SEPTEMBER 2020

VEGETATION, AQUATIC AND RISK ASSESSMENTS FOR THE PROPOSED DOLERITE QUARRY OUTSIDE PIETERMARITZBURG AREA, MSHWATI MUNICIPALITY, KWAZULU-NATAL.

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Project Name:	**VEGETATION, AQUATIC AND RISK ASSESSMENTS FOR THE PROPOSED DOLERITE QUARRY OUTSIDE PIETERMARITZBURG, MSHWATI MUNICIPALITY, KWAZULU-NATAL**
Project Code:	**1025**

Verification	Designation	Name	Signature	Date
Author:	Senior Ecologist	Jake Alletson		16/10/2020
Checked By:	Senior Aquatic Specialist	Amanda Austin		12/11/2020
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SPECIALIST DECLARATION

I, **Jake Alletson**, 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 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.

16/10/2020

_____ _____

Jake Alletson (BSc Hons, PrSciNat) **Date**

Scientist

SACNASP Reg No. 125697

SPECIALIST DECLARATION

I, **Amanda Austin**, 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);
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- 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.

17/11/2020

_____ _____

Amanda Austin (MSc, PrSciNat) **Date**

Aquatic Specialist

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EXECUTIVE SUMMARY

GreenMined (Pty) Ltd appointed Amanzi Aquatics (Pty) Ltd, with the assistance of Alletson Ecologicals, to undertake the Specialist Vegetation-, Aquatic Ecological and Risk Assessments for the Proposed Dolerite Quarry near Pietermaritzburg, Mshwati Municipality, KwaZulu-Natal, South Africa (**Figure 3-1**).

The proposed dolerite quarry is approximately 5 ha in extent and situated north Pietermaritzburg and M30, east of the R33, and west of the M70 and uMngeni River. The site visits were undertaken during September/October (late spring, early summer), during the low flow season of 2020.

The site is situated within Quarter Degree Square (QDS) 2931CB, the Pongola-Mtamvuna Water Management Area (WMA) 4 and the Quaternary Catchment U20G (DWS, 2016).

The main findings of this report have been summarised below:

- According to the desktop assessment, the vegetation is classified as *Moist Coast Hinterland Grassland* (*Gs 20*) and regarded as being Endangered. In addition, the *Ngongoni Veld* is a Threatened Ecosystem – nationally listed as Vulnerable and provincially as Endangered. The project site is mapped as a Biodiversity Sector Plan 3 (BSP 3), which means it do occur in within Critical Biodiversity Area specifically a CBA 3 Optimal. These areas are the most optimal to meet the biodiversity conservation targets while avoiding high cost areas as much as possible.
- However, despite the aforementioned statements and spring season, approximately 58 indigenous species and 19 alien species were identified. Of the indigenous species, only one (*Brachystelma franksiae*) was found to be listed as a species of concern. It may be rated as "Vulnerable" due to habitat loss but is known to occur at seven or eight other localities. The vegetation was found to be in generally **poor** condition, and this is attributed to over frequent veld burning and to heavy grazing by livestock. In addition, the *Aloe* spp. and especially the *Aloe ferox* (Bitter Aloe) are felling and harvested the surrounding community. It was evident, during the field visit, that some of these plant species have been ripped out of the soil and left to dry out. The level of utilisation is not sustainable, and the population is being reduced. Overall, the indigenous vegetation consists of two communities which are described as semi-open savannah and semi-closed savannah.

- The instream and riparian habitat and basic ecosystem functions of the unnamed tributary of the uMngeni River are impacted on by alien vegetation, inundation by middle earth dams, drainage trenches, dirt roads and power line crossings, foot paths etc.
- The water course was dry, and no aquatic macro-invertebrates or fish were collected in the watercourse.
- Because of the nature of the proposed operation and **Terrestrial Biodiversity Impact Assessment**, it is inevitable that the vegetation and the unnamed tributary at the site will eventually be destroyed, with there being no option of site rehabilitation when the dolerite extraction is complete.
- Based on the **DWS Risk Assessment**, all components scored a moderate to high impact significance, which was revised, and can in some cases be reduced to a low to moderate with the application of various mitigation measures.
- The **Recommended Mitigation Measures** should be followed by the client, to ensure the potential impacts are limited or completely negated, during the construction and operational phases of the proposed project. These mitigation measures should be incorporated in conjunction with the recommendations from the wetland specialist report.
- An **Aquatic Biomonitoring Programme** was compiled for the early identification of emerging impacts to allow for timeous management intervention, which reduces the significance of the impact, alleviates the ecological consequence of that impact, and renders the mitigation procedures more cost effective.

In conclusion, the planned dolerite quarry mining will require a **Water Use Licence (WUL)** as contained in Notice 509 of 2016. It is, however, the prerogative of the Department of Water and Sanitation (DWS) to advise on whether the quarry mining activities can be authorised under a WUL or not.

VEGETATION, AQUATIC AND RISK ASSESSMENTS FOR THE PROPOSED DOLERITE QUARRY OUTSIDE PIETERMARITSBURG, MSHWATI MUNICIPALITY, KWAZULU-NATAL – September 2020 Survey

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ACRONYMS

ACRONYM	DESCRIPTION
AIP	Alien Invasive Plant
BSP	Biodiversity Sector Plan
CBA	Critical Biodiversity Area
CR	Critically Endangered
DEDTEA	Department of Economic Development, Tourism and Environmental Affairs
DWS	Department of Water and Sanitation
EC	Ecological Category
ECO	Environmental Control Officer
EI	Ecological Importance
EIS	Ecological Importance and Sensitivity
EN	Endangered
ES	Ecological Sensitivity
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorisation
GPS	Global Positioning System
GSM	Gravel, Sand and Mud
IHIA	Intermediate Habitat Integrity Assessment
MPN	Most Probable Number
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NFEPA	National Freshwater Ecosystem Priority Areas
PA	Protected Area
PES	Present Ecological State
%PTV	Percentage of Pollution Tolerant Valves
REMP	River Eco-status Monitoring Programme
RHP	River Health Programme
SANAS	South African National Accreditation System
SANS	South African National Standards
SANBI	South African National Biodiversity Institute
WMA	Water Management Area
WQ	Water Quality
WUL	Water Use License

1 INTRODUCTION

GreenMined (Pty) Ltd appointed Amanzi Aquatics (Pty) Ltd, with the assistance of Alletson Ecologicals, to undertake the Specialist Vegetation-, Aquatic Ecological and Risk Assessments for the Proposed Dolerite Quarry near Pietermaritzburg, Mshwati Municipality, KwaZulu-Natal, South Africa (**Figure 3-1**).

2 SCOPE OF WORKS

The initial scope of works is indicated in **ANNEXURE A (Section 12.1)**. During the field visit and ground truthing, an alternative approach was adopted since, some of the indices could not be applied.

3 STUDY AREA

The desktop survey was undertaken by searching a number of data sources and include, but not limited to, the following:

- Vegetation Mapping (SANBI Vegetation Types of South Africa).
- Species Literature.
- SANBI Threatened Ecosystems Database.
- KZN Provincial Conservation Plan.
- KZN Biodiversity Sector Plan including Critical Biodiversity Areas and Biodiversity Support Areas; and
- Google Earth Imagery.

The uMgungundlovu District Municipality Environmental Management Framework Decision Support Tool should be used. However, it was not available at the time of production of this report.

3.1 DESKTOP REVIEW

A brief description of the location and biophysical characteristics of the study area, that are relevant to the current assessment, is given below.

The site is situated within Quarter Degree Square (QDS) 2930CB. The study area is situated north Pietermaritzburg and M30, east of the R33, and west of the M70 and uMngeni River (**Figure 3-1**).

The proposed dolerite quarry is approximately 5 ha in extent and is situated within Mshwati Municipality, Province of KwaZulu-Natal, South Africa.

3.1.1 Land-use

The main forms of land-use in the larger study area include:

- Urban areas and stormwater.
- Waste Water Treatment Works (WWTWs) and return flows.
- Alien Invasive Plants (IAP).
- Agricultural activities e.g. cultivation, crocodile and chicken farms, feedlots etc.
- Low density and rural settlements.
- Dams in the tributaries and flow hydrograph reversed.

3.1.2 Ecoregion

The study area is located within **Ecoregion 16: South Eastern Upland**[1], specifically 16.03.

A complex range of terrain morphological classes occur in this region: plains with a moderate relief, lowlands with a low relief, lowlands with a high relief, open hills with low relief, open hills with high relief, closed hills with a moderate relief and low mountains with a high relief.

Vegetation types are equally diverse and include a variety of Grassland types, Bushveld types, Thicket types and Afromontane Forest. The most prominent amongst these are Moist Upland Grassland. A range of rivers such as, Mgeni, Mzimvubu, Mkomazi, Mzimkulu and Groot Kei traverses this region. Perennial tributaries of these rivers are also common.

[1] Ecoregions are ecosystems and their components that display regional patterns that are reflected in spatially variable combinations of causal factors such as physiography, climate, geology, soils and potential natural vegetation.

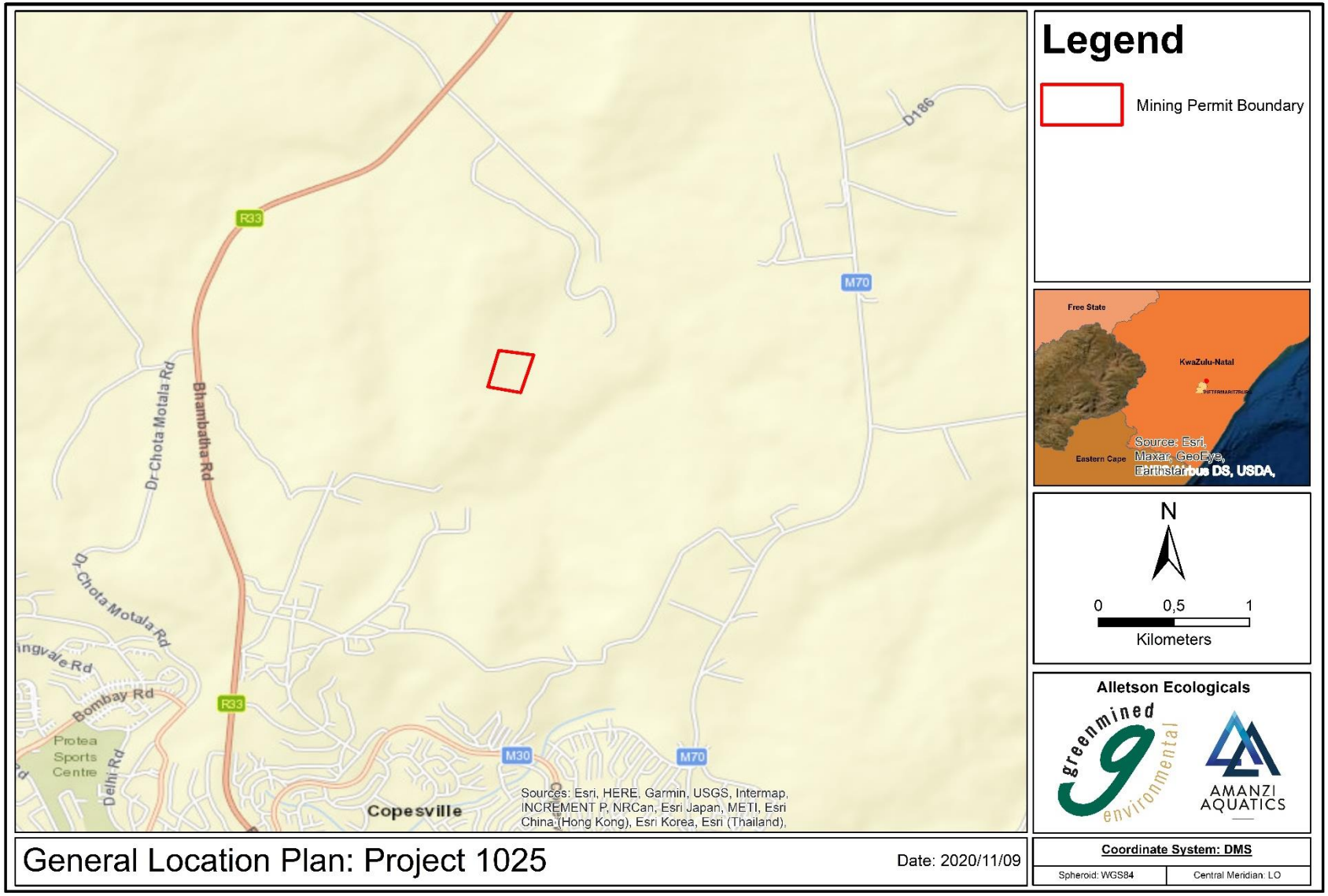


Figure 3-1: Locality Map of the Project Area

The size of this ecoregion is 54091.1 km^2 and a summary of the general conditions and characteristics is indicated in **Table 3-1.**

Table 3-1: Main attributes of the Ecoregion 16: South Eastern Uplands

Main Attributes	South Eastern Uplands
Terrain Morphology: Broad division (dominant types in bold) (Primary)	Plains Low Relief (limited) Plains moderate Relief (limited) **Lowlands, Hills and Mountains, Moderate and High Relief** Open Hills, Lowlands, Mountains: Moderate and High Relief; Table Lands; Moderate and High Relief **Closed Hills, Mountains: Moderate and High Relief**
Vegetation types (dominant types in bold) (Secondary)	Coast Hinterland Bushveld, Eastern Thorn Bushveld, Sub-arid Thorn Bushveld (very limited), Short Mistbeld Grassland; North Eastern Mountain Grassland; **Moist Upland Grassland,** Coastal Grassland (very limited), South Eastern Mountain Grassland (very limited), AltiMountain Grassland (very limited) and Patches Afromontane Forest.
Altitude (m a.m.s.l) Secondary	300-500 (limited), 500-1700, 1700-2300 (limited)
MAP (mm) (modifying)	500 to 1000
Coefficient of Variation (% of annual precipitation)	<20 to 30
Rainfall concentration index	15 to 60
Rainfall seasonality	Early to late summer
Mean annual temp. (C)	10 to 22
Mean daily max. temp. (C): February	20 to 30
Mean daily max. temp. (C): July	12 to 24
Mean daily min. temp. (C): February	8 to 20
Mean daily min. temp. (C): July	0 to 10
Median annual simulated run-off (mm) for quaternary catchment	40 to >250

The study area occurs in a strongly seasonal summer rainfall area, within a warm and temperate climate. The Mean Annual Precipitation (MAP) ranges between 500mm-1000mm and the most precipitation falls in January (140 mm), whilst the driest month is June (12 mm). February is the warmest month, whilst July has the lowest average temperature of the year (www.climate-

data.org). The weather data for the city of Pietermaritzburg that lies on 631 above sea level is indicated in **Figure 3-2** below.

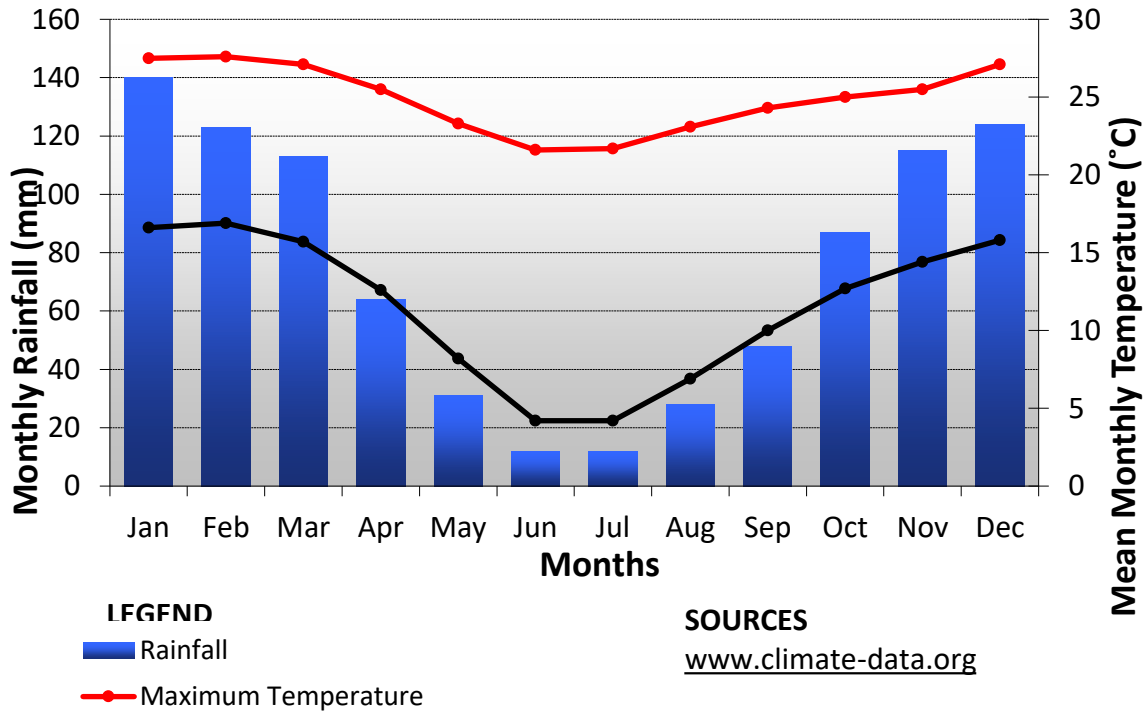


Figure 3-2: The weather data for Pietermaritzburg

3.1.3 Vegetation

The study area falls within the Grassland Biome. The natural vegetation at the project site is classified as *Moist Coast Hinterland Grassland* (*Gs 20*) according to SANBI. This type was formerly known (Mucina & Rutherford, 2006) as *KwaZulu-Natal Hinterland Thornveld* (*SVs 3*). It occurs in the KwaZulu-Natal and Eastern Cape Provinces from near Melmoth in the north to near Libode in the south (including Eshowe, New Hanover, Thornville, Richmond, Harding, Lusikisiki) and is generally found below *Midlands Mistbelt Grassland* (*Gs 9*).

It is typically found in rolling and hilly landscapes. Dense tall sour grassland is dominated by unpalatable Ngongoni grass (*Aristida junciformis*) with this mono-dominance associated with low species diversity, when in good condition dominated by *Themeda triandra* and *Tristachya leucothrix*. It is low in terms of endemicity although certain bioresource units within it are considered endemic. Its status is categorised as **Endangered** since some 25% has been lost to various forms of agricultural and urban development. No wetlands occur within the project area.

The KwaZulu-Natal (KZN) vegetation type conservation targets, extents, ecosystem status and level of protection based on 2011 accumulated transformation statistics and protected area (PA) are indicated in **Table 3-2** below.

Table 3-2: KwaZulu-Natal (KZN) vegetation type conservation targets, extents, ecosystem status and level of protection based on 2011 accumulated transformation statistics and protected area (PA) proclamation as at January 2016

	Moist Coast Hinterland Grassland
KZN Biome	Grassland
Conservation target (%)	25
Original extent (ha)	437 556
Remaining natural (ha)	157 573
Remaining natural less fragments (ha)	153 031
Ecosystem status	**Endangered (EN)**
Total Protected Area (ha)	873
Level of protection	Nominally Protected

Source: Jewitt (2016)

In addition, Scott-Shaw (1999) lists the following plant species of concern for the area:

Table 3-3: Plant Species of Conservation Concern possibly occurring in the Project Area

Scientific Name	Common Name	Status	Probability of presence
Asclepias bicuspis	Not Given	Critically Endangered	None, due to lack of correct habitat.
Asclepias woodii	Not Given	Vulnerable	Very low – grassland species.
Brachystelma natalense	Natal Brachystelma	Critically Endangered	Very low – occurs further east.
Brachystelma pulchellum	Beautiful Brachystelma	Near Threatened	In grasslands near sandstone.
Dierama pallidum	Not Given	Vulnerable	Possible but highly unlikely
Gerbera auriantica	Hilton Daisy	Endangered	Very low
Hydrostachys polymorpha	Water Plant	Vulnerable	None.
Kniphofia latifolia	Broad-leaf Poker	Endangered	Very low due to lack of correct habitat.
Ocotea bullata	Black Stinkwood	Endangered	None, due to lack of correct habitat.
Senecio exuberans	Not Given	Endangered	Very low due to lack

Scientific Name	Common Name	Status	Probability of presence
			of correct habitat.
Stenoglottis molweniensis	Cliff Orchid	Rare	None, due to lack of correct habitat.
Watsonia canaliculata	Not Given	Endangered	None, due to lack of correct habitat.

The reason for the likely absence of all the above species is that their natural habitat is commonly mistbelt grassland, mistbelt forest, or riverine. While all these habitat types do occur in the general area, they are not present at the project site.

3.1.4 Soil Types

The soils in the area are leached, acid, heavy soils derived from Karoo Supergroup sediments and intrusive Karoo dolerites. They are freely drained and structureless and are often shallow. Erodibility is high and fertility is typically low.

3.1.5 Aquatic Ecosystems, Hydrology and Drainage

In terms of the hydrology, the study area is situated within the Pongola-Mtamvuna Water Management Area (WMA) 4 and Quaternary Catchment U20G (DWS, 2016). The unnamed tributary originates in the south-west of the study area, flows in a north-easterly direction, and joins the upper reaches of the uMngeni River approximately 1 km downstream.

A study completed by the DWS (2014) included aspects such as water quality, riparian vegetation, invertebrates, fish, and hydrology at a subquaternary catchment level (SQ catchment 4240). Based on the available information, the PES of the uMngeni River is **Moderately Modified** (C Category) which means that a moderate loss and change of natural habitat and biota have occurred. A summary of the uMngeni River's Eco-status[2] and impacts is indicated in **Table 3-4**. The Ecological Importance (EI) is **High** whilst the Ecological Sensitivity (ES) of the uMngeni River is **Very High** due

[2] Eco-status = The totality of the features and characteristics of the river and its riparian areas that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services.

to the possible presence of the following species significant species as indicated in the **Table 3-5** and below.

Table 3-4: Summary of the uMngeni River's Eco-status and impacts

Quaternary Catchment	Water Resource	Present Ecological State (PES)	Ecological Importance (EI)	Ecological Sensitivity (ES)
U20G	uMngeni River	**C Moderately Modified**	**High**	**Very High**
Current Impacts				
Flow hydrograph reversed, feedlot, crocodile farm, chicken farms, cultivation, high nutrients, mines and dams in tributary.				

Table 3-5: Species List

Species	Common Name	Conservation Status	Population Trends
Birds			
Balearica regulorum	Grey crowned crane	**Endangered (EN)**	Decreasing
Pelecanus onocrotalus	Great white pelican	Least Concern (LC)	Unknown
Pelecanus rufescens	Pink-backed pelican	Least Concern (LC)	Stable
Amphibians			
Hemisus guttatus	Spotted snout-borrower	**Near threatened (NT)**	Decreasing
Reptiles			
Crocodylus niloticus	Nile crocodile	Least Concern (LC)	Stable
Fish			
Oreochromis mossambicus	Mozambique tilapia	**Near Threatened (NT)**	Decreasing
Mammals			
Aonyx capensis	African clawless otter	**Near Threatened (NT)**	Decreasing

Source: IUCN (2020)

Other plant species worth mentioning are *Geranium natalense; Gladiolus cruentus; Hydrostachys polymorpha; Kniphofia latifolia* which will more than like not be found because it is not endemic to the project and surrounding areas.

3.2 AREAS OF SIGNIFICANCE

Several conservation initiatives and spatial/strategic plans were consulted for this section. These are highlighted below:

- *Freshwater Ecosystem Priority Area (NFEPA).* The study area does not fall within a NFEPA in terms of the wetland and/or rivers (**Figure 3-3**);
- *SANBI Threatened Ecosystems Database*. The Moist Coast Hinterland Grassland (*Gs 20*) is classified as **Endangered (EN).** In addition, the Ngongoni Veld is a Threatened Ecosystem – nationally listed as **Vulnerable (VU)** and provincially as **Endangered (EN)** (**Figure 3-4**).
- *Provincial Conservation Plan.* The project site is mapped as a Critical Biodiversity Area specifically a **CBA 3 Optimal** (Irreplaceable Score >0 and <0.8). CBA Optimal are areas that are the most optimal to meet the biodiversity conservation targets while avoiding high cost areas as much as possible. In addition, the closest CBA 1 site is the Ferncliffe Forests above Pietermaritzburg and is approximately 3.5 km away from the project area (**Figure 3-5**).
- *KZN Biodiversity Sector Plan (BSP).* BSPs incorporate provincial biodiversity conservation priorities and other available information to determine the Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA) within a bioregion which is then used for the development of a Bioregional Plan. The project site is mapped as a **BSP 3**, which means it do occur in a CBA (as mentioned above) but not within an Ecological Support Area (ESA) or conservation-related corridors.
- *Game and Nature Reserves and Biodiversity Stewardship Sites*. The project site is not mapped as being in the 5 km wide buffer of any NEMPAA listed or private game or nature reserve or other conservation area. It is however within 3 km of the Highthorn Private Game Reserve. The vegetation in that reserve is most unlikely to be influenced by the proposed dolerite quarry since the intervening area includes existing shale quarries and a brick factory.
- *Google Earth Imagery*

  The Google Earth Imagery shows that the area within the project area and its immediate surrounds is largely natural although there is agriculture to the west on the opposite side of the ridge and a shale quarry some 200 m to the east. Small scrape dams have been pushed near the eastern boundary of the project site and a further one is present approximately 300 m further north. These two are dry virtually all of the time since there is only water present at times of high rainfall. Since they have no storage function their purpose is not known.

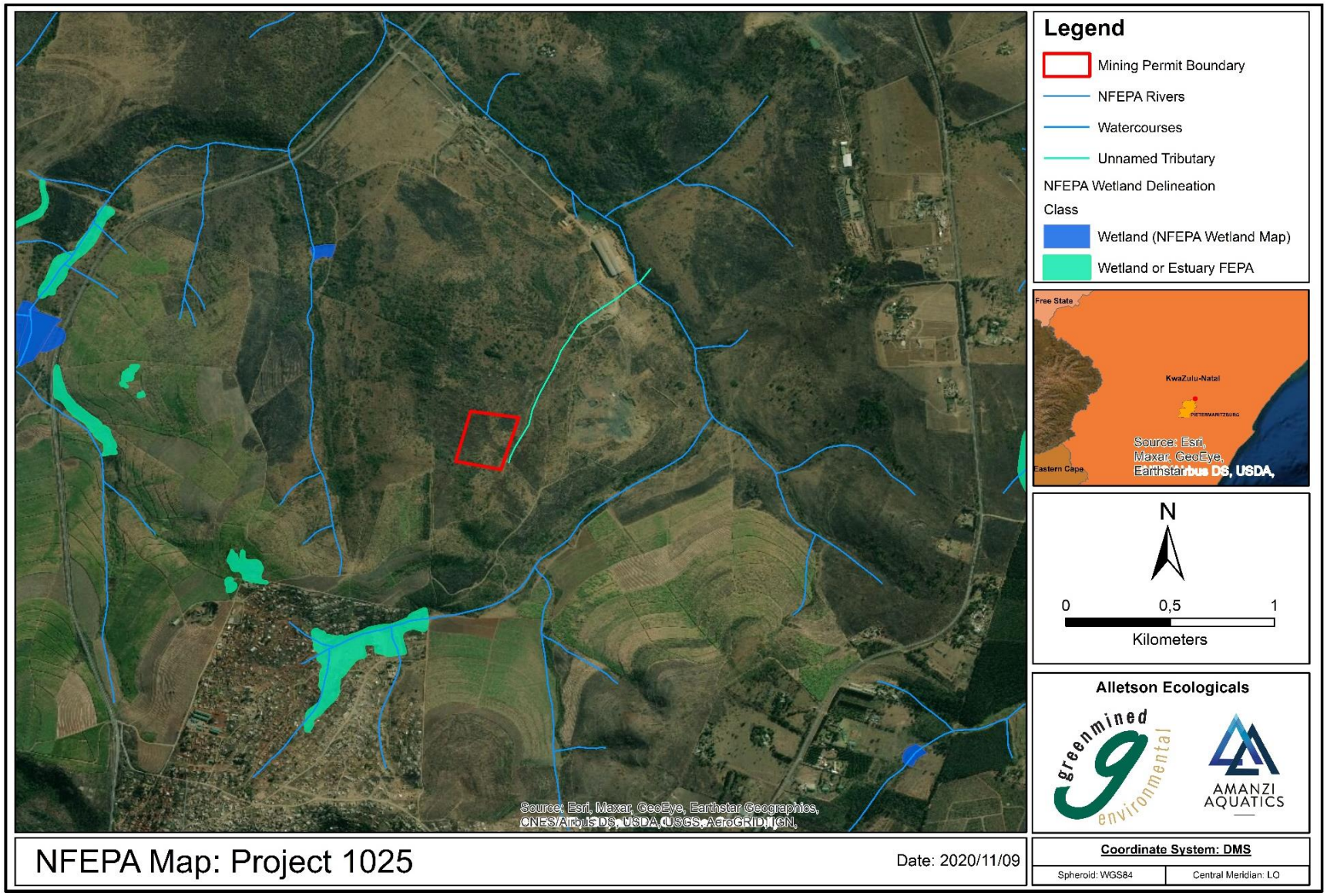


Figure 3-3: National Freshwater Ecosystem Priority Areas

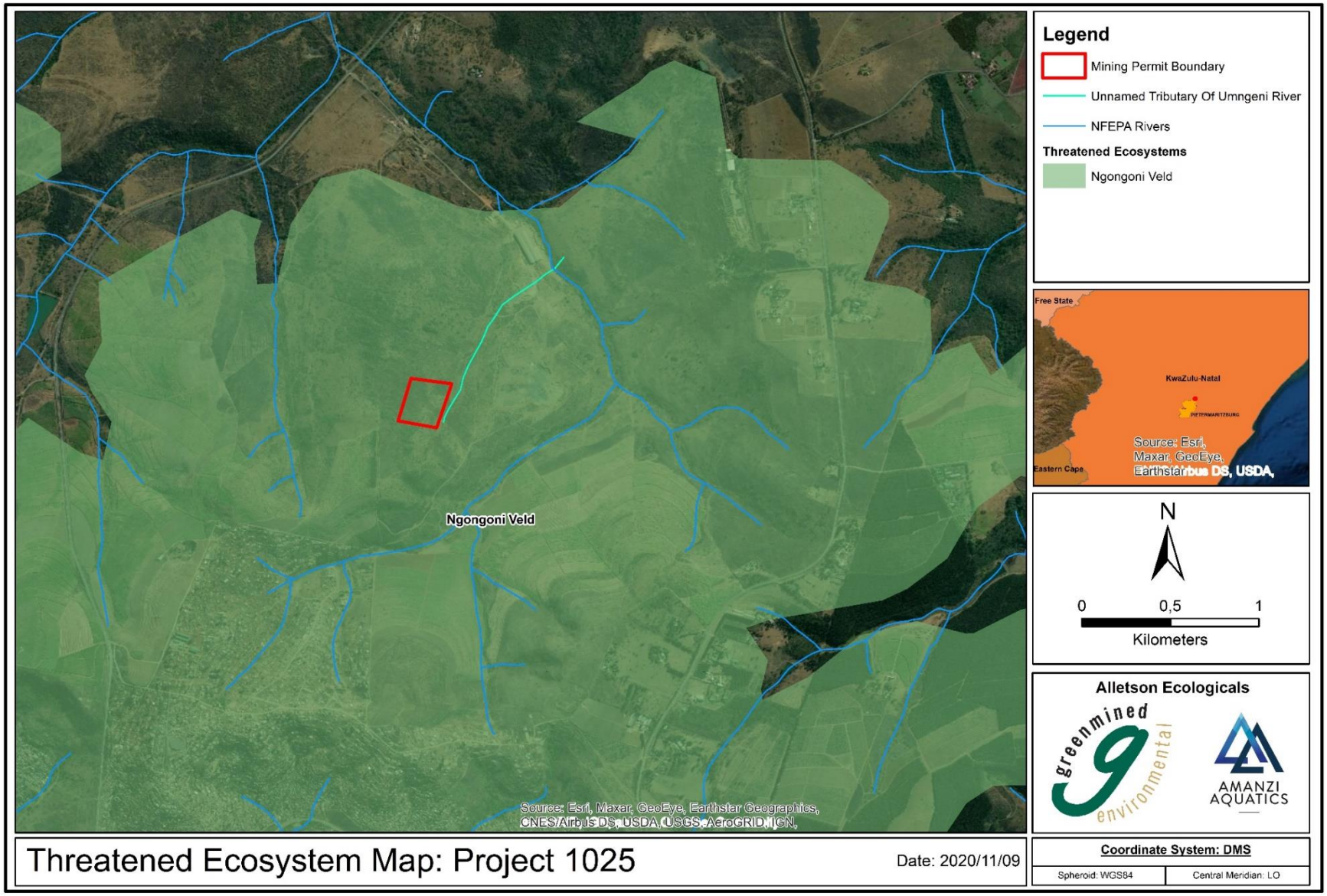


Figure 3-4: Map of the Threatened Terrestrial Ecosystems – Ngongoni Veld

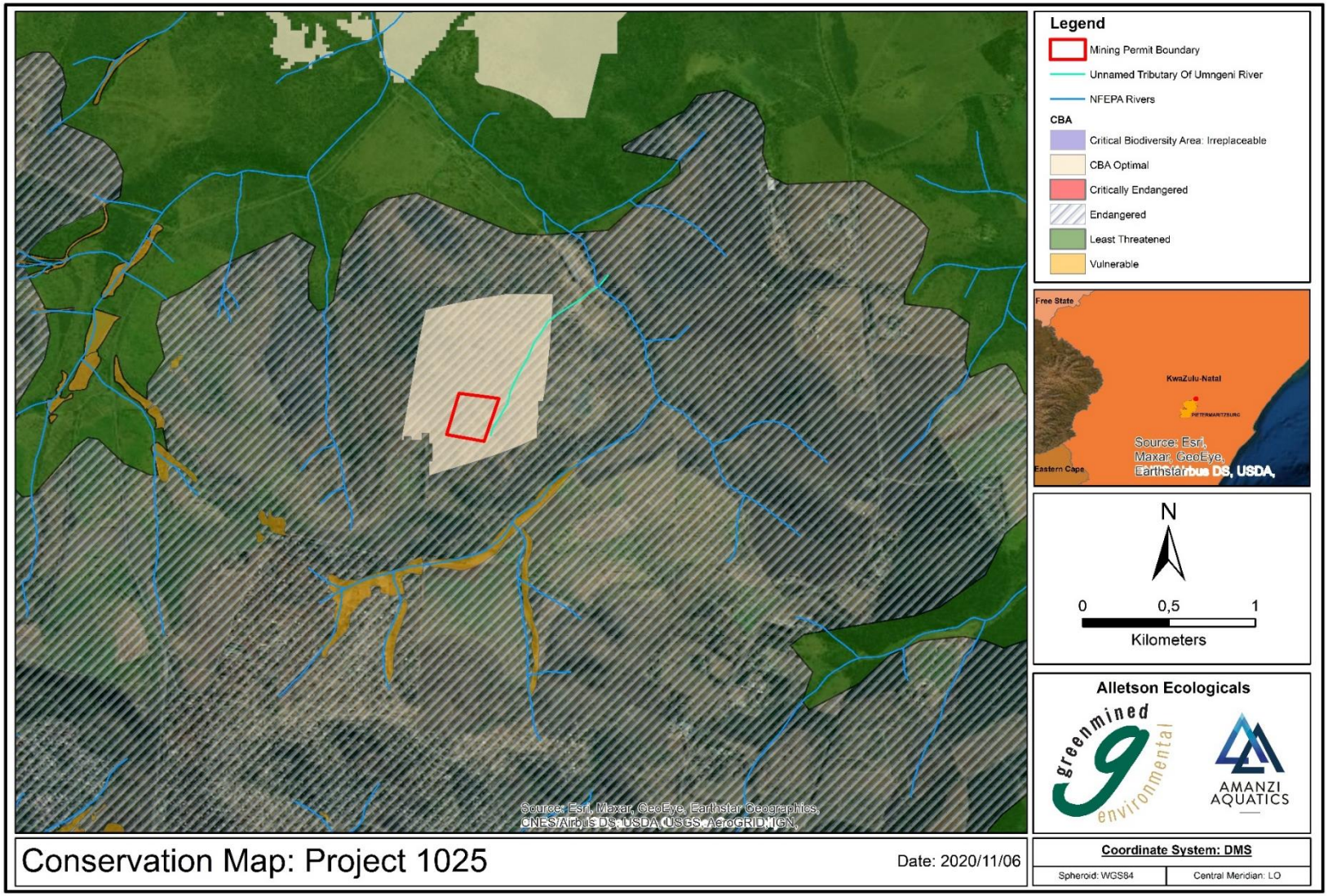


Figure 3-5: Map indicating the Critical Biodiversity Area (CBA) Optimal and Endangered Status

4 METHODOLOGY

4.1 VEGETATION ASSESSMENT

4.1.1 Visual Assessment, Sampling and Assessment

The site visit was conducted in September/October 2020 (late spring) to assess the actual ecological state and current land-use in the area and to identify potential sensitive ecosystems and plant species within the project footprint and surrounding area. The field survey was not chosen for a particular season but driven by the project timelines. The site visit was conducted over a period of two days.

It was possible to walk the whole project area because of the small extent of 5 ha. The available time were fully utilised to search thoroughly for plants. In addition, views were taken from nearby hill tops which overlook the project area. Photographs were taken with various Canon cameras of both individual plants, and of panoramic overviews of the area.

Plants were identified in the field and/or photographed for later identification. In a few instances, clippings were collected and taken back for final identification from reference books.

The level of the assessment of the vegetation on the site is considered sufficient to ensure a general overview of the plant diversity and the presence of any sensitive communities within the proposed development area.

4.2 AQUATIC ASSESSMENT

4.2.1 Visual Assessment

The objective of this study is to determine the baseline condition and Present Ecological State (PES) of the watercourse prior to the mining of the proposed dolerite quarry.

In order to do so, specific Department of Water and Sanitation (DWS) protocols should be included i.e. Surface Water, Diatoms, (VEGRAI), South African Scoring System (SASS5), Index of Habitat Integrity (IHI), Invertebrate Habitat Assessment system (IHAS), Macro-Invertebrate Response Assessment Index (MIRAI) and Fish Response Assessment Index

(FRAI). However, the majority of these indices are exclusive to riverine systems and it is not applicable in wetlands, impoundments, estuaries and other lentic habitats. If the index is used in these types of systems, the results would be erroneous and open to misinterpretation.

A site visit was undertaken on the 30th of September 2020, during the low flow and dry season. The stream was dry, and no surface water or diatoms could be collected either. Therefore, only a visual assessment was done which include some aspects of the habit assessment to discuss the current impact to the system.

4.2.2 Intermediate Habitat Integrity Assessment (IHIA)

As mentioned before, the Intermediate Habitat Integrity Assessment (IHIA), developed by Kleynhans (1996) and adapted by Kemper (1999), is exclusive to streams and riverine systems and it is not applicable in wetlands, impoundments, estuaries, lentic and dry habitats.

Therefore, the protocol for the IHIA was used to assess the impacts on the aquatic and surrounding habitats. These protocols were not applicable from a scoring point of view because the water course was dry. However, it was theoretically applied, to be able to pinpoint specific impacts that would generally affect the instream (IH) and riparian (RH) habitats of water sources, taking in consideration its current state and season. These disturbances represent some of the important and easily quantifiable anthropogenically-induced impacts and include bank erosion, bed-, channel- and flow modification; alien aquatic fauna, exotic macrophytes and exotic vegetation encroachment; indigenous vegetation removal; inundation; solid waste disposal and water abstraction and releases as indicated in **Table 4-1** in **Table 4-2**, below.

Table 4-1: Summary of the Intermediate Habitat Integrity Index

IMPACT CLASS	DESCRIPTION
None	No discernible impact or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability is limited.
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are fairly limited.
Large	The modification is generally present with a clearly detrimental impact on

IMPACT CLASS	DESCRIPTION
	habitat quality, diversity, size and variability. Large areas are, however, not affected
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.

Source: Kleynhans (1996) and Kemper (1999)

Table 4-2: Visual Assessment of Instream and Riparian Habitat Integrity

INSTREAM CRITERIA		RIPARIAN CRITERIA
Water abstraction/release		Indigenous Vegetation removal
Water quality impacts		Exotic vegetation encroachment
Flow modification		Bank erosion
Bed modification		Channel modification
Channel modification		Water abstraction/release
Inundation		Inundation
Exotic macrophytes		Flow modification
Alien fauna		Water quality
Solid Waste Disposal		

Source: Kleynhans (1996) and Kemper (1999)

4.3 VEGETATION IMPACT ASSESSMENT

4.3.1 Significance of identified impacts

Scoring, assessing and predicting the significance of environmental impacts through evaluation of the following factors such as probability of the impact; duration of the impact; extent of the impact; and magnitude of the impact. Each of these aspects is rated according to **Table 4-3** below. Where Duration, Extent and Magnitude are assessed first, followed by Likelihood.

Table 4-3: Table of Evaluation criteria ranking

Score	Label	Criteria
Duration		
1	Very short term	0-1 years

Score	Label	Criteria
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

Once each of these aspects is rated, the overall significance can be scored (based on the score for Effect). The significance is calculated by combining the criteria in the following formula:

S = (D+E+M) P

S = Significance weighting

D = Duration

E = Extent

M = Magnitude

P = Probability

The explanation for each of the overall significance ratings are presented in **Table 4-4**, with the layout of all possible scores and their overall significance presented in **Table 4-5**.

Table 4-4: 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 4-5: Possible significance score based on Effect x Likelihood

Likelihood	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

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 (Impact scores given "with mitigation" are based on the assumption that the mitigation measures recommended in this assessment are implemented correctly and rehabilitation of the site is undertaken). Each of the above impact factors have been used to assess each potential impact using ranking scales as per the following:

- <30 significance points = Low significance.
- 31-59 significance points = Moderate significance.
- >60 significance points = High significance.

4.4 DWS RISK ASSESSMENT

Any project activity in or near a riverine system will have an impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was to identify and assess the significance of the potential impacts caused by the proposed dolerite

quarry on the unnamed tributary of the uMngeni River and to provide a description of the mitigation required so as to limit the perceived impacts on the natural environment.

Freshwater ecosystems, including wetlands and rivers, are particularly vulnerable to human activities and these activities can often lead to irreversible damage or longer term, gradual/cumulative changes to these ecosystems. When making inferences on the impact of project activities on aquatic ecosystems, it is important to understand that these impacts speak specifically to their effect on the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) or functional importance/value of aquatic ecosystems. All of these are linked to the physical components and processes of aquatic ecosystems, including hydrology, geomorphology and vegetation as well as the biota that inhabit these ecosystems (Macfarlane *et al*. 2014).

Anthropogenic activities generally impact either directly (e.g. physical change to habitat) or indirectly (e.g. changes to water quantity and quality) (Macfarlane *et al*. 2014). Mitigation measures must be used to limit the significance of these impacts on the functionality and hydrology of the uMngeni River associated with the proposed dolerite quarry project.

4.4.1 DWS Risk Assessment Matrix

The risk assessment was conducted in accordance with the DWS risk-based water use authorisation approach and delegation guidelines.

The matrix assesses impacts in terms of consequence and likelihood. Consequence is calculated based on the following formula:

Consequence = Severity + Spatial Scale + Duration

Whereas likelihood is calculated as:

Likelihood=Frequency of Activity + Frequency of Incident +Legal Issues + Detection.

Significance is calculated as:

Significance\Risk= Consequence x Likelihood.

Each metric of the severity (flow regime, water quality, geomorphology, biota, and habitat) and spatial scale, duration, frequency of the activity, frequency of the incident/impact and detection are rated to a 1 to 5 scale.

The score is then placed into one of the three classes, with low risks to the watercourse will qualify for a General Authorisation (GA). Medium and high risk activities will require a Section 21(c) and (i) water use licence as per the National Water Act of 1998 (**Table 4-6**).

Table 4-6: Significance rating matrix

Rating	Class	Management Description
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

5 RESULTS AND DISCUSSION

5.1 VEGETATION ASSESSMENT

5.1.1 Indigenous Plant Species

The list of indigenous species found is presented **Table 5-1**. Photographs of some of the indigenous vegetation are illustrated in **Figure 5-1**.

Table 5-1: Plant Species found in the project area

FAMILY	INDIGENOUS SPECIES	COMMON NAME	STATUS
FORBS			
Acanthaceae	*Adhatoda andromeda*	Adhatoda	Least Concern
Acanthaceae	*Blepharis integrifolia*	Herb	Least Concern
Acanthaceae	*Chaetacanthus burchellii*	Fairy Stars	Least Concern
Acanthaceae	*Chaetacanthus setiger*	Hairy Fairy Stars	Least Concern
Acanthaceae	*Ruellia cordata*	Veld Violet	Least Concern

FAMILY	INDIGENOUS SPECIES	COMMON NAME	STATUS
Amaryllidaceae	*Cyrtanthus contractus*	Fire Lily	Least Concern
Asclepiadaceae	*Brachystelma franksiae*	Franks's Brachystelma	**Vulnerable**
Asparagaceae	*Asparagus africanus*	Bush Asparagus	Least Concern
Asphodelaceae	*Aloe arborescens*	Krantz Aloe	Least Concern
Asphodelaceae	*Aloe ferox*	Bitter Aloe	Least Concern
Asphodelaceae	*Aloe maculata*	Common Soap Aloe	Least Concern
Asphodelaceae	*Aloe marlothii*	Mountain Aloe	Least Concern
Asteraceae	*Aster bakerianus*	Pink Daisy	Least Concern
Asteraceae	*Berkheya spp.*	Robust Herbs	Least Concern
Asteraceae	*Gerbera ambigua*	Pink and White Gerbera	Least Concern
Asteraceae	*Gerbera piloselloides*	Small Yellow Gerbera	Least Concern
Asteraceae	*Senecio coronatus*	Woolly Grassland Senecio	Least Concern
Asteraceae	*Senecio madagascariensis*	Annual Herb	Least Concern
Asteraceae	*Vernonia natalensis*	Silver Vernonia	Least Concern
Commelinaceae	*Commelina africana*	Yellow Commelina	Least Concern
Convolvulaceae	*Convolvulus cf. natalensis*	Prostrate or Twining Herb	Least Concern
Crassulaceae	*Crassula cf. pellucida*	Succulent	Least Concern
Dipsacaceae	*Scabiosa columbaria*	Wild Scabiosa	Least Concern
Euphorbiaceae	*Acalypha schintzii*	Bearded Brooms and Brushes	Least Concern
Euphorbiaceae	*Acalypha villicaulis*	Heart-Leaved Brooms and Brushes	Least Concern
Euphorbiaceae	*Clutia monticola*	Branching Clutia	Least Concern
Euphorbiaceae	*Phyllanthus burchellii*	Herb	Least Concern
Fabaceae	*Hoffmanseggia sandersonii*	Sanderson's Herb	Least Concern
Fabaceae	*Indigofera spicata*	Creeping Indigo	Least Concern
Fabaceae	*Lotononis calycina*	Hairy Lotononis	Least Concern
Fabaceae	*Tephrosia macropoda*	Creeping Tephrosia	Least Concern
Fabaceae	*Zornia capensis*	Caterpillar Bean	Least Concern
Geraniaceae	*Pelargonium luridum*	Stork's Bill Pelargonium	Least Concern
Hyacinthaceae	*Albuca setosa*	Small White Albuca	Least Concern
Hyacinthaceae	*Ledebouria cf. zebrina*	Ledebouria	Least Concern
Hypoxidaceae	*Hypoxis filiformis*	Grass Star Flower	Least Concern
Hypoxidaceae	*Hypoxis iridifolia*	Yellow Star Flower	Least Concern
Iridaceae	*Freesia laxa*	Small Red Iris	Least Concern
Lamiaceae	*Becium obovatum*	Cat's Whiskers	Least Concern
Lamiaceae	*Leonotis intermedia*	Broad-Leaved Wild Dagga	Least Concern
Lamiaceae	*Stachys aethiopica*	African Stachys	Least Concern

FAMILY	INDIGENOUS SPECIES	COMMON NAME	STATUS
Malvaceae	*Sida dregei*	Spider Leg	Least Concern
Orchidaceae	*Eulophia clavicornis*	Club-Horned Eulophia	Least Concern
Rubiaceae	*Kohautia amatymbica*	"Tremble Tops"	Least Concern
Rubiaceae	*Pentanisia prunelloides*	Broad-Leaved Pentanisia	Least Concern
Solanaceae	*Solanum incanum*	Bitter Apple	Least Concern
Solanaceae	*Solanum panduriforme*	Bitter Apple	Least Concern
Tilaceae	*Grewia occidentalis*	Cross-Berry	Least Concern
Ferns			
Pteridaceae	*Cheilanthes viridus*	Common Lip Fern	Least Concern
Trees			
Anacardiaceae	*Searsia pentheri*	Crow-Berry	Least Concern
	Searsia cf. dentata	Nana-Berry	Least Concern
Araliaceae	*Cussonia spicata*	Cabbage Tree	Least Concern
Bignoniaceae	*Tecomaria capensis*	Cape Honeysuckle	Least Concern
Boraginaceae	*Ehretia rigida*	Puzzle-Bush	Least Concern
Celastraceae	*Gymnosporia buxifolia*	Common Spikethorn	Least Concern
Ebenaceae	*Diospyros lycioides*	Bluebush	Least Concern
Fabaceae	*Erythrina latissima*	Broad-Leaf Coral Tree	Least Concern
Mimosaceae	*Acacia (Vachelia) caffra*	Common Hook Thorn	Least Concern
	Acacia (Vachelia) natalita	Pale-Bark Sweet Thorn	Least Concern
	Acacia (Vachelia) sieberiana	Paperbark Thorn	Least Concern
Mimosaceae	*Dichrostachys cinerea*	Sickle-Bush	Least Concern
Rhamnaceae	*Zizyphus mucronata*	Buffalo-Thorn	Least Concern
Sterculiaceae	*Dombeya rotundifolia*	Common Dombeya	Least Concern
Grasses			
Poaceae	*Aristida junciformis*	Ngongoni Grass	Least Concern
	Cynodon dactylon	Couch Grass	Least Concern
	Digitaria eriantha	Finger Grass	Least Concern
	Eragrostis curvula	Love Grass	Least Concern
	Hyparrhenia hirta	Common Thatch Grass	Least Concern
	Harpochloa falx	Caterpillar Grass	Least Concern

The greater majority of the indigenous plant species are, classified in the SANBI list as being, “Least Concern”. The single species that is “Vulnerable” is *Brachystelma franksiae*. The reason for the listing is described as follows: “This subspecies was previously thought to have a restricted range occurring in a highly transformed area between Pietermaritzburg

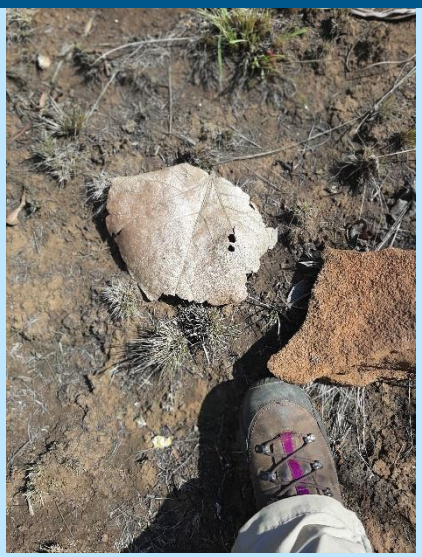
and Camperdown. However, recent collections have enlarged its range to 16 000 km². It is now known from between four and eight locations and remains severely threatened by urban expansion and alien plant invasion at the majority of its locations."

It was noted that residents of the surrounding areas are felling Aloes and especially the Bitter Aloe (*Aloe ferox*). It is assumed that they are being harvested for medicine or other traditional purposes, but the level of utilisation is not sustainable and that the population is being reduced.

Aloe ferox (Bitter Aloe)

Aloe maculata (Common Soap Aloe)

Erythrina latissima (left side - flowering)



Erythrina latissima (leave)

Figure 5-1: Photographs of some of the indigenous vegetation species on site

5.1.2 Alien and Invasive Plant Species

The area is heavily infested with alien weed species. As might be expected, the Category 1 species were generally the more abundant. The most common and widespread is Lantana (*Lantana camara*) which is both widespread and occurring as dense mono-species thickets in places. Other species such as Prickly Pear (O*puntia ficus-indica*) are present as just a small number of individual plants.

The alien weed species found on the site are listed in **Table 5-2** below while the invader categories are defined in **ANNEXURE A.**

Table 5-2: Alien Weed Species found in the Project Area

FAMILY	SCIENTIFIC NAME	COMMON NAME	CATEGORY
Apiaceae	*Centella asiatica*	Marsh Pennywort	
Apiaceae	*Foeniculum vulgare*	Wild Fennel	
Asteraceae	*Conyza albida*	Tall Fleabane	
Asteraceae	*Galinsoga parviflora*	Small-Flowered Quickweed	
Asteraceae	*Hypochaeris radicata*	Hairy Wild Lettuce	
Asteraceae	*Tagetes minuta*	Khaki Weed	
Asteraceae	*Taraxacum officinale*	Common Dandelion	
Cactaceae	*Opuntia ficus-indica*	Sweet Prickly Pear	Category 1b
Convolvulaceae	*Ipomoea purpurea*	Common Morning Glory	Category 1b
Euphorbiaceae	*Ricinus communis*	Castor-Oil Plant	Category 2
Meliaceae	*Melia azerdarach*	Syringa Tree	Category 1b
Mimosaceae	*Acacia mearnsii*	Black Wattle	Category 2
Moraceae	*Morus alba*	Mulberry	Category 3
Nyctaginaceae	*Boerhavia diffusa*	Spiderling	
Plantaginaceae	*Plantago lanceolata*	Narrow-Leaved Ribwort	
Plantaginaceae	*Plantago major*	Broad-Leaved Ribwort	
Solanaceae	*Solanum mauritianum*	Bugweed	Category 1b
Solanaceae	*Solanum sisymbriifolium*	Dense-Thorned Bitter Apple	Category 1b
Verbenaceae	*Lantana camara*	Lantana	Category 1b

Examination of Google Earth imagery during the desktop study had suggested that the vegetation on the ridge on which the project area lies, and the project area itself, might include a number of different communities (**Figure 5-2**). While all the vegetation is *Moist*

Coast Hinterland Grassland (Type Gs 20), the cover is not homogeneous. The drivers of the variability were not included in this study but will include the following:

- Veld burning. Generally frequent fires will suppress growth of trees as the saplings are easily destroyed by the heat on their growing tips. In contrast, grasses which have their growth points underground, are less affected by the heat even if the aerial parts of the plant are burned off. However, over frequent burning may reduce the mass of the grass sward and so fires are less hot and trees may be able to survive.
- Soil depth. While most plants can grow in deep soils if water is available, trees may not be able to grow in shallow soils as their root systems may be stunted.
- Canopy cover. The shade of a closed canopy can suppress the growth of low plants including grasses. In addition, some trees are allelopathic in that they exude chemical substances which suppress the growth, or even kill, plants underneath them. This mechanism allows trees to keep fire out and so to reduce threat to the saplings of their species.
- Grazing by livestock. If the grass cover is denuded by overgrazing by livestock, then the frequency and intensity of fires will be reduced. This allows other species, including trees, to more readily survive. However, since most weeds are pioneer species, they also readily invade the affected areas and may become prolific and even dominant.
- Rocky outcrops. Rock outcrops can reduce the intensity of fires or can even prevent fire from reaching some places. Thus, fire-sensitive species are able to survive in such areas.

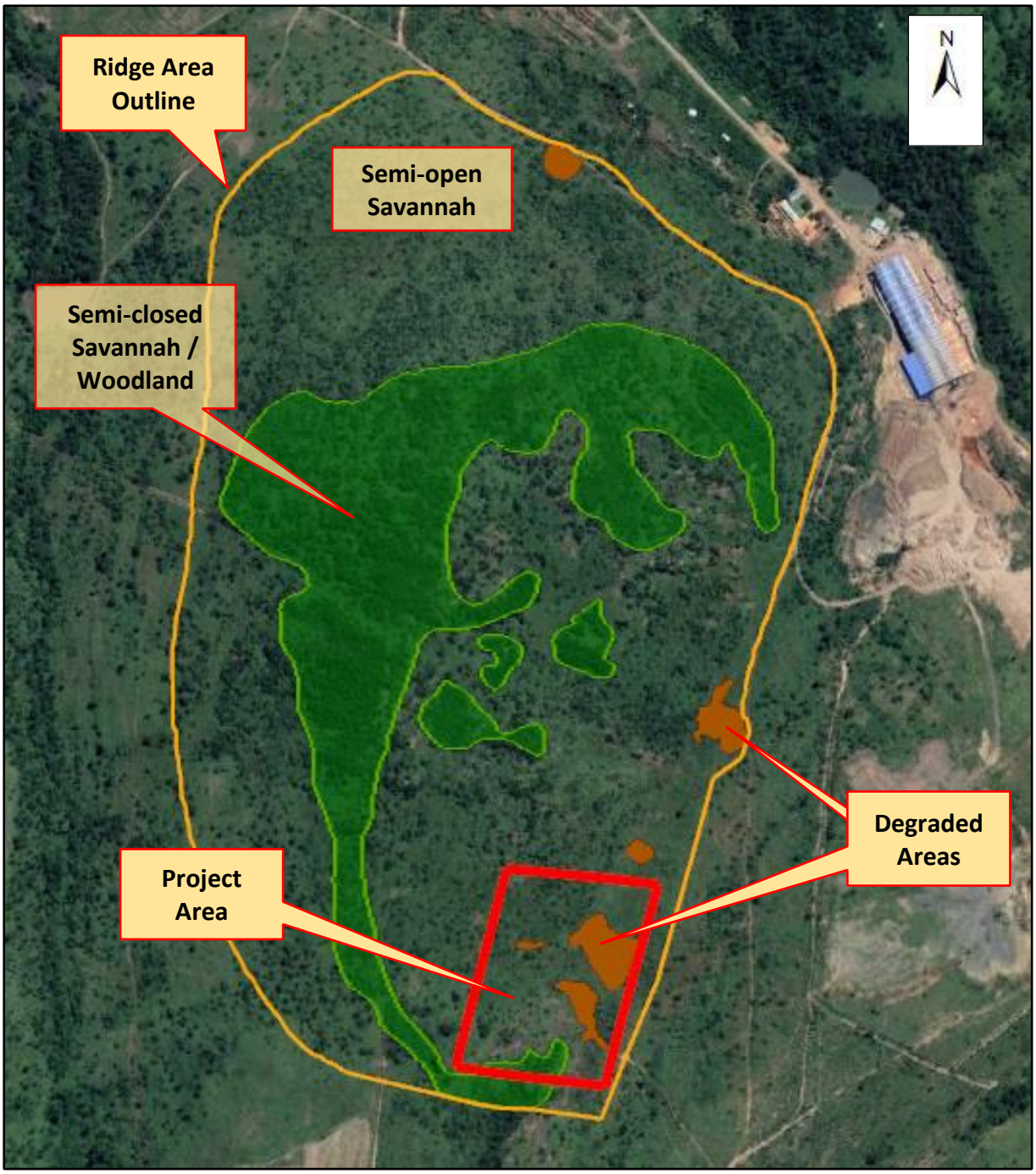


Figure 5-2: Vegetation communities in and around the project area

All of the above processes or features will be of relevance in the project area and its surrounds and will be interacting to produce plant diversity. The interactions between them are variable and complex and are beyond the present scope. The vegetation communities which were noted include the following:

- **Semi-open savannah**. This vegetation community is dominated by grasses but also contains most of the small flowering plants as well. The low-growing Aloes (*Aloe maculata*) are generally associated with this community. Trees such as *Acacia*

sieberiana var woodii are present but are scattered and the canopies do not touch. It was noted that such areas are now showing signs of degradation as a result of over-frequent burning and of heavy trampling and grazing by livestock. As a result, soil surface erosion is becoming apparent in many places and smaller weed species are encroaching. Refer to **Figure 5-4.**

- **Semi-closed savannah**. This vegetation community has numerous trees and the canopies touch or are in close proximities to one another. Typically, it occurs along the crest of the ridge or in rocky areas. Refer to **Figure 5-5**. Most of the large aloes are associated with this community.
- **Degraded areas**. In several places around the ridge, including within the project site, are degraded areas. Typically, these areas have been deliberately altered as a result of human action and those noted included extraction of shale and the construction of scrape dams with the latter being of relevance in the project area. The degraded areas are typically dominated by a variety of weed species.

Within the project area the semi-open savannah is the most common vegetation community (4.05 ha), followed by degraded areas (0.7 ha), and semi-closed savannah (0.25 ha).

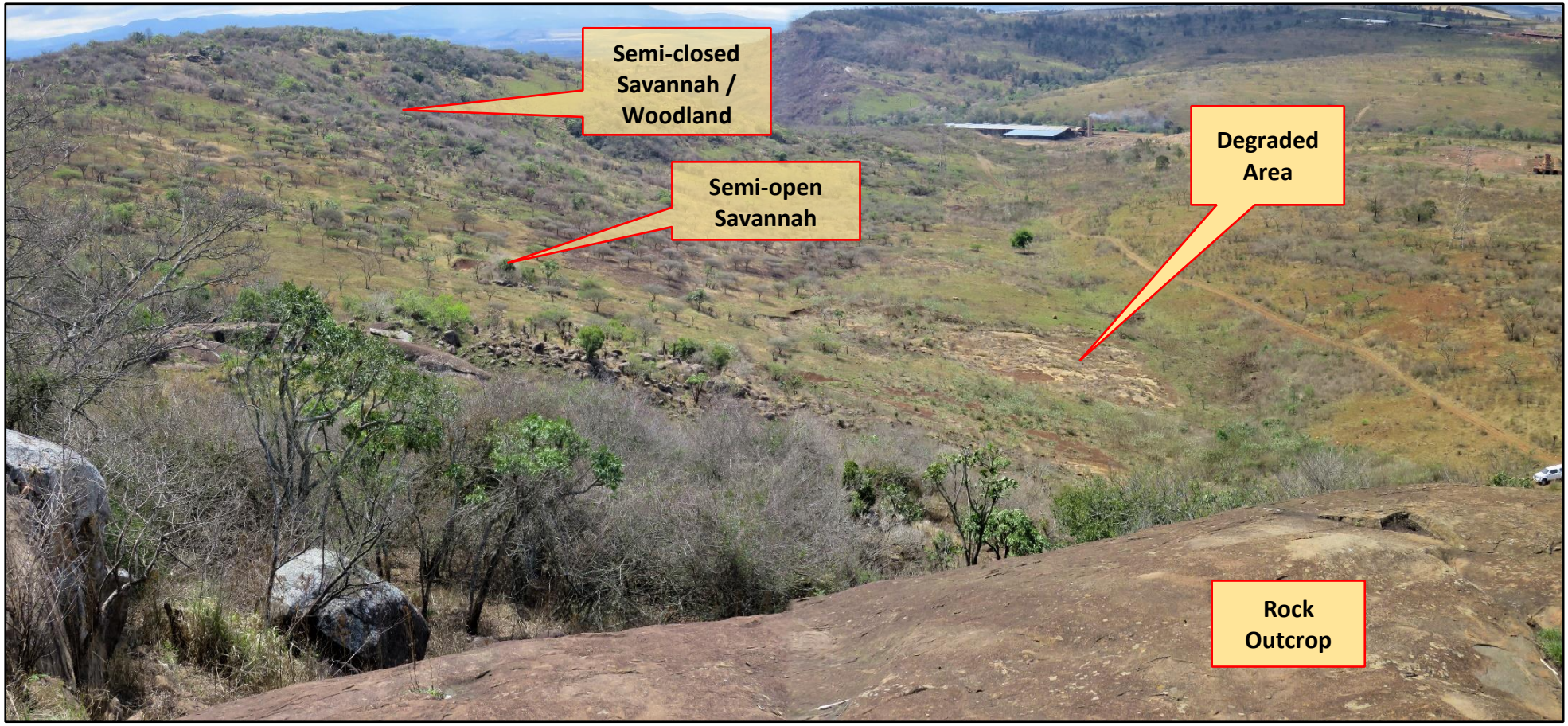


Figure 5-3: Landscape view of vegetation in the project area

Figure 5-4: Semi-open savannah. Note the poor condition of the grass basal cover

Figure 5-5: Semi-closed savannah/woodland. The vegetation is protected from fire by a rock outcrop.

Figure 5-6: Degraded area where the topsoil has been removed

Figure 5-7: Dense thicket of Lantana (Lantana camara)

5.2 FAUNAL OBSERVATIONS

The fauna at the site was not part of the SoW and, therefore, not specifically studied. However, notes were made of the animal species which were observed during the vegetation survey, as indicated in **Table 5-3**. The fauna is very sparse as a result of human activities in the general area. Hunting with dogs has been seen happening. Birds, although numerous in the area, are omitted since only common species were seen and all species are highly mobile and can readily move away from disturbance.

Table 5-3: List of fauna observed in the Project Area

Common Name	Scientific Name	How Observed
Speckled Rock Skink	*Trachylepis punctatissima*	Observed
Unidentified Agama	*Agama sp.*	Observed
Southern Tree Agama	*Agama atricollis*	Observed
Flap-neck Chameleon	*Chamaeleo dilepis*	Observed (Refer to **Figure 5-8**)
Scrub Hare	*Lepus saxitilis*	Droppings observed
Rats or mice	*N/A*	Droppings observed
Millipede	*Zinophora mudenensis*	Observed

Figure 5-8: Photograph of the Flap-neck chameleon

5.3 AQUATIC ASSESSMENT

As mentioned before, none of the DWS protocols were applicable for the aquatic assessment of the unnamed tributary of the uMngeni River. The water course originates in the South-East of the study area. and in the hills and drains in a North-Westerly direction, where it joins the uMngeni River approximately 1 km downstream.

5.3.1 Visual Assessment and Habitat Assessment

Descriptions and photographs of the unnamed tributary of the uMngeni River, and the current impacts on the habitats of the watercourse are indicated in the tables below.

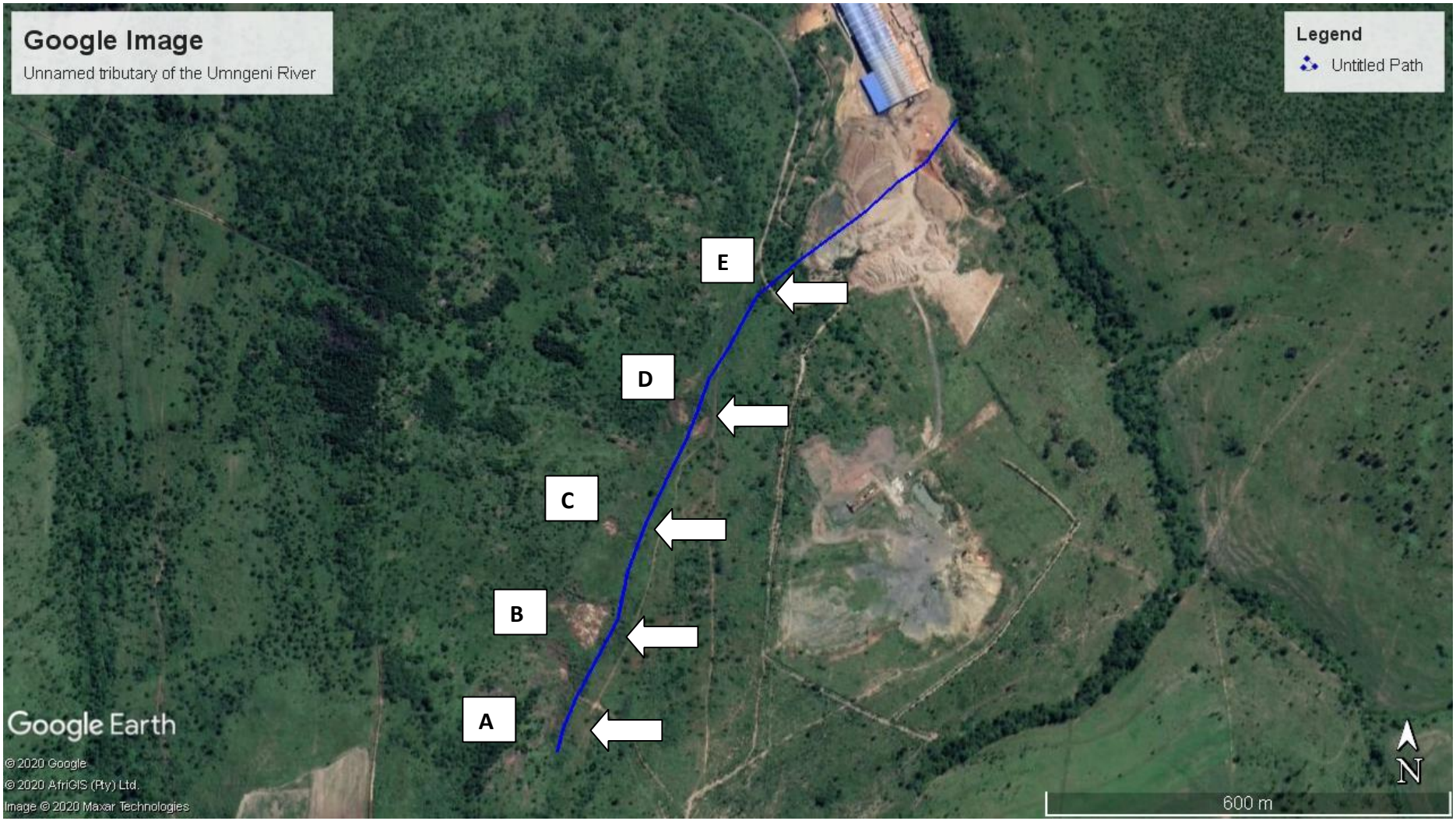


Figure 5-9: Google Imagery of the unnamed tributary of the uMngeni River

Description	Upstream / Southern View	Downstream / Northern View
A: • The source of the unnamed tributary and the catchment. • Dry. • Infested by alien vegetation. • Increased natural vegetation present on the eastern and western side of the study area.		
	Western View	**Eastern View**
		

B:

- Dry.
- Infested by alien vegetation.
- Increased natural vegetation present on the western side.
- Increased rocky and surface runoff from in the western area of the project side.
- Some possible run off from the road on the eastern side of the project area

Panorama View / Eastern View

Western View

South-Eastern View

C:	Western View	Eastern View
• Dry • In channel alien vegetation. • Increased natural vegetation present on the western side. • Drainage channels on the western hills.		
D:	**North Western View**	**Western View**
• Dry. • Middle Earth Dams to prevent water from draining into the existing downstream mining operation. • Crossing power lines and dirt road.		

E:	Upstream View	Downstream View
• Dry. • Dirt roads. • Burned field. • Possible inundation due to upstream middle earth dams and roads crossings.		
		

Figure 5-10: Impacts on the instream and riparian habitats of the unnamed tributary of the Mngeni River

The overall instream and riparian habitat and basic ecosystem functions of the unnamed tributary are impacted on by alien vegetation, inundation by middle earth dams, drainage trenches, dirt roads and power line crossings, foot paths etc.

6 TERESTRIAL BIODIVERSITY IMPACT ASSESSMENT

The potential impacts which might arise from the proposed quarry are considered below. Scoring was done according to the methodology outlined in **Section 4.3** and impacts are scored for pre-mitigation and post-mitigation.

6.1.1 No-go Impacts

Although the area within which the proposed quarry would be located is largely natural, there are already a number of other quarries in the area as well as a brickworks and various agricultural activities. A short distance to the south is the low-cost housing area of Northdale. These surrounding conditions are taken into account in considering certain of the impacts which would arise as a result of the proposed quarrying activities. At the project site the existing impacts are considered to be the following:

- The vegetation is becoming degraded as a result of overgrazing, frequent veld fires, and harvesting of certain species for traditional purposes.
- The vegetation has been cleared in places as a result of direct human activities. Most conspicuous of these is the construction of dam walls across the line of stormwater flows.
- The vegetation is being degraded as a result of invasion by alien weed species.
- Hunting has eradicated many of the larger faunal species from the area.

These pre-existing impacts have no linkage to any quarrying activities and will continue even if the quarry project is not implemented for some reason. No mitigatory measures will be applied. Therefore, they are considered to be no-go impacts. They are scored as shown in **Table 6-1.**

Table 6-1: Assessment of the No-go Impacts in the area around the project site

Impact	Degradation of the Vegetation		Loss of Fauna	
	Pre-mitigation	**Post-mitigation**	**Pre-mitigation**	**Post-mitigation**
Status	Negative	n/a	Negative	n/a
Spatial Extent	Local (2)	n/a	Local (2)	n/a

Impact	Degradation of the Vegetation		Loss of Fauna	
	Pre-mitigation	**Post-mitigation**	**Pre-mitigation**	**Post-mitigation**
Duration	Permanent (5)	n/a	Permanent (5)	n/a
Magnitude	Moderate (6)	n/a	High (8)	n/a
Probability	Definite (5)	n/a	Definite (5)	n/a
Significance	High (65)	n/a	Low	n/a

6.1.2 Construction and Operational Phase Impacts

The construction and operational phase impacts are linked together because of the nature of a quarrying operation. Opening a quarry entails clearing an area for administrative and other buildings such as stores, workshops, ablution facilities, and the like and then developing areas for the actual quarrying operation. Such areas will include crushers, stockpile heaps, spoil heaps, stormwater management, and the like. Once the support infrastructure is in place and the rock extraction commences, the quarry pit continues to expand for the life of the operation. For this reason, the "construction phase" continues because the footprint continuously expands even though the time period will be over a number of years. Thus, the impacts to the vegetation and fauna will continue through the life of the operation.

The construction/operation phase impacts foreseen are as follows:

- Destruction of vegetation. Vegetation will continue to be lost for as long as the operation continues to expand its footprint. The end point of this process cannot be determined but it is probable that the entire project area of 5 ha in extent will be affected. The loss of vegetation is considered to be permanent as rehabilitation of a large pit is usually impossible even if some small areas can be recovered.
- Impacts of dust from blasting and crushing operations on the foliage of vegetation in the surrounding area. It is common for the vegetation around mines and quarries to be coated with dust from the operation. The spatial extent of the impact depends on the climatic conditions, including rainfall and wind patterns, but can extend for several hundred metres from the site.
- Proliferation of alien weed species. Since weeds are typically pioneer species, they readily colonise disturbed soils including soil heaps, road verges, and the like. Since weeds are already common in the area it is inevitable that they will settle and grow on any soil that is exposed for more than a short while. As the weeds invade the quarry area, so the new plants

will produce seed which is able to move to the surrounding areas of natural vegetation. Thus, the quarry could act as a nucleus for further proliferation of weeds in the surrounding area.

- The fauna, especially invertebrates, which cannot leave the area will be destroyed as their habitat is lost. Other species, including birds, will move away but the distances will vary between species. Some may return in the future.

The above impacts are scored in **Table 6-2** below.

Table 6-2: Assessment of the Construction and Operational Phase Impacts

Impact	Degradation of the Vegetation		Loss of Fauna	
	Pre-mitigation	**Post-mitigation**	**Pre-mitigation**	**Post-mitigation**
Status	Negative	Negative	Negative	Negative
Spatial Extent	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)
Magnitude	Very High (10)	Moderate (6)	High (8)	Moderate (6)
Probability	Definite (5)	Definite (5)	Definite (5)	Definite (5)
Significance	High (85)	High (65)	High (75)	High (65)

6.1.3 Decommissioning Phase Impacts

At the time of writing the decommissioning process at the quarry site cannot be foreseen. However, observations on similar operations which have closed suggest that the site will consist of the following:

- A pit which may, depending on its final shape, fill to some extent with water.
- The walls, which will be stepped, are likely to be colonised by some plants and birds once mining is complete.
- Relatively flat areas at the locations of buildings, storage sites, and mine plant such as crushers and the like. All such infrastructure will have been removed. These areas are to be covered by overburden and topsoil which was stockpiled and so may have a vegetation cover which will likely become dominated by alien weed species.; and
- A surrounding fringe of vegetation which will probably be dominated by alien weed species.

These conditions will persist into the indefinite future unless some, presently unknown, use is found for the site. The above impacts, which assume that some site repair and mitigation have been undertaken, are scored in **Table 6-3**.

Table 6-3: Assessment of the Decommissioning Phase Impacts

Impact	Degradation of the Vegetation		Loss of Fauna	
	Pre-mitigation	**Post-mitigation**	**Pre-mitigation**	**Post-mitigation**
Status	Negative	n/a	Negative	n/a
Spatial Extent	Local (2)	n/a	Site (1)	n/a
Duration	Permanent (5)	n/a	Permanent (5)	n/a
Magnitude	High (8)	n/a	Moderate (6)	n/a
Probability	Definite (5)	n/a	Definite (5)	n/a
Significance	High (75)	n/a	High (60)	n/a

6.1.4 Cumulative Impacts

The landscape around the proposed quarry site is already transformed, in a number of different ways. An existing shale quarry lies some 250 m to the east and extends northwards to a brickworks which is about 750 m away. Further north on the same ridge some further shale extraction is happening. A second brickworks with its own quarry lies to the north-east on the opposite side of the valley but is some 1.6 km away.

The south of the quarry site is the Copesville low income housing area while sugar cane fields lie to the west, south, and south-east. Thus, it is apparent that the ridge on which the proposed quarry would be situated lies in a moderately transformed landscape with large expanses of untransformed vegetation lying only to the north-west. See **Figure 8-1**.

However, the quarry will have relatively little impact on the area around it other than for the issue of dust on vegetation. It will not pollute any watercourses or wetlands and will not lead to the degradation of any mapped areas of conservation importance. Therefore, it is concluded that it will have relatively little cumulative impact on the vegetation and fauna in its landscape.

7 DWS RISK ASSESSMENT

The DWS risk assessment focussed on the Proposed Dolerite Quarry near Pietermaritzburg, Mshwati Municipality, KwaZulu-Natal, South Africa. The results for the risk assessment are **Table 7-1** and all components scored a **moderate to high** impact significance. Borderline risk scores were manually adapted and reduced all components to a **low to moderate** impact significance with the application of various mitigation measures. Based on the results of the DWS risk assessment, a **Water Use Licence (WUL)** is required for the Proposed Dolerite Quarry, as per Section 21 of the National Water Act No. 36 of 1998 and Notice 509 of 2016. It is, however, the prerogative of the **DWS** to advise on whether the quarry activities can be authorised under a WUL or not.

No.	Phases	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	Boderline Low Moderate Rating Classes
1	Construction	Establishment of the construction camp and activities for quarry mining	Direct modification and destruction of instream and riparian habitats and loss of water recharge due to construction activities	Direct modification, fragmentation and destruction of instream and riparian habitat	1	2	2	1	4	2	2	8	4	5	5	3	17	136	Moderate	102	Moderate
2	Construction	Establishment of the construction camp and activities for quarry mining	Flow modification, erosion and sedimentation	Removal of vegetation will temporarily destabilise soils and make them subject to potential erosion, increased dust, altered flow regimes and lead to possible water quality deteriorations	3	3	3	1	4	3	5	12	4	5	5	3	17	204	High	160	Moderate
3	Construction	Establishment of the construction camp and activities for quarry mining	Increased in hardened surfaces, dust and toxic chemicals from hydrocarbons, metals, nutrients etc from construction vehicles	Pollution of water and soil environments	3	3	3	2	4	3	4	11	4	4	5	3	16	176	High	150	Moderate

No.	Phases	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	Boderline Low Moderate Rating Classes
4	Operational	Quarry Mining	Operation and maintance of infrastructure	Direct modification, fragmentation and destruction of instream and riparian habitats	1	3	3	1	3	3	3	9	4	4	5	3	16	144	Moderate	120	Moderate
5	Operational	Quarry Mining	Pollutition associated with quarry mining	Pollution of water and soil environments	3	3	3	2	4	3	4	11	4	4	5	2	15	165	Moderate	130	Moderate
6	Operational	Quarry Mining	Stormwater associated with quarry mining	Flow modification and increase turbidity and sedimentation due to increased hardened surfaces and stormwater discharges into watercourse	3	3	3	2	4	3	4	11	4	4	5	2	15	165	Moderate	130	Moderate
7	Decommissioning	Quarry Closure	Post disturbance invasion of ruderal and alien invasive species	Recruitment of alien plant species	3	1	3	3	3	3	3	9	4	4	5	2	15	135	Moderate	50	Low

Table 7-1: Significance rating matrix for the impacts associated with the proposed Dolerite Quarry

8 MITIGATION MEASURES

In order to minimize the impacts on the vegetation and fauna at the site of the proposed quarry the following mitigatory measures are recommended:

i. All quarry activities may only be undertaken within the registered and mapped space of the quarry site. This site must be clearly pegged out and be fenced prior to the start of operations.

ii. In accordance with Mine Health and Safety Requirements, the walls of the pit will be stepped with near vertical sections being reduced in height by a series of horizontal steps which will be formed (cut) as a part of the mining operations.

iii. Ablutions should be provided onsite, at least one for every 15 workers, and should be located at least 50m away from the edge of the riparian zone (until the unnamed tributary is completely transformed into a quarry).

iv. Regularly check vehicles, machinery and equipment operating on site, to ensure that none have leaks or cause spills of oil, diesel, grease or hydraulic fluid.

v. All temporary and permanent erosion and sediment control structures must be monitored for the duration of the construction phase and repaired immediately when damaged.

vi. A search-and-rescue for desirable plants should be undertaken by an ecologist prior to vegetation clearing. All interested parties, including plant nursery operators may be invited to take part.

vii. Vegetation clearing may only be done on an “as-needed” basis. This means that only areas that are about to be worked may be cleared.

viii. As far as possible all wood and other resources, including Aloes, should be made available to the local community for their use.

ix. Cleared vegetation to be retained at any time may not be burned but must be mulched and be stockpiled. Ideally the heaps will be covered with stockpiled topsoil and the material be retained for future site rehabilitation purposes.

x. All spoil heaps and stockpiles must be provided with a vegetation cover consisting of indigenous grasses. Recommended species include the following:

- ✓ Love Grass. *Eragrostis curvula*
- ✓ Couch Grass *Cynodon dactylon*
- ✓ Finger Grass *Digitaria eriantha*

xi. All infrastructure, including the containers, machinery and crushers etc are to be removed from the processing area and the footprint will be landscaped, compacted areas will be ripped and the topsoil will be returned and the area seeded with the listed grass species.

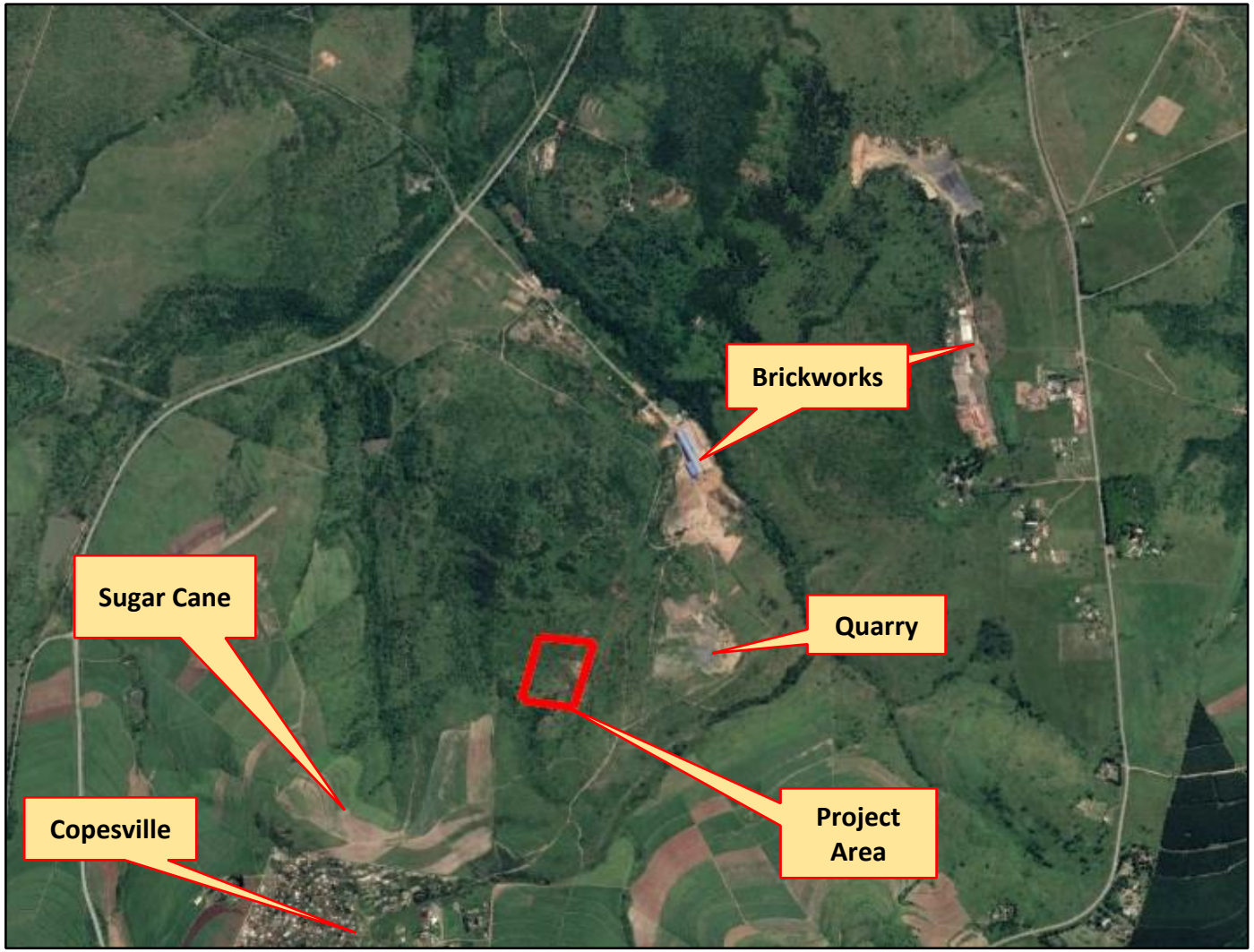


Figure 8-1: Landscape activities around the project area

xii. Once mining operations are over, pit overburden material must be pushed back into the pit to fill the upper step or steps to produce a sloped surface. Topsoil from the stockpiles must then be pushed down so that a substrate for vegetation growth may be established. The listed grass species may be used for this purpose.

xiii. All waste is to be removed from site and any stockpiled dolerite (product) will either be sold or returned to the quarry pit and used in the sloping of the quarry sides.

xiv. From the start of operations an alien weed programme must be implemented for the entire property including the working areas where relevant. This programme must be pre-planned and approved and specific targets must be set.

xv. After closure, the alien weed control measures will continue right through the maintenance and aftercare period of the quarry.

xvi. Dust management measures must be set in place so as to minimise the dust from the crushers being blown into the surrounding areas.

xvii. Undisturbed areas of vegetation must be suitably managed. This management will include the alien weed control programme but must also make provision for some protection from over frequent fires. This will require burning of a firebreak around the periphery in autumn every year. The area inside the break should be burned on a biennial (every second year) basis. The relevant veld burning legislation must be adhered to.

xviii. A licence, in terms of the Forests Act will be required to clear trees in those parts of the quarry site where the vegetation is deemed to be a "Natural Forest"[3]. The appointed ecologist will delineate any such areas.

xix. A Monitoring programme must be followed to determine if the activities from the proposed quarry have any negative impacts on the downstream watercourses. All impacts must be mitigated and rectified immediately.

The implementation of these measures will be the responsibility of the mine manager, but it is recommended that an environmental specialist be appointed to guide and assist as is necessary.

[3] Natural Forest. Definition from the National Forests Act (Act 84 of 1998): (xx) "natural forest" means a group of indigenous trees— (a) whose crowns are largely contiguous: or (b) which have been declared by the Minister to be a natural forest under section 7(2): (xxviii)

9 MONITORING PROGRAMME

The initial establishment of the quarry must be monitored by an Environmental Control Officer (ECO) or Environmental Assessment Practitioner (EAP) so as to ensure that the recommendations of the specialists are adhered to. This monitoring should be undertaken on a monthly basis for at least six months whereafter the interval may be retained or lengthened depending on the degree of mining at that time.

9.1 INTRODUCTION

Monitoring of the proposed dolerite quarry mining activities consists of various components as illustrated by the overall monitoring process (**Figure 9-1**). It must be recognised and understood that the successful development and implementation of an appropriate, accurate and reliable monitoring programme requires that a defined structured procedure be followed.

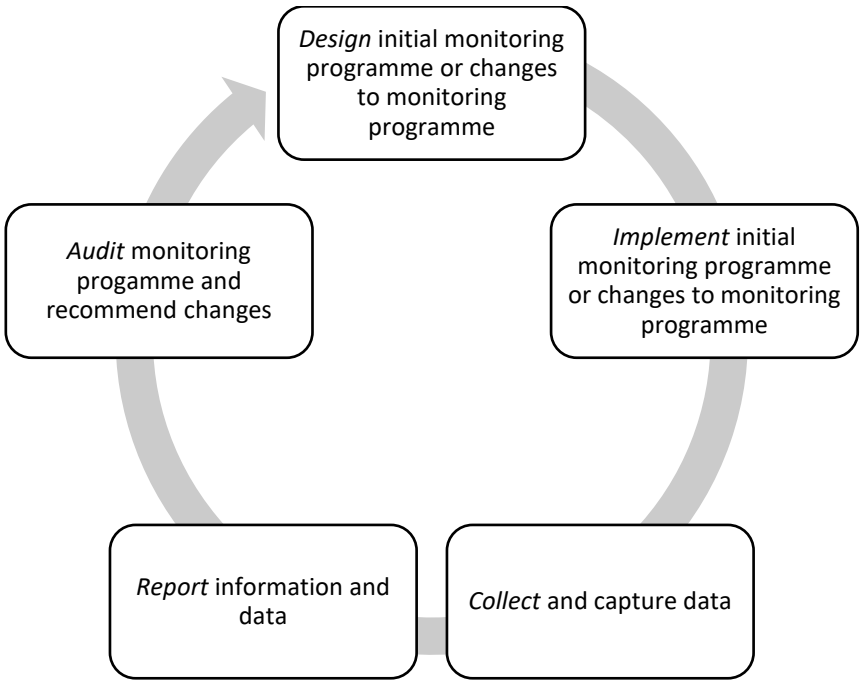


Figure 9-1: Monitoring Process

9.2 AIMS AND OBJECTIVES

The objective of this section of the report is to develop a monitoring programme that is aimed at early identification of potential impacting features that could adversely impact the watercourses located on the site and downstream from the site. Early identification of emerging impacts allows for timeous management intervention, which reduces the significance of the impact, alleviates the

ecological consequence of that impact, and renders the mitigation procedures more cost effective. A monitoring programme is, therefore, only effective if the actual monitoring is undertaken and reported on as a matter of routine.

9.3 PROPOSED MONITORING PROGRAMME

9.3.1 Sampling Site Selection

The selection of the sampling sites should be based on the final available extent of the operations, to assess the impacts from the proposed dolerite quarry mining activities, by comparing the upstream and downstream scenario. Limited baseline results were available, and the water course was dry. Therefore, these the final monitoring sites should be re-evaluated and adjusted in the follow-up monitoring surveys and as specified in the WUL/GA.

Table 9-1: Sampling Site Selection for Surface Water and Aquatic Biomonitoring

Watercourses	Site	GPS Coordinates		Location description
		Latitude	Longitude	
Unnamed tributary of the uMngeni River	1	TBD	TBD	Downstream of the proposed quarry.
uMngeni River	2	TBD	TBD	Upstream of the proposed quarry.
uMngeni River	3	TBD	TBD	Downstream of the proposed quarry.

TBD = To be determined

9.3.2 Proposed Monitoring Procedures

The proposed monitoring programme is indicated in **Table 9-2** below.

Table 9-2: Proposed Monitoring Programme

Aspect	Aim	Method	Interval	Responsible person
Abiotic				
Habitat	To evaluate instream and riparian habitat quality.	Intermediate Habitat Integrity Assessment (IHIA) developed by Kleynhans (1996) and adapted by Kemper (1999).	<u>Pre-Construction phase:</u> Baseline conditions <u>Operational phase:</u> Bi-annually (if water is available) <u>Post-Construction phase:</u> Once-off	Aquatic Specialist
Surface Water Quality	To determine the quality of the surface water due to activities from proposed quarry and to ensure that it has little to no impact on the downstream watercourses.	The *in situ* analysis of surface water quality for the following constituents: pH, electrical conductivity, total oil and grease and turbidity. Thereafter, as specified by the GA/WUL.	<u>Pre-mining phase:</u> Baseline conditions <u>Operational phase:</u> *In situ* measurements – Monthly (if water is available) <u>Post-closure phase:</u> Quarterly intervals for 3 years thereafter.	ECO / Aquatic Specialist
Biotic				
Diatoms	To determine the overall health of the watercourses as diatoms show an ecological memory of water quality over a period of time.	Sampling and laboratory procedures according to Taylor *et al.* 2005. The analysis should include the Specific Pollution Sensitivity	<u>Pre-construction phase:</u> Baseline conditions <u>Operational phase:</u> Bi-annually (if water is available)	Aquatic Specialist

Aspect	Aim	Method	Interval	Responsible person
		Index (SPI) described by CEMAGREF (1982) and the Percentage Pollution Tolerant Valves (%PTV) according to Kelly & Whitton (1995).	<u>Post-closure phase:</u> Once-off	
Vegetation	To assess vegetation community changes due to activities from quarry.	Fixed point ground truthing and/or aerial photography.	<u>Pre-construction phase:</u> Baseline conditions <u>Operational phase:</u> Annually for the next two years (specifically during the growing season). Thereafter, as indicated in the Alien Invasive Plant (AIP) Management Plan. <u>Post-Closure phase:</u> Once-off (specifically during the growing season).	Vegetation Specialist

10 CONCLUSION

The vegetation and, to a lesser extent, the fauna, at the site of the proposed dolerite quarry have been surveyed and assessed. The vegetation is classified as *Moist Coast Hinterland Grassland (Gs 20)* and the Ngongoni Veld is regarded as being Endangered (EN). The entire project area was walked, and it was possible to examine it closely. Unfortunately, the area had been burned and so many plants could not be identified. In addition, the timing of the site visits, in early Spring, meant that many plants were possibly still in their winter senescence and so were not visible. Despite these difficulties, some 58 indigenous species and 19 alien species were identified. Of the indigenous species, only one (*Brachystelma franksiae*) was found to be listed as a species of concern. It is rated as "Vulnerable" due to habitat loss but is known to occur at seven or eight other localities.

The vegetation is in a generally poor condition, and this is attributed to over frequent veld burning and to heavy grazing by livestock. However, a number of other vegetation drivers will also be of relevance. Although all of one type, the indigenous vegetation consists of two communities which are described as semi-open savannah and semi-closed savannah.

Because of the nature of the proposed operation, it is inevitable that the vegetation at the site will eventually be almost totally destroyed with there being only limited options for site rehabilitation when the dolerite extraction is complete. Due to the large pit which will be left it will not be possible to re-establish a vegetation cover over much of the affected area. Some clean-up and rehabilitation must be undertaken in the areas around the mine buildings and also on the horizontal steps along the mine wall. However, the quarry will have relatively little impact on the vegetation and fauna around it provided that the mitigatory measures put forward above are adhered to. Since the area is not rated as being of high conservation priority, it is therefore the opinion of the vegetation specialist that the impacts on the vegetation do not constitute a fatal flaw to the proposed quarry and so there is no reason to block the project in that regard.

The water course was dry. The instream and riparian habitat and basic ecosystem functions of the unnamed tributary of the uMngeni River are impacted on by alien vegetation, inundation by middle earth dams, drainage trenches, dirt roads, power line crossings, foot paths etc. No aquatic macro-invertebrates or fish were collected in the watercourse. Based on the results of the DWS Risk Assessment, a WUL is required for the Proposed Dolerite Quarry. The Aquatic Biomonitoring Programme should be implemented to allow for the early identification of emerging impacts followed by timeous management intervention, which reduces the significance of the impact,

alleviates the ecological consequence of that impact and renders the mitigation procedures more cost effective. A list of recommended mitigation measures must be followed by the client to ensure the potential impacts are limited or completely negated during the different phases of the proposed project. These mitigation measures should be incorporated. In conclusion, it is the prerogative of the DWS, to advise on whether the mining activities can be authorised under a WUL or not.

11 REFERENCES

NOTE: The following publications were used for general reference purposes and not all are specifically referred to in the text.

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12 ANNEXURE A

12.1 SCOPE OF WORKS (SoW)

The client will be notified one week prior to undertaking of the baseline vegetation assessment. The assessment will include a desktop assessment of the area; one site visit as well as the review and comparison of the previous assessments in the study area (if available). After completion of the assessment, a comprehensive report will be provided. This report will include site photographs, data collected during the field survey as well as a comprehensive discussion. A Vegetation / Terrestrial Biodiversity Impact and Risk Assessment detailing the potential impacts to the receiving environment, due to the proposed dolerite mining, will be included.

In addition, a Baseline Aquatic and DWS Risk Assessment will be completed at approximately two sampling sites on the unnamed tributary of Mngeni River. The following aquatic methodologies will be included:

- *In situ* analyses of the water quality, including pH, Temperature, Electrical Conductivity, Total Dissolved Solids (TDS), Dissolved Oxygen, Oxygen Saturation and Turbidity.
- A habitat integrity assessment using the Integrated Habitat Assessment Index (IHAS) (McMillan, 1998); and
- Aquatic invertebrate community analyses using the South African Scoring System version 5 (SASS5) (Dickens and Graham, 2001) – *We are DWS accredited SASS5 practitioners*.

The information collected will be used to recommend mitigation and management intervention, where applicable.

The report that will be submitted to the Client will include one soft copy.

12.2 INVASIVE PLANT CATEGORIES

Category 1a (PROHIBITED) : Listed Invasive Species

A person in control of a Category 1a Listed Invasive Species must comply with the provisions of section 73(2) of the Act; immediately take steps to combat or eradicate listed invasive species in compliance with sections 75(1), (2) and (3) of the Act; and allow an authorised official from the Department to enter onto land to monitor, assist with or implement the combatting or eradication of the listed invasive species.

Category 1b (PROHIBITED / Exempted if in Possession or Under control) : Listed Invasive Species

A person in control of a Category 1 b Listed Invasive Species must control the listed invasive species in compliance with sections 75(1), (2) and (3) of the Act. A person contemplated in sub-regulation (2) must allow an authorised official from the Department to enter onto the land to monitor, assist with or implement the control of the listed invasive species, or compliance with the Invasive Species Management Programme contemplated in section 75(4) of the Act.

Category 2 (PERMIT REQUIRED): Listed Invasive Species

Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be. A landowner on whose land a Category 2 Listed Invasive Species occurs or person in possession of a permit, must ensure that the specimens of the species do not spread outside of the land or the area specified in the Notice or permit. Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1 b Listed Invasive Species and must be managed according to Regulation 3. Notwithstanding the specific exemptions relating to existing plantations in respect of Listed Invasive Plant Species published in Government Gazette No. 37886, Notice 599 of 1 August 2014 (as amended), any person or organ of state must ensure that the specimens of such Listed Invasive Plant Species do not spread outside of the land over which they have control.

Category 3 (PROHIBITED): Listed Invasive Species

Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of the Act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of the Act, as specified in the Notice. Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to regulation 3.

Last Updated 2019-02-13 with latest NEMBA classifications in accordance with the NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT NO. 10 OF 2004) ALIEN AND INVASIVE SPECIES LISTS, 2016