, only seven (7) reptiles have been recorded within the **2528DA** Quarter Degree Grid Cell (SARCA, IUCN, 2014). Table 5-10 shows the reptiles that are modelled as present with the study area.

Table 5-10: Reptiles found within the 2528DA Quarter Degree Grid Cell

Species name	Red List Category	Suitable Habitat	Potential of Occurrence
Aparallactus capensis (Black-headed Centipede-eater)	**LC**	A terrestrial species that may be partially fossorial (burrowing), with an affinity for old termitaria. Present in a wide variety of habitat types from near sea level up to 2,300 m	**Medium**
Lamprophis aurora (Aurora House Snake)	**LC**	It is widespread and closely associated with grassland habitats that are heavily transformed by urban development and agriculture. Specimens are known from the coast up to the plateau (1,700 m) of the Highveld. Often found near streams and under rocks, occasionally in old termitaria.	High
Nucras holubi (Holub's Sandveld Lizard)	**LC**	This species is found primarily in grassland and savanna. It is often associated with rocky terrain in mesic savanna of the north and sandy flats in the south. As is typical for most sandveld lizards, this species shelters in burrows in the ground or under rocks.	**Medium**
Naja annulifera (Snouted Cobra)	**LC**	Inhabits savanna and grassland, entering coastal scrubland and forest, from near sea level to 1,400 m. Takes refuge in holes in the ground, old termite mounds and rocky outcrops, and basks in the sun near its retreat.	**Medium**
Acanthocercus atricollis (Southern Tree Agama)	**LC**	Largely arboreal and typically associated with large trees, but sometimes found among rocks or on walls. Individuals cross open ground only when moving between trees, but may forage at or around the tree base, as well as bury their eggs in nearby moist soil. They take refuge and sleep under loose bark, in hollow branches, or in holes or crevices in tree trunks. Found in woodlands in wooded grasslands in KwaZulu-Natal. This species readily adapts to peri-urban garden areas where it appears to thrive.	**Low**
Python natalensis (Southern African Python)	**LC**	Found in a wide variety of habitats, but usually in riverine or rocky areas, and often in association with large animal burrows which appear to form a critical microhabitat for reproduction. Although more abundant in low-lying areas, it may occur on lower mountain slopes if suitable rocky refugia are available.	**Low**
Trachylepis punctatissima (Speckles Rock Skink)	**LC**	Living among rocks (rupicoulus) or amongst trees (arboreal) found on rock outcrops, trees and houses, predominantly along the escarpment and on the Highveld. It occurs from the KwaZulu-Natal Midlands (610 m) to elevations of 2,600 m on the Drakensberg escarpment,	**High**

No reptile species of conservation significance were modelled as present within the study area.

5.5.2 Field work results

The Field Guide for Snakes and Reptiles of Southern Africa (Brach, 2001) and South African Red Data Book for Reptiles (Branch, 1988) were used during the field survey. Industrial development and agricultural activities within the study area may have resulted in increased habitat fragmentation and transformation. The densification of industrial complexes, settlements and road traffic has further compounded the decline of suitable habitat for reptiles. As such, these impacts have resulted in the decline of reptile populations. Furthermore, it is anticipated that the indiscriminate killing of snakes, that is associated with human presence has resulted in the mortality of some species from the site.

Table 5-11 below indicates reptile species recorded in the proposed study area.

Table 5-11: Reptiles recorded within the study area.

Genus	Species	Common name
Nucras holubi	Holub's Sandveld Lizard	**Least Concern (SARCA 2014)**
Trachylepis punctatissima	Speckles Rock Skink	**Least Concern (SARCA 2014)**

The majority of the vegetation community within the study site were relatively unproductive with regards to sighting of reptiles.

Termite mounds, which offer an abundancy of ants and millipedes that are the preferred diet for the lizards and skinks were encountered within the grassland community. See **Photo 19** below.

Photo 19: Termite mounds that offer ants for the lizards and skinks.

5.5.3 Habitat Associated with Red Data reptile species

The probability of occurrence of Red Data Species along the proposed project site is projected as very low due to anthropogenic disturbances that have occurred, however the rocky outcrops and watercourses associated with the study site may provide suitable habitat for some reptiles due to an abundancy of frogs and rodents.

6 INVESTIGATION RESULTS – Watercourses

6.1 Results of investigation

Onsite assessment and delineation for watercourses located within the 500m DWS Regulated Zone and 32m of EIA Regulated Zone from the study site identified the presence of three (3) watercourses units.

Two (2) of the three (3) watercourse units were flagged as susceptible to the proposed development and therefore at risk, whilst the remaining watercourse unit was determined to be located outside the zone of impact due to its position within the terrain (**See Figure 6-1** below).

The three (3) watercourse units were assessed and classified as:

1. **Watercourse Unit 1**: Channelled Valley Bottom Wetland (CVB-Unit 01).
2. **Watercourse Unit 2:** Riparian Habitat (R-Unit 02) not assessed further.
3. **Watercourse Unit 3:** Seep Wetland (SP-Unit 03).

The spatial distribution of the delineated watercourse units is mapped below in **Figure 6-1**.

Figure 6-1: Infield delineated watercourses.

6.2 Watercourse Description

The general characteristics of the infield delineated watercourse units are described in **Table 6-1 and 6-2.**

Table 6-1: Description of Channelled Valley Bottom Wetland CVB-Unit 01.

Aspect	Description	Size
HGM Type	Channelled Valley Bottom Wetland (CVB Unit-01)	**10.9 ha**
Photo Plates	 **Photo Plate 20:** Represented view of the Channelled Valley Bottom Wetland (west facing).	
General Description	Unit CVB-01 was classified as a Channelled Valley Bottom Wetland that is located west of the site. The Channelled Valley Bottom Wetland is associated with a seasonal to weakly perennial stream that flows in a north-easterly direction. At the study site, the wetland has a longitudinal gradient of less than 2.44% and a width of ~ 15-20m.	
Watercourse Characteristics		
Hydrology	Water inputs are mainly in the form of concentrated surface flows from upstream supplemented by ephemeral drainage lines and upstream channels. Water moves through and exits the stream mainly as concentrated overland flow. Other inputs may include groundwater inflow.	
Soil	Soil sampling and analysis within the wetland confirmed the presence of wetland indicators. The soil samples highlighted signs of mottling at 0-30cm and 30-50cm depth. Samples collected and analysed were mostly loamy and clayish with high organic content (>20%).	
Vegetation	Vegetation composition can be described as comprising of a mix of reeds (60%), grasses (30%) and some forbs (10%). The wetland plants were found to be dominated primarily by species such as: *Imperata cylindrica, Typha capensis, Cyperus sps, Schoenoplectus brachyceras, Cynodon dactylon* and *Sporobolus pyramidalis*. Common indigenous grasses included: *Melinis repens* (d), *Panicum maximum* (d), *Themeda triandra* (d) *Heteropogon contortus*, *Sporobolus fimbriatus*, *S. pyramidalis.* Exotic plants included: *Bidens pilosa, Ageratum conyzoides, Ricinus communis, Solanum* incanum, *Lantana camara, Tagetes minuta* and *Verbena bonariensis*.	
Watercourse Categorisation		
Aspect	**Category**	**Findings**

Present Ecological State (PES)	**3.5/10 C**	**PES: Moderately Modified** The PES condition of the Channelled Valley Bottom Wetland CVB-01 was evaluated as moderately modified (PES Class of C), which implies a moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact **Key impacts identified included**: (i) Presence of instream artificial dams resulting in impoundment of natural flow (ii) proliferation of alien plants resulting in lowering of vegetation quality (iii) Streamflow altering activity such as timber plantations located within the boundary of wetland. The following suite of representative photos show some of the impacts recorded during the assessment.  **Photo Plate 21:** Representative view of the instream man-made dam. Note the remnants of timber plantation trees at the background of picture.  **Photo Plate 22:** Representative view of proliferation of alien plants (foreground of picture).

<table>
<tr><td>Eco-Services</td><td colspan="2">The most notable ecosystem services provided by CVB-Unit 01 include:
• Flood attenuation.
• Sediment trapping
• Nitrate removal.
• Erosion control.
• Maintenance of biodiversity.
• Water Supply for Human Use.</td><td>Eco-services graph
 
</td></tr>
<tr><td rowspan="4">Ecological Importance and Sensitivity (EIS)</td><td>Category</td><td>Rating</td><td>Rationale</td></tr>
<tr><td>Ecological Importance and Sensitivity:</td><td>1.67 Moderate EIS</td><td>A score of 1.67 indicated that the wetland was of Moderate EIS. This is largely attributed to the importance of the channelled valley bottom wetland with regards to: (i) water quality regulation (ii) refuge for small both aquatic and terrestrial biota.</td></tr>
<tr><td>Hydrological Functional Importance:</td><td>1.7 Moderate EIS</td><td>The results of the evaluation implied that the wetland is of moderate importance in terms of providing hydrological function.</td></tr>
<tr><td>Direct Human Benefits:</td><td>1.2 Low</td><td>The wetland is of low importance with regards to providing human benefits.</td></tr>
</table>

Table 6-2: Description of Seep Wetland SW-Unit 03.

Aspect	Description	Size
HGM Type	Seep Wetland (Unit-03A and Unit-03B)	**17.3 ha**
Photo Plates	 **Photo Plate 23:** Representative view of the Seep Wetland Unit-03.  **Photo Plate 24:** Represented view of the soil sample indicating wetness.	
General Description	The Seep Wetland (Unit-03A and Unit-03B) (see figure 6-1 above) was assessed and classified as a seep wetland due to their position within the terrain. The seep wetland is located south of the project site and within the footprint of the proposed shooting bay. Analysis of the soil and vegetation composition indicated that the wetland is weakly seasonally saturated. The wetland has a width of 50-70m and its slope was calculated as less than 0.88%.	
Watercourse Characteristics		
Hydrology	Water inputs are mainly in the form of interflow from up slope. Water moves through and exits the wetland mainly as interflow.	

Soil	Soil sampling and analysis within the confirmed the presence of wetland indicators. The soil samples showed signs of mottling at 0-30cm and 30-50cm depth. Samples collected were mostly sandy loam.
Vegetation	Vegetation composition can be described as comprising of a mix of both terrestrial grass (30%), hygrophilous plants (60%) and some forbs (10%). The wetland vegetation was found to be dominated the following: *Imperata cylindrica, Schoenoplectus brachyceras, Cynodon dactylon, Kyllinga sps and Sporobolus pyramidalis*. Common indigenous grasses included: *Eragrostis curvula*, *Melinis repens* (d), *Panicum maximum* (d), *Themeda triandra* (d) *Heteropogon contortus*, *Sporobolus fimbriatus*, *S. pyramidalis.* Exotic plants included: *Chromolaena odorata, Bidens pilosa, Ageratum conyzoides* and *Tagetes minuta*.  **Photo Plate 25:** Represented view of wetland geophyte (*Watsonia sps*.)  **Photo Plate 26:** Represented view of *Imperata cylindrica.*  **Photo Plate 27:** Represented view of a *Cyperus sps.*

Watercourse Categorisation		
Aspect	**Category**	**Findings**
Present Ecological State (PES)	**1.8/10 B**	**PES: largely Natural** The PES condition of the Seep Wetland SW-Unit 03 was evaluated as largely modified (PES Class of B), which implies that the wetland is 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.

Key impacts identified included: (i) proliferation of alien plants resulting in lowering of vegetation quality (See **Photo Plate 28**) (ii) informal access roads passing through the wetland (iii) Artificial channels (furrows) draining the wetland, possibly created as part of previous agricultural activates within the farm.

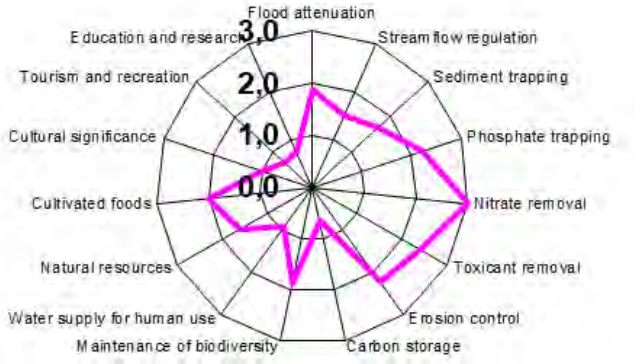
Photo Plate 28: Represented view showing spread of alien plants within the wetland

Eco-Services

The most notable ecosystem services provided by SW-Unit 03 include:

- Flood attenuation.
- Sediment trapping
- Nitrate removal
- Phosphate trapping
- Erosion control.
- Maintenance of biodiversity.
- Water Supply for Human Use
- Cultivated food.

Eco-services graph



Ecological Importance and Sensitivity (EIS)

Category	Rating	Rationale
Ecological Importance and Sensitivity:	**1.70 Moderate EIS**	A score of 1.70 indicated that the wetland was of Moderate EIS. This is largely attributed to the fact that the seep wetland does not harbour any conservation important biota and is of limited sensitivity.
Hydrological Functional Importance:	**1.95 Moderate EIS**	The results of the evaluation implied that the wetland is of moderate importance in terms of providing hydrological function.
Direct Human Benefits:	**1.17 Low**	The wetland is of low importance with regards to providing human benefits.

7 Ecological Habitat Condition and Sensitivity Analysis

7.1 Ecological Habitat Condition and Sensitivity Analysis

After identifying vegetation communities and delineating their respective boundaries, the various vegetation communities defined for the study site were further assessed qualitatively in terms of their ecological condition in order to estimate relative habitat sensitivity.

Ecological functionality describes the structural and functional integrity of the vegetation communities/habitats which support the faunal communities. It also refers to the degree of ecological connectivity between the identified vegetation communities/habitats and other systems within the landscape (such as a combination of species composition; structural intactness and existing levels of anthropogenic disturbance, woody encroachment, etc.).

Systems with a high degree of landscape connectivity amongst each other are perceived to be more sensitive and may be considered as conservation important.

The matrix on **Table 7-1** below was used to determine the ecological condition of the vegetation communities/ ecological habitat.

Table 7-1: Generic matrix used for the estimation and rating of vegetation/habitat ecological condition (using joint consideration of species composition and structural intactness).

		SPECIES COMPOSITION			
		Natural	Good	Fair	Poor
		Representative of reference vegetation type	>75% of expected species occur compared with an undisturbed site in a comparable vegetation type	<75% of expected species occur compared with an undisturbed site in a comparable vegetation type	<25% of expected species occur compared with an undisturbed site in a comparable vegetation type
Structural Intactness	Contiguous (reference)	Natural	Good	Fair	Poor
	Clumped	Good	Good	Fair	Poor
	Scattered/patchy cover	Fair	Fair	Poor	Poor
	Sparse	Poor	Poor	Poor	Very Poor

The ecological condition of the vegetation/ habitat community is mapped as **Figure 7-1.**

The generic matrix in **Table 7-2**below was used for the assessment of vegetation/habitat sensitivity. The results are presented in **Table 7-3.**

Table 7-2 : Generic matrix used for the estimation of habitat sensitivity (based on the joint consideration of habitat condition and threat status of the vegetation type).

		HABITAT/VEGETATION CONDITION				
		Natural	**Good**	**Fair**	**Poor**	**Very Poor/ Transformed**
THREAT STATUS	**CRITICALLY ENDANGERED**	**High**	**High**	**High**	Moderate	Low
	Endangered	**High**	**High**	**High**	Moderate	Low
	Vulnerable	**High**	**High**	Moderate	Low	Low
	Near Threatened	Moderate	Moderate	Moderate	Low	Low
	Least Threatened	Moderate	Moderate	Low	Low	Very Low

Table 6-3. Summary of the ecological condition and sensitivity assessment for the various terrestrial vegetation communities and habitat types.

Vegetation Community	Condition	Threat Status	Ecological Sensitivity
1. Disturbed Highveld Grassland	Fair	Vulnerable	Moderate
2. Disturbed Wetland Vegetation	Good	Least Threatened	Moderate
3. Rocky Outcrops	Fair	Least Threatened	Low

The ecological sensitivity of the vegetation community / ecological habitat is mapped as **Figure 7-2**. No areas were regarded as High in terms of terrestrial ecological sensitivity. None of the areas were considered as "no-go" areas. However, the Disturbed Wetland Vegetation should be regarded as relatively more ecological sensitive compared to other vegetation communities.

Figure 7-1: Ecological condition map of the habitat/ vegetation in the study site.

Figure 7-2: Ecological sensitivity map of the habitat/vegetation in the study site.

8 IMPACT ASSESSMENT & MITIGATION

Any development/road construction project taking place within a natural system has a potential to impose an impact in that particular environment as well as the surrounding. In most instances the associated impact to the development activity are negative. The main aim of this phase of study is to identify and asses the significance of the potential impacts which may be a result of the project and to provide a description of the mitigation measures required so as to restrict the identified impacts on the natural environment. Significance scoring both assesses and predicts the significance of environmental impacts through evaluation of the following factors; probability of the impact; duration of the impact; extent of the impact; and magnitude of the impact. The significance of environmental impacts is then assessed taking into account any proposed mitigations. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required. Each of the above impact factors have been used to assess each potential impact using ranking scales (Table 8-1).

Unknown parameters are given the highest score (5) as significance scoring follows the Precautionary Principle.

Table 8-1 : Significance scoring used for each potential impact.

	Score	Label	Criteria
Duration	1	Very short term	0 -1 years
	2	Short term	2 – 5 years
	3	Medium term	5 – 15 years
	4	Long term	>15 years
	5	Permanent	Permanent
Extent	1	Minor	Limited to the immediate site of the development
	2	Local	Within the general area of the town, or study area, or a defined Area of Impact
	3	Regional	Affecting the region, municipality, or province
	4	National	Country level
	5	International	International level
Magnitude	0	Negligible	Very small to no effect on the environment
	2	Minor	Slight impact on the environment
	4	Low	Small impact on the environment
	6	Moderate	A moderate impact on the environment
	8	High	The impacts on the environment are large
	10	Very high	The impacts are extremely high and could constitute a fatal flaw
Probability	1	Very improbable	Probably will not happen
	2	Improbable	Some possibility, but low likelihood
	3	Probable	Distinct possibility
	4	Highly probable	Most likely
	5	Definite	The impact will occur

Significance Points = (Magnitude + Duration + Extent) x Probability.

The maximum value is 100 Significance Points.
Potential Environmental Impacts are rated as high, moderate or low significance as per the following:

Table 8-2 : Significance weighting.

Score	Label	Motivation
<10	Negligible	The impact is very small to absent
10-20	Low	where this impact would not have a direct influence on the decision to develop in the area
20-50	Medium	where the impact could influence the decision to develop in the area unless it is effectively mitigated
50 -70	High	where the impact must have an influence on the decision process to develop in the area
>70	Very high	Where the impact may constitute a fatal flaw for the project

Table 8-3: Possible significance scores based on Effect and Likelihood ratings.

Likeli-hood	Effect																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Very improbable (1)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Improbable (2)	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
Probable (3)	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
Highly probable (4)	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
Definite (5)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

Each impact was assessed based on the methodology above, and a table produced, indicating the scores and the overall significance rating both without and with mitigation. Where relevant, mitigation measures are recommended.

The DWS Risk Matrix is provided as Table 8-8 (Appendix C of the report).

8.1 Loss of faunal habitat and ecological structure

The proposed construction of magazine storage areas and shooting bay will result in the loss of faunal habitats within the area. This impact relates to the complete removal or partial destruction/disturbance of existing vegetation by machinery and workers, impacting directly on the ecological condition of natural vegetation and habitat availability. These activities will have an impact on foraging, breeding and roosting ecology of faunal species. Loss of vegetation generally affects nutrient cycles, removes the organic litter layer and results in habitat fragmentation and destruction of wildlife corridors.

Habitats associated with the study site are however already significantly disturbed by the spread of human related activities and impacts such as: expansion of industrial areas, spreading of alien vegetation and farming activities. The study site is not a unique habitat within the landscape primarily as a result of human related disturbances. It is not envisaged that any Red Data faunal species will be displaced by the habitat transformation that will take place as a result of proposed development. The impact on smaller, non-Red Data species that are potentially breeding in the area, such as any rodents, will be local in extent, in that it will not have a significant effect on regional or national populations. Table 8-4 below provides recommendation measures for the above impact.

Table 8-4 : Loss of faunal habitat and ecological structure

Faunal impacts										
Potential Impact	**Recommended Mitigation**									
Loss of habitat and ecological structure	• All construction activities must be carried out according to the generally accepted environmental best practice and the temporal and spatial footprint of the development and its servitude must be kept to a minimum. In particular, care must be taken in the vicinity of the wetlands and existing access routes must be used for access. • The construction area, including stockpiling areas, are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area. No activities are to infringe upon any watercourses. • Any natural areas beyond the footprint of the construction area, which have been disturbed, must be rehabilitated using indigenous plant species. • Education and awareness campaigns on faunal species and their habitat are recommended to help increase awareness, respect and responsibility towards the environment for all staff and contractors.									
Site Establishment Phase										
Probability		Duration		Extent		Magnitude		Significance (without mitigation)	Significance (with mitigation)	
without	with	without	with	without	with	without	with			
5	3	1	1	1	1	8	4	**50 (medium)**	**18 (low)**	
Operation Phase										
Probability		Duration		Extent		Magnitude		Significance (without mitigation)	Significance (with mitigation)	
without	with	without	with	without	with	without	with			
5	3	3	3	1	1	8	4	**6o (high)**	**24 (medium)**	

8.2 Spread of alien vegetation

Any disturbances of the indigenous vegetation communities within the study site will provide opportunity for alien invasive species encroachment. This will result in the negative impact on the functionality of the vegetation community within the study site. Alien species generally out-compete indigenous species for water, light, space and nutrients as they easily adapt in changing environmental conditions and with this special adaptation, they have they easily invade a wide range of ecological niches (Bromilow, 2010). Alien invader plant species pose an ecological threat as they alter habitat structure, lower biodiversity variation and quality of species, change nutrient cycling and productivity and modify food webs (Zedler, 2004). Some alien plants were noted within the study site, therefore disturbances may result in proliferation. However, the spread of alien plants may be cured provided an Alien Invasive Programme is implemented.

Table 8-5 : Alien vegetation

Alien Vegetation	
Potential Impact	**Recommended Mitigation**
Spread of alien vegetation	• In accordance with the requirements of the National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations, the Applicant/Contractor must ensure Alien invasive species and noxious weeds are

	effectively controlled by implementing a site specific Alien Invasive Eradication Programme. • Vegetation clearing should be kept to a minimum, and this should only occur where it is absolutely necessary and the use of a brush-cutter is highly preferable to the use of earth-moving equipment. • Rehabilitate all disturbed areas as soon as the activities associated with the road upgrade are completed within the study site. • Ensure that all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm and this can be achieved through provision of appropriate awareness to all personnel. • The location of the site office and Contractor's camp must be situated outside environmental sensitive areas in agreement with the ECO.

Site Establishment Phase									
Probability		Duration		Extent		Magnitude		Significance (without mitigation)	Significance (with mitigation)
without	with	without	with	without	with	without	with		
5	3	1	1	1	1	8	4	**50 (medium)**	**18 (low)**
Operation Phase									
Probability		Duration		Extent		Magnitude		Significance (without mitigation)	Significance (with mitigation)
without	with	without	with	without	with	without	with		
5	3	3	3	1	1	6	4	**5o (medium)**	**18 (low)**

8.3 Direct faunal and avifaunal impacts

Activities involving the clearing/harvesting of natural vegetation will result in the loss of faunal species. Faunal diversity within all habitat units have been negatively impacted as a result of historic and on-going disturbances associated with grazing pressure and general anthropogenic activities. Bush clearance relating to crop cultivation activities has significantly modified the habitat. It is not envisaged that any Red data species will be present on the site and thus directly impacted. The proposed development may lead to a further loss of faunal diversity. During the construction phase, a further loss of faunal diversity and ecological integrity will occur due to increase in human activity and potential poaching.

Table 8-6 : Direct faunal impacts

Direct faunal impacts	
Potential Impact	**Recommended Mitigation**
Direct faunal and avifaunal impacts	• Any bird nests that are found during the construction period must be reported to the Environmental Control Officer (ECO). • It is recommended that the speed limit of 30km/hr is implemented on all roads within the study area during all phases in order to minimise risk to fauna from vehicles. • No trapping or hunting of fauna is to take place. Access control must be implemented to ensure that no illegal trapping or poaching takes place. • Should any Red Data faunal/avifaunal species be noted within the project area, these species must be relocated to similar habitats within the vacant land with the assistance of a suitably qualified Ecologist.

	• Any fauna or avifauna directly threatened by the construction activities must be removed to a safe location by the ECO or qualified Ecologist. • All staff and contractors must undergo an environmental induction course held by the ECO as well as faunal and avifaunal education and awareness programmes.

Site Establishment Phase									
Probability		Duration		Extent		Magnitude		Significance (without mitigation)	Significance (with mitigation)
without	with	without	with	without	with	without	with		
5	3	1	1	5	5	8	4	**75 (very high)**	**30 (medium)**
Operation Phase									
Probability		Duration		Extent		Magnitude		Significance (without mitigation)	Significance (with mitigation)
without	with	without	with	without	with	without	with		
5	3	3	3	5	5	8	4	**80 (Very high)**	**36 (medium)**

8.4 Direct impacts on watercourses and habitat

Based on the initial design layout that was assessed, the location of the shooting bay posed negative impacts on the Seep Wetland (SW-Unit 03A and Unit 03B). These impacts included, but not limited to alteration of surface and subsurface flows, increase is pollutants and potentially sedimentation. For example, disturbances on wetland vegetation will eventually have a knock-on-effect on the flora and fauna utilising the wetland habitat. Spoil material from excavations activities and the use of hazardous chemical substances could result in organic compounds entering and polluting the watercourses, either directly through surface runoff during rainfall events, or via subsurface water movement. An increase in pollutants will lead to changes in the water quality of the watercourses and affecting its ability to harbour biota. As such, mitigation measures are therefore key to limiting these impacts.

Table 8-7 : Impacts on watercourses and habitat

Impacts on watercourses and habitat	
Potential Impact	**Recommended Mitigation**
Deterioration of watercourse health and loss of functionality	• Given that alternatives for the siting of the shooting bay were investigated and no other alternatives could be pursued because of modelled blasting circles, SASOL must undertake an application for water use authorisation in terms of Section 21 (c) and (i). • Activities that are not directly related to construction, such as: stockpiling, equipment laydown and refuelling, must take place outside the recommend 20m buffer width of the wetlands. • Unauthorised vehicular access to identified watercourses is strictly prohibited as it may result in adverse impacts on the hydrology and soil structure of these areas; • Emergence contingence plans must be readily available on site and training of contactors and employees must be carried out regularly on how to manage spills, leaks and other impacts to the aquatic systems; • All soil and stockpiles must be placed outside the watercourse habitats. • Any soil contaminated by hydrocarbons (fuel and oils) must be removed and the affected area rehabilitated immediately. • Chemical toiles must be located atleast 50m outside the edge of the delineated watercourses.

	• Chemical toilets must be provided to workers during the establishment phase. A single chemical toilet must be provided for every 10 employees. • Chemical toilets must be serviced regularly by a registered service provider and waybills must be retained as proof of servicing. • In the event that storage of hazardous materials (including fuels) is conducted on-site, storage must be carried out in a bunded structure that prevents the ingress or egress of stormwater. • The bund must be able to contain at least 110% capacity of the stored volume. • No refueling, servicing nor chemical storage should occur within 50m of the delineated water resources or within the 100-year flood line, whichever is applicable. • Mixing and/or decanting of all chemicals and hazardous substances must take place on a tray, shutter boards or on an impermeable surface. • Drip trays must be utilised at all dispensing areas. • A chemical spill kit must be present onsite at all times and once used it must be disposed of at a registered hazardous landfill site. **Stormwater Management Recommendations** • All stormwater discharges into watercourses must be attenuated at discharge points prior to entering the watercourse. Such attenuation infrastructure must ideally be located outside delineated watercourses. The longer the distance the better. • Appropriate outlet structures and energy dissipater blocks are to be specified at all discharge points to break the energy of the storm water.

Site Establishment Phase									
Probability		Duration		Extent		Magnitude		Significance (without mitigation)	Significance (with mitigation)
without	with	without	with	without	with	without	with		
5	3	1	1	1	1	8	6	**50 (medium)**	**18 (low)**
Operation Phase									
Probability		Duration		Extent		Magnitude		Significance (without mitigation)	Significance (with mitigation)
without	with	without	with	without	with	without	with		
5	3	1	1	1	1	8	4	**30 (medium)**	**18 (low)**

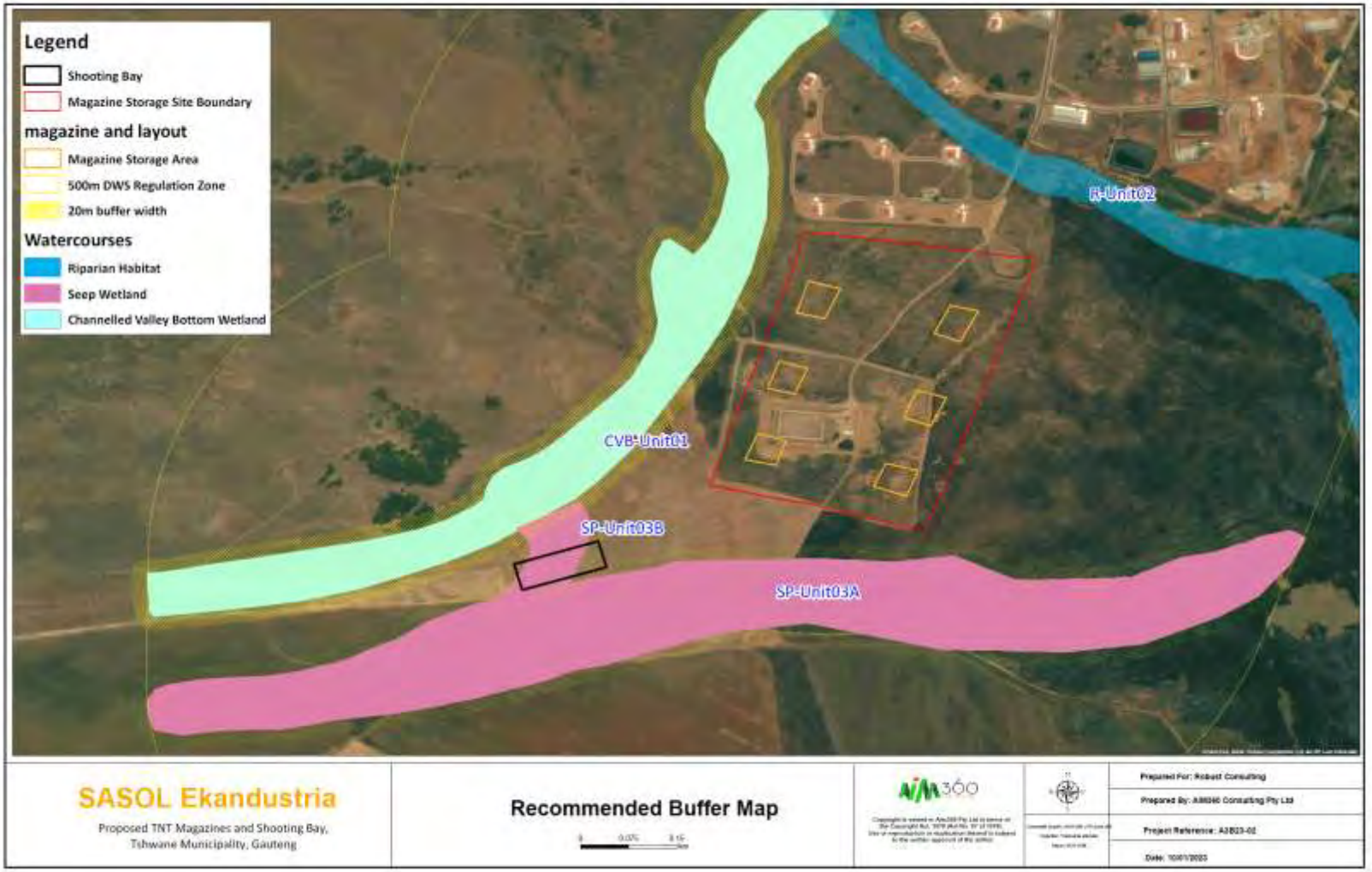


Figure 8-1: Recommended Layout and Buffer Width

9 Conclusions

Infield assessment for the biodiversity impact study was undertaken on 23 January 2023 as part of a suite of environmental specialist studies to determine ecological diversity and species composition within the boundaries of the study site of the proposed construction of 6x100T Magazines for storage of Trinitrotoluene (TNT) and a Shooting Bay. The project is located at SASOL Ekandustria in Bronkhorstspruit, Tshwane Metropolitan Municipality, Gauteng.

Interrogation of the Gauteng C-Plan dataset in relation to the study site modelled the presence of three (3) CBAs regarded as Important Areas within the study site and its surrounding area. The implication is that the project has an impact on biodiversity conservation targets for the area, particularly with regards to the conservation of primary grasslands, Red Data Bird species and prioritised watercourses.

However, results from undertaking site reconnaissance determined that ecological habitats within the study site are largely disturbed by human disturbances relating to agricultural disturbances, proliferation of alien plants and widespread increase of industrial activities. The disturbances have had deleterious impacts on the quality and composition of biodiversity, including the loss of sensitive ecological habitats. Direct impacts relate to mortality of species, habitat destruction and loss of ecological corridors.

Despite the notable disturbances on the vegetation communities and the subsequent diminished habitat quality, the existing habitats still provide foraging, breeding and roosting habitats for faunal species, albeit to a smaller degree.

Three (3) plants of conservation significance, requiring an Ordinary Plant Permit in terms of Section 11 of the Gauteng Nature Ordinance 12 of 1983 prior to disturbance, were recorded at the study site. The plants include: *Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia, aloe Aloe greatheadii var. davyana*.

In terms of faunal species, the majority of fauna modelled as present within the study site, including small sized species such as the Scrub Hare, may likely be residing specifically in the vicinity of the Disturbed Highveld Grassland vegetation community. No Red Data faunal species were encountered within the study site due to high levels of habitat transformation.

The majority of avian species recorded during the site visit were those often associated with human dwellings and have generalist habitat and dietary requirements. These are mainly granivorous (seed eating) species and “exploiters” of human areas such as Guineafowls. In terms of Red Data bird species, the potential of occurrence for Lanner Falcon (*Falco biarmicus)* is modelled as Moderate within the study site. However, no foreseeable impacts resulting from the project are anticipated on the bird species.

Low reptile diversity was recorded due to the largely disturbed nature of the site (impacts having been compounded by agricultural activities and increase of alien plants). No Red Data reptile species are modelled as present within the study area. Sightings made during the assessment were mostly Distant’s Ground Agama (*Agama aculeata distanti*) which are widespread at the study area. The study site is unlikely to form a critical habitat for Red Data reptilian species due to widespread human related disturbances.

Notwithstanding the significant habitat disturbance that has already taken place within the study site, the proposed construction of magazine storage areas and shooting bay will likely have a significant impact on some patches of indigenous vegetation, particularly the Highveld Grassland and watercourses within the study site. However, should mitigation measures presented in this report be accurately and effectively implemented, the proposed project can be considered acceptable.

All recommended mitigation measures must be included in the EMPr in order to effectively mitigate negative impacts associated with the project.

Kindly contact the undersigned specialist using the contact details provided below for comments or queries pertaining to this report.

Prepared by

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Appendices

Appendix A: Study Methodology

11 METHODOLOGY

11.1 Flora

The flora assessment consisted of two complementary approaches:

- The assessment commenced in January 2023 with a desktop study during which data related to the study area was collected and studied using existing literature, maps and aerial photography and Geographical Information Systems (GIS). During the desktop exercise, floral species and vegetation types of conservation significance with a potential to be affected by the proposed project were identified before field verification. A broad-level desktop analysis was carried out using the following available information:
  - Latest and historic Imagery (Google EarthTM).
  - Aerial photography shapefiles.
  - South African Vegetation Map (Mucina and Rutherford, 2006).
  - 5m Elevation Contours (Surveyor General).
  - Pretoria Computerised Information System (PRECIS).
  - South African National Biodiversity Institute (SANBI) Threatened Species Programme (TSP).
- Infield data was collected in January 2023 during a site survey conducted over two days. A walk through survey was carried out where different habitat units were identified prior to analysis of the composition of floral species. A species inventory list was compiled for each habitat unit. The species list was compared to the expected “benchmark” vegetation to provide an indicator of the ecological integrity and conservation value of each habitat unit.

11.2 Fauna

The presence of observed mammals and indicators (such as spoors and stool) were recorded during a field visit conducted in January 2023. The assessment was carried out during the day, no night surveys were conducted. Emphasis was made with regards to determining habitats that may potentially support faunal species. Animal calls, burrow traps and visual observation are some of the methods that were used to establish the presence of faunal inhabitants.

It is improbable that all faunal species could have been identified due to the behaviour (and consequently the availability) of some species being subject to seasonal changes. Breeding and foraging patterns amongst faunal species are determined by the season.

11.3 Avifauna

Desktop analysis to determine birds associated with the habitat systems was carried out using the following:

- Southern African Bird Atlas Project from the University of Cape Town.
- The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes, 2000).

Infield investigation was carried out in January 2023. A 10x42 Bushnell Waterproof Binocular was used to visually observe bird species. Bird calls and feathers were also used to identify species associated with the study site. Where required, Sasol Birds of Southern Africa (Sinclair *et al*. 2002) was used to verify certain bird species.

11.4 Reptiles

The reptile assessment was carried out by examining the habitat types associated with the presence of reptiles. Reptiles were identified by examining burrows, rocky ridges and kopjes. A list of reptiles potentially occurring within the study area was compiled from a Southern African distribution list.

11.5 Wetland

Wetlands were delineated in accordance to the methods and indicators described in DWS's practical field procedure for identification and delineation of wetlands and riparian areas (DWAF, 2005). Soil indicators were used as the primary indicator by analysing for hydric soils. Hydric soils are defined as those which show characteristics associated with prolonged and repeated saturation. Characteristics include the presence of "mottling" (i.e. bright insoluble iron compounds) within a gleyed matrix and/or Mg/Fe concretions. The percentage of mottling becomes reduced between samples allowing for the classification of different zones of saturation. However, were wetland conditions are normal, vegetation composition is used as a primary indicator. In untransformed areas, plant communities undergo distinct changes in species composition as one moves through a gradient of wetness, from the centre of the wetland to its edges, and into adjacent areas (DWAF, 2005). Where hydric soils may not be visible at the top 50cm, vegetation indicators maybe the best alternative of assessing zones of hydration. As a rule of thumb, obligate wetland species always grow in wetlands (>99% occurrence), facultative wetland species usually grow in wetlands (67-99% occurrence) but are occasionally found in non-wetland areas, facultative species are equally likely to grow in wetlands (34-66% occurrence) and non-wetland areas, and facultative dry-land species usually grow in non-wetland areas but may, albeit rarely, grow in wetlands (1-34% of occurrence). Lastly, the terrain (such as breaks in slopes and topographic settings) were used to determine the likelihood of wetland presence.

11.6 Risk Assessment and Recommendations

Following the completion of the terrestrial ecological assessment, a risk assessment was conducted and recommendations were developed to address and mitigate impacts associated with the proposed housing development and related activities. These recommendations also include general 'best practice' management measures, which apply to the development and related activities as a whole, and which are presented in the report. Mitigation measures have been developed to address issues in all phases throughout the life of the operation including planning, construction and operation. The detailed site-specific mitigation measures are outlined in Section 6 of this report.

11.7 Impact assessment

Finally, considering the outcome of the above-mentioned assessments, the potential impacts that the proposed development could have during the construction and operational phases of the activity were investigated. Where possible, mitigation and / or management measures were proposed to limit the impact of the proposed development on wetland and other aquatic ecosystems. Rehabilitation or enhancements measures were also recommended where necessary.

Impact rating was carried out for the identified impacts. Different aspects of the impacts, outlined below, can affect the rating. These include the following:

- **Extent**– the area over which the impact will be experienced.
- **Intensity**– the magnitude of the impact in relation to the sensitivity of the receiving environment.
- **Duration**– the time frame for which the impact will be experienced.
- **Probability**– the likelihood of the impact occurring.

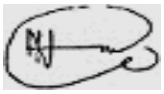
The different levels under each of the above aspects that were used in the impacts description are discussed in Section 6 of the report.

Appendix B: Specialist Declaration

Specialist Declaration

I, **Ntandokazulu Kumalo** declare that:

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



Signature of the specialist: **Date:** 20 February 2023

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Appendix C: DWS Risk Matrix

12 DWS Risk Assessment for watercourses

The risk assessment considered both direct and indirect impacts, if any, for the two (2) wetland systems. The area to be developed will consist of a footprint that's already disturbed and its corridor. Restriction of construction activities within the limits of a working corridor should limit threats on the wetlands which result in vegetation clearance, habitat loss and degradation and consequently loss of wetland functionality.

Findings from the DWS aspect and impact register / risk assessment are provided in Table 12-1 to Table 12-2 below.

Table 12-1 : Impacts identified for the proposed project in regards to the identified wetlands

Activity	Aspect	Impact
Construction of Magazine and Shooting Bay	Removal of vegetation	- Impeding the flow of water. - Altered surface flow dynamics. - Erosion of watercourse. - Sedimentation of the water resource. - Flow sediment equilibrium change. - Water quality impairment.
	Stripping and stockpiling of top soil	
	Compaction of areas	
	Geotechnical sites	
	Storm water run-off	
	Drainage patterns change due to development	
	Excavation for structures	
	Clearing of areas for access roads	
	Operation of equipment and machinery	
	Vehicular activity	
	Ablutions-accidental spillages and leaks	
Operation of Magazine and Shooting Bay	Drainage patterns change due to development	- Altered surface flow dynamics. - Water quality impairment.
	Storm water discharge	
	Spills and leaks – vehicles	
	Pollution- vehicles and pedestrian activity	

Table 12-2: DWS Risk Impact Matrix for the proposed project

Severity								
Aspect	**Flow Regime**	**Water Quality**	**Habitat**	**Biota**	**Severity**	**Spatial scale**	**Duration**	**Consequence**
Construction Phase								
Removal of vegetation	2	**2**	**2**	**2**	2	**1**	**3**	6
Stripping and stockpiling of top soil	2	2	1	2	1.75	1	3	5.75
Compaction of areas	2	**2**	**1**	**1**	1.5	**1**	**3**	5.5
Geotechnical sites	2	1	2	1	1.5	1	2	4.5
Storm water run-off	2	1	1	1	1.25	2	3	6.25
Drainage patterns change development	2	1	2	1	1.5	2	3	6.5
Excavation for structures	2	2	2	2	**2**	2	2	6
Clearing of areas for infrastructure	2	2	2	2	2	2	2	6
Additional Associated Infrastructure	2	2	2	2	2	2	2	6
Operation of equipment and machinery	1	2	2	1	1.5	2	2	5.5
Vehicular activity	1	2	2	2	1.75	2	2	5.75
Ablution spillages and leaks	2	2	2	2	2	2	3	7
Operational Phase								
Drainage patterns change due to development	4	4	4	4	4	2	5	11
Storm water management	2	1	1	1	1.25	2	4	7.25
Spills and leaks –vehicles	1	2	1	1	1.25	2	4	7.25
Pollution-Vehicle and pedestrian activity	1	1	2	2	1.5	1	4	6.5

Table 12-3: 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	**2**	**3**	**5**	**3**	**13**	**78**	**Moderate***	**Low**
Stripping and stockpiling of top soil	2	3	5	3	**13**	**74.75**	**Moderate***	**Low**
Compaction of areas	**2**	**3**	**5**	**3**	**13**	**71.5**	**Moderate***	**Low**
Geotechnical sites	1	2	5	3	**11**	**49.5**	**Low**	**Low**
Storm water run-off	3	3	1	3	**10**	**62.5**	**Moderate***	**Low**
Drainage patterns change development	3	3	1	3	**10**	**65**	**Moderate***	**Low**
Excavation for structures	2	3	5	3	**13**	**78**	**Moderate***	**Low**
Clearing of areas for infrastructure	2	2	1	3	**8**	**48**	**Low**	**Low**
Additional Associated Infrastructure	2	2	1	3	**8**	**48**	**Low**	**Low**
Operation of equipment and machinery	2	2	1	3	**8**	**44**	**Low**	**Low**
Vehicle activity	2	2	1	3	**8**	**46**	**Low**	**Low**
Ablution spillages and leaks	2	2	1	3	**8**	**56**	**Moderate***	**Low**
Operational Phase								
Drainage patterns change due to development	5	5	5	5	**20**	**220**	**High***	**Moderate**
Storm water management	2	2	1	3	**8**	**58**	**Moderate***	**Low**
Spills and leaks – vehicles	3	2	1	3	**9**	**69.75**	**Moderate***	**Low**
Vehicle and pedestrian activity	1	2	1	3	**7**	**45.5**	**Low**	**Low**

(*) denotes - In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.