Mining Permit Application

African Lime (Pty) Ltd

Mining of Limestone
Port Shepstone area, KwaZulu-Natal

DMR Ref No.: KZN30/5/1/3/2/10628MP

Faunal Report

Brousse-James & Associates cc

This Faunal Report for a Mining Permit application for African Lime (Pty) Ltd in the Port Shepstone area, KwaZulu-Natal, was completed in September 2019 and was compiled by:

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EXECUTIVE SUMMARY

Brousse-James & Associates were contracted by EnviroPro Environmental Consulting (Pty) Ltd to undertake a faunal specialist report for a proposed Mining Permit on the property Portion 9 of the farm West Slopes No. 5828 in extent 26.7534 ha.

The property is located within the Ray Nkonyeni Local Municipality, which is part of the Ugu District Municipality.

Two alternative potential mining areas were identified on the property (Appendix 1: Map 2). The first option (Option 1) is a 4.8 ha area on the central, southern boundary of the property, extending from the top of a hill and down the predominantly grassy, extremely steep south-west and north-west slopes of that hill. The second option (Option 2) is the entire north-easterly section of the property, covering an area of 4.7 ha. This includes the farmhouse and sheds, which are located on a north-west to south-east trending ridge. Option 2 is the preferred option.

The north-eastern boundary of the property consists of sugar cane, while the northern and southern boundaries are natural areas. The western boundary is the Mzimkhulu River. There is a steep, rocky stream flowing near the northern boundary of the property, bounded by riparian forest.

Habitat loss is one of the greatest threats facing animals and the biggest cause of extinction of animal species. West Slopes 5828 is located within the northern section of the Pondoland Centre of Endemism. It is within an Irreplaceable Critical Biodiversity Area and the Mzimkhulu River is listed as a Freshwater Ecosystem Priority Area. The grassland component of the area is highly diverse, with over 400 species of grassland-specific grasses and forbs, and within the forested areas 214 tree species have been recorded. This translates into habitat for a large number of vertebrate and invertebrate species. The general area therefore has very high conservation importance, particularly for immobile endemic plants, molluscs and millipedes. Of particular importance is that there are numerous rocky streams in the area that provide critical habitat for the endangered Kloof Frog (*Natalobatrachus bonebergi*) and many other animal species.

Portion 9 of West Slopes has one of those rocky streams, running from east to west down a very steep valley within a small, isolated catchment. A large proportion of that catchment (southern and eastern portions) is contained within the property and any disturbance to the catchment will destroy the integrity of the stream, which at present is fringed by riparian forest and has numerous clean and clear rocky pools supporting a healthy population of Kloof Frogs, which were actively breeding at the time of the field trips in March/April 2019. During the April 2019 field trip, the Endangered endemic millipede, *Doratogonus infragili*, was also found along the stream, as was the unusual KwaZulu-Natal and Pondoland endemic snail, *Trachycystis scolopendria*.

In terms of general protection of biodiversity in the area, Rem of West Slopes 5828, which is

just north of Portion 9, was set aside as a biodiversity offset area for the Rossmin mine and a Biodiversity Stewardship Agreement was formalised with Ezemvelo KwaZulu-Natal Wildlife. This offset area was primarily set aside for protection of endemic invertebrates (molluscs and millipedes), but has general biodiversity benefits as well. The presence of another mine on its southern boundary, namely Portion 9 of West Slopes 5828, will contribute to isolating that offset area from other natural areas, particularly because its eastern boundary is sugar cane.

The biggest concern with the proposed mining area on Portion 9 of West Slopes 5828, particularly the lower, first option, is that it will be virtually impossible to mine and have sufficient access to the mine without impacting on the stream and destroying Kloof Frog habitat and habitat for other Endangered and endemic species. For this reason, Option 1 is fatally flawed from an ecological perspective. Mining within Option 2 can be considered, but it would have to include sufficient safeguards to ensure consistent and long-term maintenance of both quantity and quality of water entering the stream. Therefore water quality assessments would be needed, both prior to mining (baseline) and at regular intervals during the operational lifespan of the mine. In addition, the breeding status of the frogs should be assessed annually and measures taken to protect them if there is any evidence of negative impacts on the population.

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1 INTRODUCTION

Brousse-James & Associates were contracted by EnviroPro Environmental Consulting (Pty) Ltd to undertake a faunal specialist report for a proposed Mining Permit on the property Portion 9 of the farm West Slopes No. 5828 in extent 26.7534 ha (Appendix 1: Map 1 and Appendix 2: Photos 1-3).

The property is located within the Ray Nkonyeni Local Municipality (previously Hibiscus Coast Local Municipality), which is located within the Ugu District Municipality.

The 1:50,000 topographical sheet which includes the property is 3030CB Port Shepstone.

Two alternative potential mining areas have been identified on the property (Appendix 1: Map 2 and Appendix 2: Photos 1-3). The first option (Option 1) is a 4.8 ha area on the central, southern boundary of the property, extending from the top of a hill and down the predominantly grassy, extremely steep south-west slope of that hill. The second option (Option 2) is the entire north-easterly section of the property, covering an area of 4.7 ha. This includes the farmhouse and sheds, which are located on a north-west to south-east trending ridge. Option 2 is the preferred option.

The north-eastern boundary of the property consists of sugar cane, while the northern and southern boundaries are natural areas. The area around the farmhouse is very disturbed, with a lot of alien plants, but the remaining area consists of natural grassland. The western boundary is the Mzimkhulu River. There is a steep, rocky stream flowing near the northern boundary of the property, bounded by riparian forest.

To access Portion 9 of West Slopes 5828: From the N2 toll plaza north of Port Shepstone (exit 51), take the P68-1 St Faiths Road and travel 10.3 km inland. Take the turnoff towards the left to the Rossmin Mine and turn left just before the mine processing plant entrance, and then turn right. Follow the farm road for 1 km until the farmhouse on Portion 9 of West Slopes 5828 is reached.

2 DESCRIPTION OF THE RECEIVING ENVIRONMENT

Westlands 5828 is located within the Indian Ocean Coastal Belt, as defined by Mucina and Rutherford (2006). This is an almost 800 km long coastal strip between the South African border with Mozambique extending as far south as the mouth of the Great Kei River near East London. It is a climatically, ecologically and biogeographically peculiar region that, they have argued, deserves to stand on its own at the level of a Biome within the scope of the South African vegetation. It is characterised by a regional concentration of endemic species. Whilst the northern landscapes are flat, the southernmost landscapes (where the proposed mining area is located) are characterised by elevated plateaus separated by deep gorges associated with major river valleys.

This area is also the northern edge of the Pondoland Centre of Endemism[1], which is a

[1] Endemic species or communities are species or communities that originate from, and exist only within, a particular limited geographic area. They are therefore highly vulnerable to extinction, should there be any large-

southern part of the Indian Ocean Coastal Belt, hereafter referred to as Pondoland, which is relatively small, but extremely important for biodiversity conservation. It covers an area of 180,000 ha. The area stretches from just north of Port St Johns to the Msikaba Formation Sandstone gorges of the Oribi Gorge. However, most of the area within the KwaZulu-Natal portion of Pondoland has been transformed, with sugar cane destroying vast areas of grassland, and forest areas being threatened by uncontrolled exploitation, alien plant invasion and poor management or destruction of adjacent grassland.

Pondoland is described as one of the two Centres of Endemism within the Maputaland-Pondoland Region of Plant Diversity. Currently, there are only 235 such Centres worldwide. Centres of exceptional species endemism in Southern Africa were identified under the auspices of the IUCN Plant Conservation Programme. The formal criteria for inclusion of the sites as Centres is that they must be both species-rich and have high levels of endemism. There are eight such Centres in South Africa. The Pondoland Hotspot (Centre of Endemism) occurs within the Maputaland-Pondoland Region.

Large areas of Pondoland are underlain by mineralogically mature, quartz-rich Msikaba Formation Sandstone, which has been separated on lithostratigraphic grounds from the Natal Group Sandstone with which it was previously correlated. The weathering resistant rock forms steep sided plateaus incised by deep river valleys and gorges. The flat areas are characterised by sandy textured and unstructured soils. Rainfall is high and there is thus a high degree of leaching, which results in soils of low fertility. In addition, the soils are high in aluminium, which can be toxic to certain plants. Low soil fertility is known as one of the contributing factors for high species diversity.

Habitat loss is one of the greatest threats facing animals and the biggest cause of extinction, and therefore it is relevant to discuss the vegetation types on the property and their conservation status. Mucina and Rutherford (2006) include the area within which West Slopes 5828 is located as part of CB4 Pondoland-Ugu Sandstone Coastal Sourveld, but Ezemvelo KZN Wildlife have refined the description and separated it into two further veld types. According to their vegetation coverage, therefore, the bulk of West Slopes 5828 consists of CB6 KwaZulu-Natal Coastal Belt Thornveld, whilst a very small portion of the eastern, upper section around the farmhouse consists of CB3 KwaZulu-Natal Coastal Belt Grassland. The entire area of the farm West Slopes 5828 is located within an Irreplaceable Critical Biodiversity Area, as described in Section 3.3.

FOz5 Pondoland Scarp Forest is found on the property, Ndongini, slightly upstream, on the steep gradients overlooking the Mzimkhulu River. Biogeographically, and from the point of view of biodiversity, Scarp Forest is considered to be the most valuable forest type in South Africa (Mucina and Rutherford, 2006). These forests are under threat, mostly from overexploitation and, indeed, in previous work that has been done by the author of this report in the general area, there was evidence of extensive exploitation of the forest, such as bark stripping, *muthi* extraction and cutting of poles for building. There are riparian forests along all of the streams and drainage lines in the area, as well as along the Mzimkhulu River and on all of the south-facing slopes, which show characteristics of Scarp Forest.

Transformation of natural veld in the surrounding area is high. Land use in the area is

scale physical changes within that geographic area.

primarily sugar cane farming (over 88 % of the cultivated area) and subsistence farming in the communal areas. However, subsistence farming areas are undergoing rapid development to small-scale sugar cane farming and small-scale commercial tree farming, which is resulting in the loss of vast areas of natural vegetation (Mucina and Rutherford, 2006). In addition to large-scale transformation, alien plants are a major and growing threat, with *Chromolaena odorata* and *Lantana Camara* being the major threat. In communal areas, indiscriminate burning of grasslands affects many natural plant communities and the ecological functioning of bush clumps and forest margins.

The average annual rainfall for the area is 1000 mm, with the majority of rainfall falling over a six month period during the summer and about 31.8 % of the annual rainfall being experienced in the winter. There are often downpours and, as a result of the incised nature and steepness of the coastal catchments, there is little surface water storage, with the majority of surface water creating major flood peaks. This means that the water levels in drainage lines and streams rise rapidly to become raging torrents. This has serious implications for mining and the subsequent damage to animal habitats when the hydrology of the area is disrupted.

Portion 9 of West Slopes 5828 is located on the extremely steep eastern bank of the Mzimkhulu River. It slopes from the highest point in the north-east of the property at 260 m a.s.l to the Mzimkhulu River at ~ 20 m a.s.l. Riparian forest and thicket are found from the banks of the Mzimkhulu River in the west for a distance of about 250 m, as well as on the fringes of a steep, rocky stream running along the northern boundary of the property. A grassy patch extends from the top of the hill, down the steep slope and around the farmhouse and sheds, though the immediate area around the farmhouse and sheds is heavily infested with alien plants such as *Chromolaena odorata* (Triffid Weed), *Lantana camara* (Lantana), *Solanum mauritianum* (Bugweed) and *Tithonia diversifolia* (Mexican Sunflower).

3 METHOD AND DATA SOURCES

The compilation of the faunal assessment consisted of two site visits and a desktop study, and drew from the experience of the author working in the area over a period of 21 years.

The two site visits were undertaken on the 19 March 2019 and the 11 April 2019. Notes were made of the general condition of the site, as well as any signs of important bird nests or other important animal habitat. Molluscs and millipedes were searched for and photographs were taken of the site (Appendix 2: Photos). The second site visit was particularly focussed on trying to ascertain whether or not the Endangered Kloof Frog (*Natalobatrachus bonebergi*) was present in the stream.

During the desktop study, existing animal species' records were extracted for quarter degree square 3030CB, as described below. The information presented and discussed as a result of the desktop study was drawn from the following sources:

1. Modelling (Ezemvelo KZN Wildlife).
2. Biodiversity Sector Plans, including Minset (Ezemvelo KZN Wildlife).
3. University of Cape Town Animal Demography Unit (ADU) – verified observations.
4. Available literature (as cited in the individual sections).
5. The author's personal knowledge of habitats and distribution.

There are certain deficiencies inherent in each of the data sources and these are discussed in the following sections (3.1-3.2).

3.1 Ezemvelo KZN Wildlife database

It is important to note that the KZN Wildlife species database consists of a combination of modelled and actual recorded occurrences of species and that, even within protected areas managed by them, this database does not nearly include all of the species in those areas. The greatest confidence is placed in sampled records. However, ironically, sometimes species that are common in a protected area are not recorded in databases because nobody thought to sample them. It is clear that this database is quite inadequate on its own to predict animal species distributions, particularly because it does not take into account actual conditions on any given site. Therefore it takes intelligent interpretation and must be supplemented by local knowledge or direct fieldwork. This was therefore supplemented by available literature as listed in 3.2 below.

3.2 Available literature

In 1974, Mentis compiled a distribution list of wild animals in the erstwhile province of Natal (Mentis, 1974). In 1984 a complete inventory of animals found in the nearby Oribi Gorge Nature Reserve was undertaken by Bourquin, and Mathias (1984).

In the early 1990s, David Rowe-Rowe, of the Natal Parks Board, compiled two booklets on the occurrence and distribution of carnivores (Rowe-Rowe, 1992) and ungulates (Rowe-Rowe, 1994) in Natal. The data was sourced from Natal Parks Board internal records, as well as from farm data sheets compiled by Zone Officers. At that stage, conservation in the Province was divided between the Natal Parks Board and the KwaZulu Bureau of Natural Resources, so, unfortunately, these booklets do not adequately cover the former KwaZulu

homeland areas. Nevertheless, they are a reasonable starting point for determining the distribution of these mammals, and a combination of the knowledge of the animals' habitat requirements and some intelligent extrapolation can give a reasonable idea of what to expect in a given area of the Province.

Other relevant reports produced under the auspices of Brousse-James & Associates include Brousse-James & Associates (2012), Herbert (2002), Hamer (2011) and Harvey (2011). Work done on Kloof Frogs in the area by Jeanne Tarrant was also consulted (Tarrant, 2014).

3.3 Biodiversity Sector Plans

A number of Biodiversity Sector Plans (BSPs) have been developed by KZN Wildlife for District Municipalities throughout KwaZulu-Natal. These BSPs were developed as a precursor to a bioregional plan for the Province. The purpose of a BSP is to provide a map of biodiversity priorities, with accompanying land use planning and decision-making guidelines, to inform land use planning, environmental assessment and authorisations, as well as natural resource management. The biodiversity priorities are identified as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). KZN Wildlife has stated that it is important that the BSP maps are consulted by environmental consultants when undertaking the EIA process or compiling biodiversity reports for the process.

CBAs are those areas of natural or near-natural features, habitats or landscapes that include terrestrial, aquatic and marine areas that are considered critical for (i) meeting national and provincial biodiversity targets and thresholds; (ii) safeguarding areas required to ensure the persistence and functioning of species and ecosystems, including the delivery of ecosystem services; and/or (iii) conserving important locations for biodiversity features or rare species. Conservation of these areas is crucial, in that if these areas are not maintained in a natural or near-natural state, biodiversity conservation targets cannot be met.

Ecological Support Areas (ESAs) are functional, but not necessarily entirely natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the Critical Biodiversity Areas.

CBAs can be divided into two sub-categories, namely "Irreplaceable" and "Optimal" and each of these can be divided up into further sub-categories. Irreplaceable areas are those that are considered critical for meeting biodiversity targets and thresholds and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.

1. The Irreplaceable Areas category consists of:
    a. Irreplaceable Areas (Strategic Conservation Assessment - SCA).
    b. Irreplaceable Linkages (Terrestrial and Aquatic).
    c. Expert Input.
2. The Optimal category consists of:
    a. Optimal (SCA).
    b. Expert Input.

The Ecological Support Areas category is made up of four sub-categories, namely:

1. ESA (SCA): Functional but not necessarily entirely natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes.
2. ESA: Expert input - Areas identified by local experts as areas of functional but not

necessarily entirely natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the Critical Biodiversity Areas (CBAs).
3. ESA: Species Specific - Areas required for the persistence of specific species.
4. ESA: Corridors - Corridors created to facilitate linkages in the landscape.

The entire area of the farm West Slopes 5828, including all portions, is located within an Irreplaceable Critical Biodiversity Area.

3.4 University of Cape Town Animal Demography Unit (ADU)

The University of Cape Town (UCT) Animal Demography Unit (ADU) runs a Virtual Museum (vmus.adu.org.za), which provides a platform for citizen scientists to contribute to biodiversity projects. The concept was developed by ADU and the public are encouraged to submit digital photos of various species, along with certain basic information (including location). The species are identified by observers, but confirmed by a panel of experts. This assists in compiling distribution maps, and in providing species lists for selected areas.

This ADU data is recorded at the coarse resolution of quarter degree squares and some of the databases require some significant "cleaning up", particularly the mammals database. Therefore, the species lists need to be interpreted intelligently. Within a particular quarter degree square, one needs to determine whether or not the site under discussion has the habitat required by the species in question and thus if the habitat requirements are not met, that species can be left off the list.

3.5 Red Data Lists

Red Data Lists (Red Lists) and Red Data Books are scientific publications that document the conservation status of species. They are based on a system that categorises species according to their risk of extinction. Red Lists are not in themselves legislation to protect species, but are used to inform threatened species legislation.

Red Data List Categories
1. Critically Endangered (CE): A taxon is considered to be facing an extremely high risk of extinction in the wild.
2. Endangered (E): A taxon is considered to be facing a very high risk of extinction in the wild.
3. Vulnerable (V): A taxon is considered to be facing a high risk of extinction in the wild.
4. Near Threatened (NT): Does not qualify for Critically Endangered (CE), Endangered (E) or Vulnerable (V) now, but is close to qualifying for, or is likely to qualify for, a threatened category in the near future.
5. Least Concern (LC): Does not qualify for CE, E, V or NT. Widespread and abundant taxa are included in this category.
6. Data Deficient (DD): There is inadequate information to make a direct or indirect assessment of the taxon's risk of extinction based on its distribution and/or population status. More information on this taxon is required and acknowledges the possibility that future research will show that threatened classification is appropriate.
7. Not Listed (NL): Not a species considered to be at risk.

4 FAUNAL ASSESSMENT

A total of 6 fish, 14 amphibians, 9 lizards, 12 snakes and 40 mammal species have been recorded at Oribi Gorge by the Natal Parks Board (now Ezemvelo KZN Wildlife) and documented in 1984 (Bourquin & Mathias). It is likely that many of these documented species occur within the greater West Slopes 5828, although not all of the specialised habitats present in the Oribi Gorge occur on the property.

4.1 Mammals

The sour nature of the veld means that there probably was never a high incidence of large mammals in the grasslands in and around West Slopes 5828. The incidence of antelope in the area at present is very low, because of the proximity of communal areas and uncontrolled access by people onto all of the properties in the general area. A lot of other animal species would also be heavily persecuted by uncontrolled hunting and presence of domestic dogs.

Naturally-occurring ungulates found in the general area today, though in low numbers, include blue duiker, bushbuck, bushpig and grey duiker. Naturally-occurring carnivores include aardvark, aardwolf, African wild cat (highly likely to be hybridised with domestic cats), banded mongoose, black-backed jackal, Cape clawless otter, caracal, large grey mongoose, large-spotted genet, leopard, slender mongoose, serval, striped polecat, possibly striped weasel, water mongoose and white-tailed mongoose. Other mammals recorded in the general area include baboons, bushbaby, dassies, greater red rock hare, porcupine, scrub hares, vervet and samango monkeys. There are also records of a number of rodent and bat species in the area (Mentis, 1974; Bourquin & Mathias, 1984; Rowe-Rowe, 1978).

In addition, historically the area would have had buffalo, common reedbuck, eland, elephant, hippo, lion, oribi, red hartebeest, zebra, and possibly black wildebeest and red duiker. The last elephant shot in the region was at Esperanza in 1860 and the last lion was shot by the Mzimkhulu River in 1865 by General Bisset.

Threatened forest species in the general area include samango monkey, dassie (tree hyrax), Temminck's hairy bat, Sclater's forest shrew and blue duiker. Threatened grassland species include oribi (not on West Slopes 5828), the rough-haired golden mole and serval.

Species that occur in the area (on NPC-Cimpor land), but that did not occur historically, include blesbok, impala and nyala. The presence of nyala in the area should be seriously questioned since they compete with naturally-occurring bushbuck and nyala should be eliminated if they migrate onto West Slopes 5828.

Access control on the adjacent Rossmin biodiversity offset area on the northern boundary of Portion 9 of Westlands 5828 may possibly encourage the recovery of mammal species over time.

Although the heavy hunting pressure has drastically reduced the number of larger mammals living in the area, West Slopes and surrounding properties have valuable, diverse and intact habitats for many mammal species.

4.2 Birds

The 3030CB bird list extracted from the Roberts Birds CD includes 437 birds. David Johnson edited this list for work undertaken on the Rossmin Westlands site in 2011 to exclude vagrants and birds of habitats not represented in the immediate area. The list was thus reduced to 199 species. These are the species that could occur on the greater West Slopes 5828, even if only as isolated occurrences (refer also to Harrison *et al.*, 1997). Westlands has almost identical habitats to West Slopes, therefore this list can be considered valid for West Slopes.

The Trogons Bird Club, based in Port Shepstone, has done a number of bird surveys on NPC-Cimpor land on the southern side of the Mzimkhulu River and has compiled a list of 139 species. The bird list for the Oribi Gorge Nature Reserve compiled by Ezemvelo KZN Wildlife includes 237 species and many of the birds that occur there should occur within West Slopes. Nevertheless, it is important to keep in mind that these lists include "once-offs" and species of specialised habitats found only in the Nature Reserve.

The Oribi Conservancy and Trogons Bird Club list include 139 species, but they include 26 species which would be found in habitats not present on West Slopes 5828. The remaining 113, together with a few of the rarer "fringe" species, form the basis of the following discussion.

Red Data Species (Barnes, 2000)
The Cape Vulture, red-listed as Vulnerable, does not appear on the short lists, but is on both longer lists and, since there is a breeding colony on a farm adjacent to Oribi Gorge Nature Reserve. This colony lies at the south-eastern extremity of the breeding range. The Cape Vulture is endemic to southern Africa, with a population of about 10,000. The combination of rarity and endemism makes it a very important species. West Slopes 5828 lies within the foraging range of the colony. In former times, Cape Vultures relied upon carcases of indigenous animals. Today, domestic stock makes up about 90 % of their diet, so the species is more-or-less reliant, certainly in this area, upon human activity. Open grassy areas are the favoured foraging habitat, but obviously are of little use in the absence of domestic stock.

The African Crowned Eagle is red-listed Near-threatened. It is uncommon simply because it is a large territorial predator. The ridges and intervening riverine vegetation on the property will be quite a small part of one territory. The forest in the area will be the most important foraging area, as opposed to the open ridges which would be little used. No obvious nest trees have been noted in the area, primarily because all large trees were removed in the 1900s due to limestone mining on the south bank of the Mzimkhulu River, during which time the forests of the north bank were also affected by felling of large trees.

The African Finfoot, red-listed Vulnerable is known from the Mzimkhulu River immediately below the site. It is a habitat specialist, relying upon relatively clean flowing water with dense overhanging vegetation. Cumulative damage to local streams, for example, to the one running between Portion 9 of West Slopes 5828 and the Rossmin biodiversity offset area, will cause changes to the river, most notably by increasing the silt load.

The Southern Ground-Hornbill, red-listed Vulnerable, does not appear on the short lists, but is on both longer lists, and a family lives in and around Oribi Gorge Nature Reserve. Although widespread in the eastern and south-eastern sub-tropics of South Africa, its social

system means that it will always be rare. Each family has a territory of about 100 km^2, which must consist mostly of open habitat. The more open parts of West Slopes 5828 could be utilised by them, but to-date there have been no observations of Ground Hornbills by people working on the Rossmin biodiversity offsets area (Rem of West Slopes 5828).

The Knysna Warbler, red-listed Vulnerable, is both endemic and rare. Its total world population is probably less than 10,000. It is confined to dense evergreen thickets near the coast, with its easterly limit at Mbumbazi (nearby, approximately 17 km to the south-west). Until recently, it was not known at all in KwaZulu-Natal, and its presence might represent an extending range or poor recording in the past. Because of its furtive nature, it is poorly known. There is a possibility that it could be found on West Slopes 5828. To-date, no Knysna Warblers, but plenty of Barratt's Warblers, have been noted on the Rossmin biodiversity offset area on Rem of West Slopes 5828.

Endemics:

Cape Vulture
Forest Buzzard
Jackal Buzzard
Knysna Turaco
Knysna Warbler
Southern Boubou
Southern Tchagra
Cape White-eye
Cape Weaver
Forest Canary

Endemic birds always have intrinsic conservation interest. However, apart from the Cape Vulture and Knysna Warbler, discussed above, none of the others is rare or endangered.

Bird List, as extracted from Roberts CD for 3030CB and edited by David Johnson

Rob	English Name
63	Blackheaded Heron
71	Cattle Egret
83	White Stork
86	Woollynecked Stork
91	Sacred Ibis
94	Hadeda Ibis
102	Egyptian Goose
118	Secretarybird
122	Cape Vulture
126	Black Kite
126.1	Yellowbilled Kite
127	Blackshouldered Kite
128	Cuckoo Hawk
130	Honey Buzzard
135	Wahlberg's Eagle
136	Booted Eagle
139	Longcrested Eagle
140	Martial Eagle
141	Crowned Eagle
149	Steppe Buzzard
150	Forest Buzzard
152	Jackal Buzzard
155	Redbreasted Sparrowhawk
157	Little Sparrowhawk
158	Black Sparrowhawk
160	African Goshawk
161	Gabar Goshawk
169	Gymnogene
172	Lanner Falcon
173	Northern Hobby Falcon
180	Eastern Redfooted Kestrel
181	Rock Kestrel
188	Coqui Francolin
196	Natal Francolin
198	Rednecked Francolin
200	Common Quail
203	Helmeted Guineafowl
205	Kurrichane Buttonquail
211	Corncrake
229	African Finfoot
297	Spotted Dikkop
350	Rameron Pigeon
352	Redeyed Dove
354	Cape Turtle Dove
355	Laughing Dove
358	Greenspotted Dove
359	Tambourine Dove
360	Cinnamon Dove
361	African Green Pigeon
370	Knysna Lourie
371	Purplecrested Lourie
374	Eurasian Cuckoo
377	Redchested Cuckoo
378	Black Cuckoo
382	Jacobin Cuckoo
384	Emerald Cuckoo
385	Klaas's Cuckoo

386	Diederik Cuckoo
391	Burchell's Coucal
401	Spotted Eagle Owl
404	Eurasian Nightjar
405	Fierynecked Nightjar
408	Freckled Nightjar
411	Eurasian Swift
412	Black Swift
415	Whiterumped Swift
417	Little Swift
418	Alpine Swift
421	Palm Swift
424	Speckled Mousebird
426	Redfaced Mousebird
427	Narina Trogon
432	Pygmy Kingfisher
435	Brownhooded Kingfisher
444	Little Bee-eater
446	Eurasian Roller
451	African Hoopoe
452	Redbilled Woodhoopoe
455	Trumpeter Hornbill
460	Crowned Hornbill
463	Southern Ground Hornbill
464	Blackcollared Barbet
469	Redfronted Tinker Barbet
473	Crested Barbet
474	Greater Honeyguide
475	Scalythroated Honeyguide
476	Lesser Honeyguide
478	Sharpbilled Honeyguide
483	Goldentailed Woodpecker
484	Knysna Woodpecker
486	Cardinal Woodpecker
488	Olive Woodpecker
489	Redthroated Wryneck
494	Rufousnaped Lark
518	Eurasian Swallow
527	Lesser Striped Swallow
529	Rock Martin
530	House Martin
536	Black Sawwing Swallow
538	Black Cuckooshrike
540	Grey Cuckooshrike
541	Forktailed Drongo
543	Eurasian Golden Oriole
545	Blackheaded Oriole
547	Black Crow
548	Pied Crow
550	Whitenecked Raven
554	Southern Black Tit
568	Blackeyed Bulbul
569	Terrestrial Bulbul
572	Sombre Bulbul
574	Yellowbellied Bulbul
576	Kurrichane Thrush
577	Olive Thrush
581	Cape Rockthrush
589	Familiar Chat
596	Stonechat
598	Chorister Robin
600	Natal Robin
601	Cape Robin
606	Starred Robin
613	Whitebrowed Robin
616	Brown Robin
619	Garden Warbler
637	Yellow Warbler
643	Willow Warbler
645	Barthroated Apalis
648	Yellowbreasted Apalis
651	Longbilled Crombec
657	Greenbacked Bleating Warbler
661	Grassbird
664	Fantailed Cisticola
672	Rattling Cisticola
678	Croaking Cisticola
679	Lazy Cisticola
681	Neddicky
683	Tawnyflanked Prinia
689	Spotted Flycatcher
691	Bluegrey Flycatcher
694	Black Flycatcher
700	Cape Batis
701	Chinspot Batis
708	Bluemantled Flycatcher
710	Paradise Flycatcher
716	Grassveld Pipit
718	Plainbacked Pipit
720	Striped Pipit
728	Yellowthroated Longclaw
732	Fiscal Shrike
733	Redbacked Shrike
736	Southern Boubou
740	Puffback
741	Brubru
742	Southern Tchagra
744	Blackcrowned Tchagra
747	Gorgeous Bush Shrike
748	Orangebreasted Bush Shrike
750	Olive Bush Shrike
751	Greyheaded Bush Shrike
761	Plumcoloured Starling
764	Glossy Starling
768	Blackbellied Starling
769	Redwinged Starling
775	Malachite Sunbird
783	Lesser Doublecollared Sunbird
785	Greater Doublecollared Sunbird
787	Whitebellied Sunbird
789	Grey Sunbird
790	Olive Sunbird
792	Black Sunbird
793	Collared Sunbird
796	Cape White
803	Cape Sparrow
804	Southern Greyheaded Sparrow
805	Yellowthroated Sparrow
807	Thickbilled Weaver
808	Forest Weaver
810	Spectacled Weaver
811	Spottedbacked Weaver
820	Cuckoofinch
821	Redbilled Quelea
828	Redshouldered Widow
831	Redcollared Widow

835	Green Twinspot	864	Black Widowfinch
840	Bluebilled Firefinch	869	Yelloweyed Canary
844	Blue Waxbill	872	Cape Canary
846	Common Waxbill	873	Forest Canary
848	Grey Waxbill	877	Bully Canary
852	Quail Finch	881	Streakyheaded Canary
857	Bronze Mannikin	884	Goldenbreasted Bunting
858	Redbacked Mannikin		
860	Pintailed Whydah		

4.3 Reptiles

A total of 26 reptile species have been recorded in the ADU database for quarter degree square 3030CB. Species seen on previous field visits (Harvey, 2011), but not listed in the ADU database include Distant's Ground Agama (*Agama aculeata distanti*), Spotted Gecko (*Pachydactylus maculatus*) and Walberg's Snake-eyed Skink (*Afroblepharus walbergi*). In addition, a Nile (Water) Monitor (*Varanus niloticus*) was flushed in the stream on the edge of the property during the recent site visit on 19 March 2019 (Appendix 2: Photo 5). Species in the ADU database which have also been seen on site during previous visits include the Red-lipped Snake (*Crotaphopeltis hotamboeia*) and Spotted Bush Snake (*Philothamnus semivariegatus*). This brings the total to 30 species.

Table 1: Reptile list for 3030CB (30 species).

Family	Scientific name	Common name	RDB	ADU/Seen
Agamidae	*Acanthocercus atricollis*	Southern Tree Agama	LC	
	Agama atra	Southern Rock Agama	LC	
	Agama aculeata distanti	Distant's Ground Agama	LC	Seen
Chamaeleonidae	*Bradypodion melanocephalum*	KwaZulu Dwarf Chameleon	V	
	Chamaeleo dilepis	Common Flap-neck Chameleon	LC	
Colubridae	*Crotaphopeltis hotamboeia*	Red-lipped Snake	LC	ADU & Seen
	Dasypeltis inornata	Southern Brown Egg-eater	LC	
	Dispholidus typus typus	Boomslang	LC	
	Philothamnus hoplogaster	South Eastern Green Snake	LC	
	Philothamnus semivariegatus	Spotted Bush Snake	LC	ADU & Seen
	Thelotornis capensis capensis	Southern Twig Snake	LC	
Elapidae	*Dendroaspis angusticeps*	Green Mamba	V	
	Elapsoidea sundevallii sundevallii	Sundevall's Garter Snake	LC	
	Naja mossambica	Mozambique Spitting Cobra	LC	
Gekkonidae	*Afroedura pondolia*	Pondo Flat Gecko	LC	
	Hemidactylus mabouia	Common Tropical House Gecko	LC	
	Lygodactylus capensis capensis	Common Dwarf Gecko	LC	
	Pachydactylus maculatus	Spotted Gecko		Seen
Lamprophiidae	*Duberria lutrix lutrix*	South African Slug-eater	LC	
	Lycodonomorphus laevissimus	Dusky-bellied Water Snake	LC	
	Lycodonomorphus rufulus	Brown Water Snake	LC	
	Lycophidion capense capense	Cape Wolf Snake	LC	
	Psammophis brevirostris	Short-snouted Grass Snake	LC	
Pelomedusidae	*Pelomedusa subrufa*	Central Marsh Terrapin	LC	
Scincidae	*Afroblepharus walbergi*	Walberg's Snake-eyed Skink	LC	Seen

Family	Scientific name	Common name	RDB	ADU/Seen
	Acontias plumbeus	Giant Legless Skink	LC	
	Trachylepis varia sensu lato	Common Variable Skink	LC	
Typhlopidae	*Afrotyphlops bibronii*	Bibron's Blind Snake	LC	
Varinidae	*Varanus niloticus*	Nile (Water) Monitor	E	Seen
Viperidae	*Causus rhombeatus*	Rhombic Night Adder	LC	

4.4 Frogs

Frogs are particularly important as indicator species of ecosystem health, but they are also important because it is clear that amphibian populations are declining throughout the world. These declines have not just been in habitats heavily impacted by humans, but have also occurred in pristine habitats, though in South Africa the declines are not as directly evident as in other parts of the world. There are complex factors involved in this general decline and they include habitat loss or modification, global warming, depletion of the stratospheric ozone, chemical pollution, human appetite for frogs, the pet trade, introduced predators and infectious disease.

The amphibian species list (26 species) for the quarter degree square 3030CB was downloaded from ADU (2011) and the Red Listing and descriptive source for frogs was Minter *et al.* (2004). The list is displayed in Table 2. Five of those species, namely Striped Stream Frog (*Strongylopus fasciatus*), Clicking Stream Frog (*Strongylopus grayii*), Raucous Toad (*Amietophrynus rangeri*), Red Toad (*Schismaderma carens*)and Mozambique Rain Frog (*Breviceps mossambicus*) were seen on previous field visits on Westlands, just north of West Slopes 5828 (Harvey, 2011).

Table 2: Frog list for 3030CB (26 species).

Family	Scientific name	Common name	RDB	ADU/Seen
Arthroleptidae	*Arthroleptis wahlbergi*	Bush Squeaker	LC	
	Leptopelis natalensis	Forest Tree Frog	LC	
Brevicepitidae	*Breviceps mossambicus*	Mozambique Rain Frog	LC	ADU & Seen
	Breviceps verrucosus	Plaintive Rain Frog	LC	
Bufonidae	*Schismaderma carens*	Red Toad	LC	ADU & Seen
	Sclerophrys capensis	Raucous Toad	LC	ADU & Seen
	Sclerophrys gutturalis	Guttural Toad	LC	
Hyperoliidae	*Afrixalus fornasinii*	Greater Leaf-folding Frog	LC	
Hyperoliidae	*Afrixalus spinifrons*	Natal Leaf-folding Frog	LC	
	Hyperolius marmoratus	Painted Reed Frog	LC	
	Hyperolius microps	Sharp-headed Long Reed Frog	LC	
	Hyperolius pusillus	Water Lily Frog	LC	
	Hyperolius semidiscus	Yellowstriped Reed Frog	LC	
	Hyperolius tuberilinguis	Tinker Reed Frog	LC	
	Kassina senegalensis	Bubbling Kassina	LC	
Phrynobatrachidae	*Phrynobatrachus mababiensis*	Dwarf Puddle Frog	LC	
	Phrynobatrachus natalensis	Snoring Puddle Frog	LC	
Pipidae	*Xenopus laevis*	Common Platanna	LC	

Family	Scientific name	Common name	RDB	ADU/Seen
Ptychadenidae	*Ptychadena oxyrhynchus*	Sharpnosed Grass Frog	LC	
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	LC	
	Cacosternum boettgeri	Common Caco	LC	
	Cacosternum nanum	Bronze Caco	LC	
	Natalobatrachus bonebergi	Kloof Frog	E	ADU & Seen
	Strongylopus fasciatus	Striped Stream Frog	LC	ADU & Seen
	Strongylopus grayii	Clicking Stream Frog	LC	ADU & Seen
	Tomopterna natalensis	Natal Sand Frog	LC	

The Endangered Kloof Frog (*Natalobatrachus bonebergi*) has been recorded in the nearby Hlokohloko Valley. Since the stream running on the northern edge of Portion 9 of West Slopes 5828 has perfect habitat for Kloof Frogs, with clear running streams and lots of pools with overhanging vegetation (Appendix 2: Photo 4), a second site visit was undertaken on 11 April 2019 to look for them. The best method for detecting the species itself is through visual detection of egg clumps, which are very distinguishable and are laid in conspicuous positions attached to surfaces above slow-flowing sections of stream. A number of egg clumps were found during that site visit and a lot of frogs were also observed (Appendix 2: Photos 6-10).

For background information on the Kloof Frog, Dr Jean Tarrant wrote a report for NPC-Cimpor (Tarrant, 2014), which is summarised below.

The Kloof Frog is restricted to lowland riparian forests of southern KwaZulu-Natal and the northern Eastern Cape with Dwesa Nature Reserve as its southernmost locality. The species is known from only nine locations, between 50 and 900 m.a.s.l. It inhabits rocky streams and adjacent vegetation in densely forested ravines. It is a semi-arboreal specialist, requiring clear shallow streams with overhanging vegetation. Kloof Frogs are also good swimmers and are well camouflaged in their environment of leaf-litter and rocks. They have an extended breeding season from October - May. Males have a very quiet call which they issue from the river bank or elevated positions on rocks or vegetation above the water.

Gelatinous masses consisting of 75-95 eggs are deposited on rock surfaces or vegetation overhanging pools. Females have been observed to keep the egg clutches moist with liquid from their cloacas (Appendix 2: Photo 6). Tadpoles hatch after about six days and drop into the water to complete development, which takes approximately two months.

The species has been Red Listed as Endangered since 2001 (IUCN, 2011). The habitat of the Kloof Frog is being heavily impacted by clearing for agriculture (especially sugar cane) as well as urbanisation, particularly in KwaZulu-Natal. As a result populations of this species are becoming severely fragmented. The proposed mining on Portion 9 of West Slopes 5828 could directly impact on intact habitat of the Kloof Frog. Most amphibian species are restricted in their dispersal activity and are unable to flee (as may be expected from birds or large mammals). Instead, amphibians take refuge in suitable habitat, such as riparian habitats, necessitating the need to protect these areas and maintain appropriate buffer zones around these habitats to ameliorate the effects of mining on them.

The biggest concern with the proposed mining area, particularly the lower, first option, is that it will be virtually impossible to mine and have sufficient access to the mine without impacting on the stream and destroying Kloof Frog habitat. Impacts on the stream could

include direct destruction, as well as disturbance to or destruction of its catchment and buffering vegetation, which could affect both water flow and water quality into the stream.

For this reason alone, Option 1 is fatally flawed. Mining within Option 2 can be considered, but it would have to include sufficient safeguards to ensure consistent and long-term maintenance of both quantity and quality of water entering the stream. Therefore water quality assessments would be needed, both prior to mining (baseline) and at regular intervals during the operational lifespan of the mine. In addition, the breeding status of the frogs should be assessed annually and measures taken to protect them if there is any evidence of negative impacts on the population.

4.5 Invertebrates

4.5.1 Butterflies

Butterflies are particularly important in terms of their host plant specificity. There is a direct relationship between the variety of indigenous plant species and the variety of butterfly species. In addition, the fact that butterflies are conspicuous makes them easier to record than other species. Butterflies are among the few groups of animals for which there is relatively complete data and this fulfils many of the criteria used to define "indicator" groups. Indicator groups reflect habitat health and are thus important in conservation assessment. Such groups have been regarded as flagship species. Knowing the needs of butterflies, their distribution and biology, enables us to more accurately assess rarity, vulnerability to changes and suchlike. In addition, the fact that butterflies, as a group, are rich in species, as opposed to many vertebrate groups of animals, makes butterflies more easily usable and valuable for assessment of habitat health.

The butterfly list (Table 3), as downloaded from the Animal Demography Unit Virtual Museum (VMU, 2011) for the quarter degree square 3030CB gives a total of 171 species, which is a large number of species. It must be kept in mind that the size of the area in a quarter degree square means that the scale will be quite crude and, to get a more accurate assessment of butterfly occurrence, the presence or absence of host plants would need to be confirmed.

Many species butterflies depend on Valley Thicket, Scarp Forest and grassland for their survival (Lawes, *et al.*, 2007). Insects endemic to Pondoland, and that occur in the region, include two butterflies, the greyish Wichgraf's Brown (*Stygionympha wichgrafi grisea*) and the whitish Amakosa Rocksitter (*Durbania amakosa albescens*). In terms of host plants and threats to these two species, Wichgraf's Brown larvae is thought to feed on grasses (Poaceae) and Amakosa Rocksitter's entire life-cycle occurs on lichen-covered rocks.

Table 3: Butterfly list for 3030CB (171 species).

Family	Scientific name	Common name	RDB
Arctiidae	*Ceryx fulvescens*		NL
Crambidae	*Cadarena pudoraria*		NL
Geometridae	*Callioratis abraxas*	Dimorphic tiger	LC
Hepialidae	*Gorgopis zelleri*		NL
Hesperiidae	*Acleros mackenii mackenii*	Macken's dart	LC

Family	Scientific name	Common name	RDB
	Afrogegenes sp.		
	Artitropa erinnys erinnys	Bush night-fighter	LC
	Borbo borbonica borbonica	Olive-haired swift	LC
	Borbo fallax	False swift	LC
	Borbo fatuellus fatuellus	Long-horned swift	LC
	Eretis djaelaelae	Marbled elf	LC
	Eretis umbra umbra	Small marbled elf	LC
	Kedestes macomo	Macomo ranger	LC
	Larsenia gemella	Twin swift	LC
	Metisella metis paris	Gold-spotted sylph	LC
	Metisella orientalis	Eastern sylph	
	Moltena fiara	Strelitzia night-fighter	LC
	Netrobalane canopus	Buff-tipped skipper	LC
	Pelopidas mathias	Black-banded swift	LC
	Pelopidas thrax	White-banded swift	LC
	Sarangesa motozi	Elfin skipper	LC
	Spialia dromus	Forest sandman	LC
	Spialia spio	Mountain sandman	LC
	Tagiades flesus	Clouded forester	LC
Lycaenidae	*Actizera lucida*	Rayed blue	LC
	Alaena amazoula amazoula	Yellow zulu	LC
	Aloeides penningtoni	Pennington's copper	LC
	Anthene amarah amarah	Black striped hairtail	LC
	Anthene larydas	Spotted hairtail	LC
	Anthene lemnos lemnos	Large hairtail	LC
	Axiocerses croesus	Dark-banded scarlet	LC
	Axiocerses tjoane tjoane	Eastern scarlet	LC
	Azanus jesous	Topaz babul blue	LC
	Azanus moriqua	Black-bordered babul blue	LC
	Azanus natalensis	Natal babul blue	LC
	Azanus ubaldus	Velvet-spotted babul blue	LC
	Cacyreus lingeus	Bush bronze	LC
	Cacyreus marshalli	Common geranium bronze	LC
	Chilades trochylus	Grass jewel	LC
	Cigaritis natalensis	Natal bar	LC
	Deudorix antalus	Brown playboy	LC
	Durbania amakosa albescens	Amakoza rocksitter	V
	Eicochrysops hippocrates	White-tipped blue	LC
	Eicochrysops messapus mahallakoaena	Cupreous blue	LC
	Euchrysops barkeri	Barker's smoky blue	LC
	Euchrysops malathana	Common smoky blue	LC
	Euchrysops osiris	Osiris smoky blue	LC
	Hypolycaena philippus philippus	Purplebrown hairstreak	LC
	Iolaus silas	Southern sapphire	LC

Family	Scientific name	Common name	RDB
	Lachnocnema durbani	D'Urban's woolly legs	LC
	Lachnocnema laches	Southern pied woolly legs	LC
	Lampides boeticus	Pea blue	LC
	Leptomyrina gorgias gorgias	Common black-eye	LC
	Leptotes sp.		
	Leptotes pirithous pirithous	Common zebra blue	LC
	Myrina dermaptera dermaptera	Lesser fig tree blue	LC
	Myrina silenus ficedula	Common fig tree blue	LC
	Pentila tropicalis tropicalis	Spotted pentila	LC
	Tarucus bowkeri bowkeri	Bowker's dotted blue	LC
	Tuxentius melaena melaena	Black pie	LC
	Zizeeria knysna knysna	African grass blue	LC
	Zizina otis antanossa	Dark grass blue	LC
	Zizula hylax	Tiny grass blue	LC
Noctuidae	*Achaea echo*		NL
	Chalciope pusilla		NL
	Cyligramma latona		NL
	Egybolis vaillantina vaillantina		NL
	Heraclia perdix		NL
	Hypopyra capensis		NL
	Plecoptera sp.		
	Sphingomorpha chlorea		NL
Notodontidae	*FAMILY NOTODONTIDAE*	Unidentified NOTODONTIDAE	
Nymphalidae	*Acraea aganice aganice*	Wanderer	LC
	Acraea horta	Garden acraea	LC
	Acraea natalica	Natal acraea	LC
	Acraea oncaea	Window acraea	LC
	Acraea petraea	Blood-red acraea	LC
	Amauris albimaculata albimaculata	Layman; Layman friar	LC
	Amauris echeria echeria	Chief, chief friar	LC
	Amauris ochlea ochlea	Novice, novice friar	LC
	Bicyclus anynana anynana	Squinting bush brown	LC
	Bicyclus safitza safitza	Common bush brown	LC
	Byblia anvatara acheloia	Joker	LC
	Cassionympha cassius	Rainforest brown	LC
	Charaxes achaemenes achaemenes	Bushveld charaxes	LC
	Charaxes brutus natalensis	White-barred charaxes	LC
	Charaxes candiope	Green-veined charaxes	LC
	Charaxes cithaeron cithaeron	Blue-spotted charaxes	LC
	Charaxes druceanus druceanus	Silver-barred charaxes	LC
	Charaxes ethalion ethalion	Coast charaxes	LC
	Charaxes jahlusa argynnides	Pearl-spotted charaxes	LC
	Charaxes karkloof karkloof	Karkloof charaxes	LC
	Charaxes saturnus saturnus	Foxy charaxes	LC

Family	Scientific name	Common name	RDB
	Charaxes varanes varanes	Pearl charaxes	LC
	Charaxes zoolina	Club-tailed charaxes	LC
	Coenyra aurantiaca	Pondo shadefly	LC
	Cymothoe coranus coranus	Blonde glider	LC
	Danaus chrysippus orientis	African monarch, Plain tiger	LC
	Eurytela dryope angulata	Golden piper	LC
	Eurytela hiarbas angustata	Pied piper	LC
	Gnophodes betsimena diversa	Yellow-banded evening brown	LC
	Hypolimnas anthedon wahlbergi	Variable diadem	LC
	Hypolimnas misippus	Common diadem	LC
	Junonia hierta cebrene	Yellow pansy	LC
	Junonia natalica natalica	Brown commodore	LC
	Junonia oenone oenone	Blue pansy	LC
	Junonia orithya madagascariensis	Eyed pansy	LC
	Lachnoptera ayresii	Blotched leopard	LC
	Melanitis leda	Twilight Brown	LC
	Neita neita	Neita brown	LC
	Neptis laeta	Common barred sailer	LC
	Neptis saclava marpessa	Spotted sailer	LC
	Paralethe dendrophilus indosa	Forest beauty	LC
	Pardopsis punctatissima	Polka dot	LC
	Phalanta eurytis eurytis	Forest leopard	LC
	Phalanta phalantha aethiopica	African leopard	LC
	Precis archesia archesia	Garden commodore	LC
	Precis octavia sesamus	Gaudy Commodore	LC
	Protogoniomorpha anacardii nebulosa	Clouded Mother-of-pearl	LC
	Protogoniomorpha parhassus	Mother-of-pearl	LC
	Pseudacraea boisduvalii trimenii	Trimen's false acraea	LC
	Pseudacraea eurytus imitator	False wanderer	LC
	Pseudacraea lucretia tarquinea	False chief	LC
	Sevenia boisduvali boisduvali	Boisduval's tree nymph	LC
	Sevenia natalensis	Natal tree-nymph	LC
	Stygionympha wichgrafi grisea	Wichgraf's hillside brown	LC
	Telchinia cabira	Yellow-banded acraea	LC
	Telchinia encedon encedon	White-barred acraea	LC
	Telchinia esebria	Dusky acraea	LC
	Telchinia igola	Dusky-veined acraea	LC
	Telchinia serena	Dancing acraea	LC
	Vanessa cardui	Painted lady	LC
Papilionidae	*Graphium antheus*	Large striped swordtail	LC
	Graphium leonidas leonidas	Veined swordtail	LC
	Graphium policenes policenes	Small striped swordtail	LC
	Papilio dardanus cenea	Mocker swallowtail, Flying Handkerchief	LC
	Papilio demodocus demodocus	Citrus swallowtail	LC

Family	Scientific name	Common name	RDB
	Papilio nireus lyaeus	Green-banded swallowtail	LC
	Papilio ophidicephalus phalusco	Emperor swallowtail	LC
Pieridae	*Afrodryas leda*	Autumn leaf vagrant	LC
	Appias epaphia contracta	Diverse Albatross White	LC
	Belenois aurota	Brown-veined white	LC
	Belenois creona severina	African common white	LC
	Belenois gidica abyssinica	African veined white	LC
	Belenois thysa thysa	False dotted border	LC
	Belenois zochalia zochalia	Forest white	LC
	Catopsilia florella	African migrant	LC
	Colias electo electo	African clouded yellow	LC
	Colotis annae annae	Scarlet tip	LC
	Colotis antevippe gavisa	Red tip	LC
	Colotis auxo auxo	Sulphur orange tip	LC
	Colotis erone	Coast purple tip	LC
	Colotis euippe omphale	Smoky orange tip	LC
	Colotis ione	Bushveld purple tip	LC
	Dixeia charina charina	African small white	LC
	Dixeia pigea	Ant-heap white	LC
	Dixeia spilleri	Sulphur small white	LC
	Eronia cleodora	Vine-leaf vagrant	LC
	Eurema brigitta brigitta	Broad-bordered grass yellow	LC
	Eurema desjardinsii regularis	Angled grass yellow	LC
	Leptosia alcesta inalcesta	African wood white	LC
	Mylothris agathina agathina	Common dotted border	LC
	Mylothris rueppellii haemus	Twin dotted border	LC
	Mylothris trimenia	Trimen's dotted border	LC
	Nepheronia argia varia	Large vagrant	LC
	Nepheronia buquetii buquetii	Buquet's vagrant	LC
	Pinacopteryx eriphia eriphia	Zebra white	LC
	Pontia helice helice	Common meadow white	LC
	Teracolus eris eris	Banded gold tip	LC
Thyretidae	*Automolis sp.*		
	Thyretes caffra		NL

4.5.2 Molluscs

Lime-rich environments usually show an abundance of land snails, due to the fact that the snails require calcium carbonate for everyday biological functions, such as muscle contraction and nerve impulses, as well as shell construction. Availability of environmental calcium is thus a significant limiting factor for mollusc distribution. Deposits of calcium-rich rocks are rare in eastern South Africa and usually occur as "islands". The proposed mining site on Portion 9 of West Slopes 5828 is located within the Marble Delta, which is an island-like deposit of limestone. It is the largest and most important limestone outcrop in the

province of KwaZulu-Natal, which comprises an area of about 40 km^2, at the junction of the Mzimkhulu and Mzimkhulwana Rivers. The insular nature of the Marble Delta formation renders it a particularly important region from the perspective of terrestrial molluscs because, where lime-rich environments occur as isolated island-like deposits amongst rocks of a different composition, there are often interesting endemic snails to be found, i.e., occurring nowhere else in the world.

Dr David (Dai) Herbert, then of the Natal Museum in Pietermaritzburg, collected more than 40 different species of snails in 2001 and 2002 on properties upstream (north) on the Mzimkhulu River from Portion 9 of West Slopes 5828, some of which were quite rare and unusual. Of particular interest was the discovery and description of a species new to science. This species has been described as *Gulella salpinx*, the trumpet hunter snail (Herbert, 2002). It is a small snail, only 7.5 mm long, which, unlike many other snails which feed on plant material, is a carnivore, feeding on soft-bodied creatures that live in the surface soil and leaf litter of well-wooded habitats. It is also unusual in that it does not lay its eggs, but retains them within the parent until they hatch as miniature crawling youngsters.

Prior to the commencement of the EIA process in 2011 for the neighbouring Rossmin Mine, the trumpet hunter snail was only ever found in an area covering 1,000 m^2 on the property Ndongini, on the very steep northern valley slope of the Mzimkhulu River, in an area of relatively dense Valley Thicket/Scarp Forest that showed no signs of ever having been mined (type specimen found at 30°39.056'S: 30°21.361'E). This snail therefore belongs in the highest threat category – Critically Endangered, and so requires the highest level of protection. This translates to protecting the habitat within which it lives, since active protection of the snail itself is not possible. As a result of the high diversity of mollusc species in the area and the fact that there are endemic (particularly the holoendemic *Gulella salpinx*) molluscs in that area, any potential land use changes in the area have required mollusc surveys, to ensure that critical mollusc habitat is not destroyed.

During the mollusc surveys for the Rossmin Mine, a total of 48 species of snails were found in the general area, 13 of them being widespread in Africa and beyond, with 22 of them being South African endemics and 12 being KwaZulu-Natal (KZN) South Coast and Northern Transkei endemics. One of the 48 species was not identified with any certainty (*Gulella* sp. n cf. *farquhari*) and is probably an undescribed ("new") species. Therefore its status in terms of endemicity could not be stated with any certainty. The most significant species in this area are *Gulella salpinx* (not found on West Slopes but found on Westlands and Ndongini) and *G.* sp. n. cf. *Farquharii* (found on Rem of West Slopes), which are extremely narrow range endemic species and which warrant specific conservation attention. The area just north of the proposed mining site on Portion 9 of West Slopes 5828 represents the only known localities for these two species.

Dr Herbert concluded that south-facing forested slopes on the northern side of the Mzimkhulu River in the Marble Delta provides excellent habitat for terrestrial molluscs and that they exhibit a very high level of molluscan diversity for a South African locality. In addition, a number of species are present in relative abundance.

Dr Herbert was of the opinion that, for its size, the area is one of the most malacologically (malacology = the study of molluscs) diverse sites in South Africa, perhaps even the most diverse. The composition is mostly typical of the coastal hinterland of southern KwaZulu-

Natal, with a substantial number of species endemic to the southern KwaZulu-Natal-Transkei region. It is rare to find so many of these present at a single site.

Existing and historical mining operations within the Marble Delta (NPC-Cimpor, iDwala Carbonates and Rossmin), as well as overutilisation by local communities, have had a significant impact on the area and the disturbance has facilitated the proliferation of alien plants, which have degraded much of the un-mined habitat. The authorisation of the Rossmin Mining Right involved considerable negotiations with KZN Wildlife and resulted in Rossmin setting aside the biodiversity offset area on Rem of West Slopes 5828, as well as declaring streams and afforested areas on Westlands and Ndongini as off-limits. Buffer zones of 30 m on streams and 100 m on the Mzimkhulu River were also enforced.

Of the 48 mollusc species found within both Westlands 5829 and West Slopes 5828 in 2011, 37 species were found on the greater West Slopes 5828 area (mostly Rem of West Slopes) and only thirteen were found on Portion 9 of West Slopes 5828, as in Table 4, some of which are shown in Appendix 2: Photos 11-13. A conclusion of the previous report (Brousse-James & Associates, 2012) is that the habitat and underlying geology (less/no limestone) made West Slopes 5828 less favourable for molluscs than in the areas further north that have underling limestone near the surface, though it still has value for mollusc conservation.

Table 4: Mollusc species collected on all West Slopes portions (37 species) with those collected only on West Slopes Portion 9 in 2011 (9 species) and 2019 (7 species) and across both years (13 species).

Species	2011	2019	Either	Endemicity
1. *Afrodonta bilamellaris*	1		1	SA Endemic
2. *Chlamydephorus dimidius*				KZN Endemic
3. *Chondrocyclus ?trifimbriatus*				SA Endemic
4. *Cochlitoma semigranosa*				KZN Endemic
5. *Curvella catarractae*				SA Endemic
6. *Fauxulus ponsonbyanus*				SA Endemic
7. *Gittenedouardia natalensis*		1	1	SA Endemic
8. *Gulella albersi*	1	1	1	KZN Endemic
9. *Gulella calopasa*		1	1	KZN Endemic
10. *Gulella columnella*				KZN Endemic
11. *Gulella gouldi*				Widespread
12. *Gulella himerothales*				SA Endemic
13. *Gulella isipingoensis*				SA Endemic
14. *Gulella natalensis*		1	1	SA Endemic
15. *Gulella sp. n. cf. farquhari*				Widespread
16. *Gulella zelota*	1		1	KZN Endemic
17. *Kaliella barrakporensis*				Widespread
18. *Laevicaulis natalensis*				Widespread
19. *Maizania wahlbergi*	1	1	1	Widespread
20. *Nata vernicosa*	1	1	1	Widespread
21. *Nesopupa farquhari*				SA Endemic
22. *Opeas florentiae*	1		1	SA Endemic
23. *Pupisoma harpula*				Widespread
24. *Pupisoma orcula*				Widespread
25. *Sheldonia poeppigii*	1		1	Widespread
26. *Sheldonia vitalis*				KZN Endemic
27. *Trachycystis aenea*				SA Endemic

Species	2011	2019	Either	Endemicity
28. Trachycystis bathycoele	1		1	SA Endemic
29. Trachycystis burnupi				SA Endemic
30. Trachycystis calorama				KZN Endemic
31. Trachycystis glanvilliana				SA Endemic
32. Trachycystis inclara				SA Endemic
33. Trachycystis lunaris				SA Endemic
34. Trachycystis rudicostata	1		1	Widespread
35. Trachycystis scolopendra		1	1	KZN/Pondoland Endemic
36. Tropidophora insularis				Widespread
37. Tropidophora ligata				Widespread
Total species	**9**	**7**	**13**	

Notes:
- Widespread - Species widespread in southern Africa or beyond.
- SA Endemic - Endemic to South Africa.
- KZN Endemics - Species endemic to KwaZulu-Natal (KZN) south coast and northern Transkei.

4.5.3 Millipedes

Millipedes have limited mobility, which means that they tend to have smaller distributions and thus higher levels of endemism than more mobile invertebrates, such as winged insects. Limited mobility also means that they are unable to move away from disturbance to colonise new areas. Any major disturbance of the habitat inevitably leads to local extinctions, and for endemic species with narrow ranges, complete extinction of the species. Millipedes are therefore often of conservation concern.

A total of 10 species of millipedes have been collected in the general area, with seven species being collected on the greater West Slopes area (mostly on Rem of West Slopes) and three on Portion 9 of West Slopes. Of those, two qualify as Endangered, namely *Doratogonus infragilis* and *Ulodesmus securifer*. Two large millipede species that are endemic to parts of KwaZulu-Natal are found in the region, namely the Strong black millipede (*Doratogonus infragilis*) and the Montane black millipede (*Doratogonus montanus*). Only *Doratogonus infragilis* was collected on Portion 9 of West Slopes 5828 (Appendix 2: Photo 13).

Table 5: Millipedes recorded on West Slopes 5828 (those collected on Portion 9 are highlighted).

Species	Distribution	Threat status
Sphaerotherium dorsale (Gervais, 1847) (Bristly pill millipede)	Limpopo to Knysna in W Cape; inland as far as Drakensberg in KZN, mostly coastal forest.	Least concern: large number of locations and extent of occurrence, and a variety of habitats, so while there is loss of habitat and decline in habitat quality, this species is not threatened at present.
Sphaerotherium giganteum (Porat, 1872) (Giant pill millipede)	Mozambique to Port St Johns in Eastern Cape, eastern region of South Africa.	Near threatened: large area of extent and large number of locations, but a habitat specialist and habitat declining through development, mining and clearing of coastal forest.
Sphaerotherium obtusum (C.L. Koch, 1863) (Obtuse pill millipede)	May have been confused with *S. punctulatum* in the past so distribution from database not accurate.	Data deficient, re-identification of material required before assessment of threat status can be made.

Species	Distribution	Threat status
Sphaerotherium sp.	Probably a new species.	Data deficient. Taxonomy requires attention.
Ulodesmus securifer (Attems, 1928) (Cyanide-producing keeled millipede)	KZN Endemic: only recorded from Port Shepstone and Mid Illovo in KZN.	Endangered: extent of occurrence < 1000 km^2, only three locations known, and habitat quality declining through alien invasive vegetation, and habitat loss ongoing through agriculture and development.
Centrobolus ruber (Attems, 1928) (Silver legged red millipede)	KZN Endemic: Marble Delta (Mzimkhulu River); South Coast: Port Shepstone, Ifafa, Scottburgh; Ngoye Forest.	Vulnerable: extent of occurrence < 5000 km^2, and < 10 locations, with decline in habitat quality through alien invasive vegetation, loss of habitat ongoing through development.
Centrobolus inscriptus (Attems, 1928) (Chequered red millipede)	KZN Endemic: Port Edward, along coast to Dukuduku in the north, and inland to Hluhluwe Game Reserve, and Kranskop and Pietermaritzburg.	Near threatened: extent of occurrence estimated 21,000 km^2, and > 10 locations. Large loss of habitat through development, and likely to become threatened in the near future.
Doratogonus infragilis Hamer, 2000 (Strong black millipede)	KZN Endemic: Oribi Gorge, Hella Hella region near Richmond, between Ixopo and Umzinto.	Endangered: extent of occurrence < 1000 km^2, < 5 locations, and quality of habitat deteriorating as a result of alien invasive plants, and loss of habitat through agriculture.
Orthoporoides n. sp.	Possibly endemic.	Data deficient. Taxonomy needs investigation.
Orthoporoides pontifex (Attems, 1928) (Red-headed pontifex millipede)	Coastal species, from Mozambique, KZN North Coast, Marble Delta first record from South Coast.	Near threatened: extent of occurrence > 20,000 km^2, and > 10 locations; large amount of habitat loss along the coast and likely to become threatened in near future.

4.5.4 Earthworms

Earthworms are considered to be "keystone species" because of how much they influence the physical, chemical and biological properties of the soil. The reasons are the following:

1. They play a crucial role in breaking down organic matter and fertilising the soil, simply through their constant eating and excreting casts which are full of nutrients and bacteria that are beneficial for plants
2. Earthworms are great "soil engineers". As they move through the soil, they loosen and mix it up, helping to aerate and drain it. This brings nutrients to the surface, making the soil more fertile, and helps prevent flooding and erosion.
3. Earthworms are barometers of soil health and toxicity. They're very sensitive to soil pollutants such as pesticide residues or unwanted heavy metals (zinc, lead, etc.), and they are badly affected by changes in land use, such as deforestation to clear the way for intensive farming. This means the health of local worms is proving to be a useful tool to assess the impact of different land usage and pollutants.
4. They an important food source, protein-rich and feed a number of animals.
5. Earthworms can help repair damaged soil during rehabilitation of degraded land.

Herbert's Earthworm (*Proandricus herbertii*) is a species of conservation concern, and is only known from the Marble Delta and the Mzimkhulwana and Mzimkhulu River valleys. It is likely to occur on West Slopes 5828.

4.5.5 Dragonflies

Dragonflies are important in both terrestrial and aquatic habitats. They are predators of other insects, including nuisance insects such as mosquitoes and flies, in both the nymph and adult stages. They also provide prey to birds, frogs, reptiles and other animals.

The dragonfly list (Table 6), as downloaded from the Animal Demography Unit Virtual Museum (VMU, 2011) for the quarter degree square 3030CB, gives a total of 32 species.

Table 6: Dragonfly list for 3030CB (32 species).

Family	Scientific name	Common name	RDB
Aeshnidae	*Anax speratus*	(Eastern) Orange Emperor	LC
Calopterygidae	*Phaon iridipennis*	Glistening Demoiselle	LC
Chlorocyphidae	*Platycypha* sp.	dancing jewels	
	Platycypha caligata	Dancing Jewel	LC
	Platycypha fitzsimonsi	Boulder Jewel	LC
Coenagrionidae	*Agriocnemis falcifera*	White-masked Wisp	LC
	Ceriagrion glabrum	Common Citril	LC
	Pseudagrion hageni	Painted Sprite	LC
	Pseudagrion kersteni	Powder-faced Sprite	LC
	Pseudagrion salisburyense	Slate Sprite	LC
Gomphidae	*Ceratogomphus pictus*	Common Thorntail	LC
	Paragomphus cognatus	Rock Hooktail	LC
	Paragomphus genei	Common Hooktail	LC
Lestidae	*Lestes plagiatus*	Highland Spreadwing	LC
	Lestes virgatus	Smoky Spreadwing	LC
Libellulidae	*Bradinopyga cornuta*	Horned Rockdweller	LC
	Crocothemis erythraea	Broad Scarlet	LC
	Crocothemis sanguinolenta	Little Scarlet	LC
	Nesciothemis farinosa	Eastern Blacktail	LC
	Orthetrum julia	Julia Skimmer	LC
	Palpopleura portia	Portia Widow	LC
	Trithemis sp.		
	Trithemis arteriosa	Red-veined Dropwing	LC
	Trithemis furva	Navy Dropwing	LC
	Trithemis kirbyi	Orange-winged Dropwing	LC
	Trithemis stictica	Jaunty Dropwing	LC
	Zygonyx natalensis	Blue Cascader	LC
Platycnemididae	*Allocnemis leucosticta*	Goldtail	LC
	Elattoneura glauca	Common Threadtail	LC
	Mesocnemis singularis	Common (Forest/Savanna) Riverjack	LC
Synlestidae	*Chlorolestes* sp.	True malachites	
	Chlorolestes tessellatus	Forest Malachite	LC

4.5.6 Lacewings

Lacewing larvae serve as food for fish and other aquatic vertebrates and they are beneficial as predators of agricultural pests (aphids, whiteflies and scale insects).

The lacewing list (Table 7), as downloaded from the Animal Demography Unit Virtual Museum (VMU, 2011) for the quarter degree square 3030CB, gives a total of 4 species.

Table 7: Lacewing list for 3030CB (4 species).

Family	Scientific name	Common name	RDB
Ascalaphidae	*Proctarrelabis involvens*	Owlfly	
Myrmeleontidae	*Banyutus lethalis*		
	Macroleon quinquemaculatus		
Osmylidae	*Spilosmylus interlineatus*		

4.5.7 Scorpions

The scorpion list (Table 8), as downloaded from the Animal Demography Unit Virtual Museum (VMU, 2011) for the quarter degree square 3030CB, only gives a single species.

Table 8: Scorpion list for 3030CB (1 species).

Family	Scientific name	Common name	RDB
Hormuridae	*Opisthacanthus validus*		

4.5.8 Spiders

The spider list (Table 9), as downloaded from the Animal Demography Unit Virtual Museum (VMU, 2011) for the quarter degree square 3030CB, gives a total of 7 species. The KwaZulu-Natal Endemic Tailless whip scorpion (*Damon annulatipe*) was seen in leaf litter amongst rocks next to the stream and this has been added to the spider list, though it is not a true spider as it does not produce silk or venom.

Table 9: Spider list for 3030CB (7 species).

Family	Scientific name	Common name	RDB
Aranaeidae	*Nephila* sp.	Golden orb-web spider	
	Nephilingis cruentata	Hermit spider	
	Caerostris sp.	Bark spider	
	Gasteracantha sp.	Kite spider	
Cyrtaucheniidae	*Homostola* sp.		
Phrynidae	*Damon annulatipe*	Tailless whip spider/scorpion	
Theraphosidae	*Brachionopus* sp.		
	Harpactira curator		

4.5.9 Dung Beetles

Dung beetles are very important for the breaking up of dung which would otherwise provide an ideal breeding ground for dangerous flies and parasites. The dung balls are used as brood balls for the dung beetles eggs and to feed the larvae when they hatch.

The dung beetle list (Table 10), as downloaded from the Animal Demography Unit Virtual Museum (VMU, 2011) for the quarter degree square 3030CB, gives a total of 7 species.

Table 10: Dung Beetles for 3030CDB (7 species).

Family	Scientific name	Common name	RDB
Scarabaeidae	*Catharsius sesostris*		
	Catharsius tricornutus		
	Copris elphenor		
	Onthophagus ebenus		
	Proagoderus lanista		
	Scarabaeus galenus		
	Xinidium dentilabris		

No dung beetles were recorded on site.

5 DISCUSSION AND CONCLUSION

Habitat loss is one of the greatest threats facing animals and the biggest cause of extinction of animal species. The entire West Slopes 5828 property is located within the northern section of the Pondoland Centre of Endemism, it is within an Irreplaceable Critical Biodiversity Area and the Mzimkhulu River is listed as a Freshwater Ecosystem Priority Area. The grassland component of West Slopes 5828 and Westlands 5829 is highly diverse. Since 2011, under the auspices of work undertaken by Brousse-James & Associates, over 400 species of grassland-specific grasses and forbs, and 214 tree species been recorded. This translates into habitat for a large number of vertebrate and invertebrate animal species. The general area therefore has very high conservation importance, particularly for immobile endemic plants, molluscs and millipedes. Of particular importance is that there are numerous rocky streams in the area that provide critical habitat for the endangered Kloof Frog (*Natalobatrachus bonebergi*) and many other animal species.

Portion 9 of West Slopes 5828 has one of those rocky streams, running from east to west down a very steep valley within a small, isolated catchment. A large proportion of that catchment (southern and eastern portions) is contained within the property and any disturbance to the catchment will destroy the integrity of the stream, which at present is fringed by riparian forest and has numerous clean and clear rocky pools supporting a healthy population of Kloof Frogs, which were actively breeding at the time of the site visits in March and April 2019. During the April 2019 site visit, the Endangered endemic millipede, *Doratogonus infragili,* was also found on a branch along the stream bank, and the unusual KwaZulu-Natal (KZN) and Pondoland endemic snail, *Trachycystis scolopendria*, was found in leaf litter amongst the rocks next to the stream.

In terms of protection of biodiversity in the area, Rem of West Slopes 5828 was set aside as a biodiversity offset area for the Rossmin Mine and a Biodiversity Stewardship Agreement was formalised with Ezemvelo KwaZulu-Natal Wildlife. This offset area was primarily set aside for protection of endemic invertebrates (molluscs and millipedes), but has general biodiversity benefits as well. The presence of another mine on its southern boundary, namely Portion 9 of West Slopes 5828, will contribute to isolating that offset area from other natural areas, particularly because its eastern boundary is sugar cane.

The biggest concern with the proposed mining area on Portion 9 of West Slopes 5828, particularly the lower, Option 1, is that it will be virtually impossible to mine and have sufficient access to the mine without impacting on the stream and destroying Kloof Frog habitat and habitat for other Endangered and endemic species. For this reason, Option 1 is fatally flawed from an ecological perspective. Mining within Option 2 can be considered, but it would have to include sufficient safeguards to ensure consistent and long-term maintenance of both quantity and quality of water entering the stream. Therefore water quality assessments would be needed, both prior to mining (baseline) and at regular intervals during the operational lifespan of the mine. In addition, the breeding status of the frogs should be assessed annually and measures taken to protect them if there is any evidence of negative impacts on the population.

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7 APPENDICES

Appendix 1: Maps

Appendix 2: Photographs

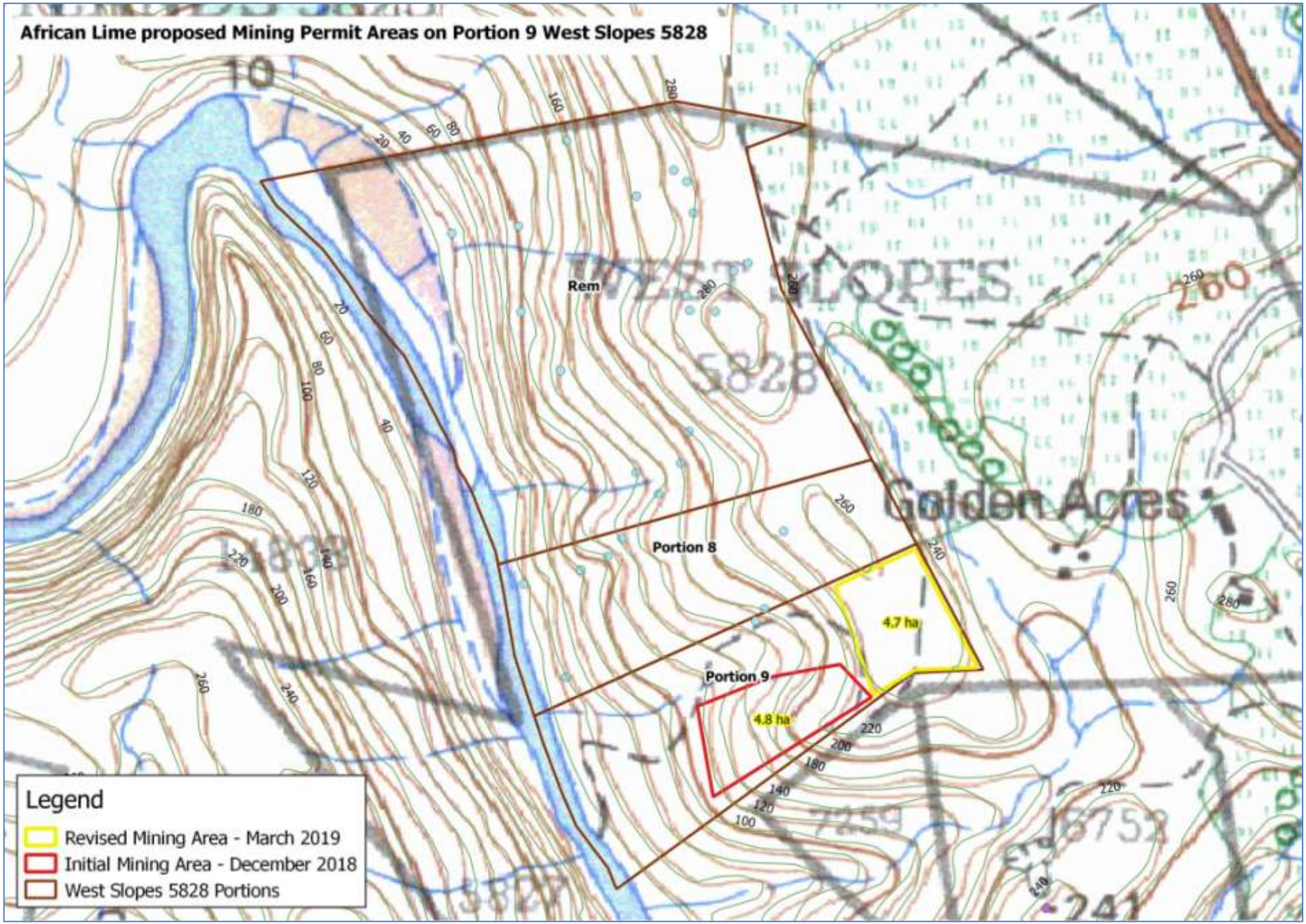
Appendix 3: Details of Environmental Assessment Practitioner

Appendix 4: Specialist Declarations of Independence

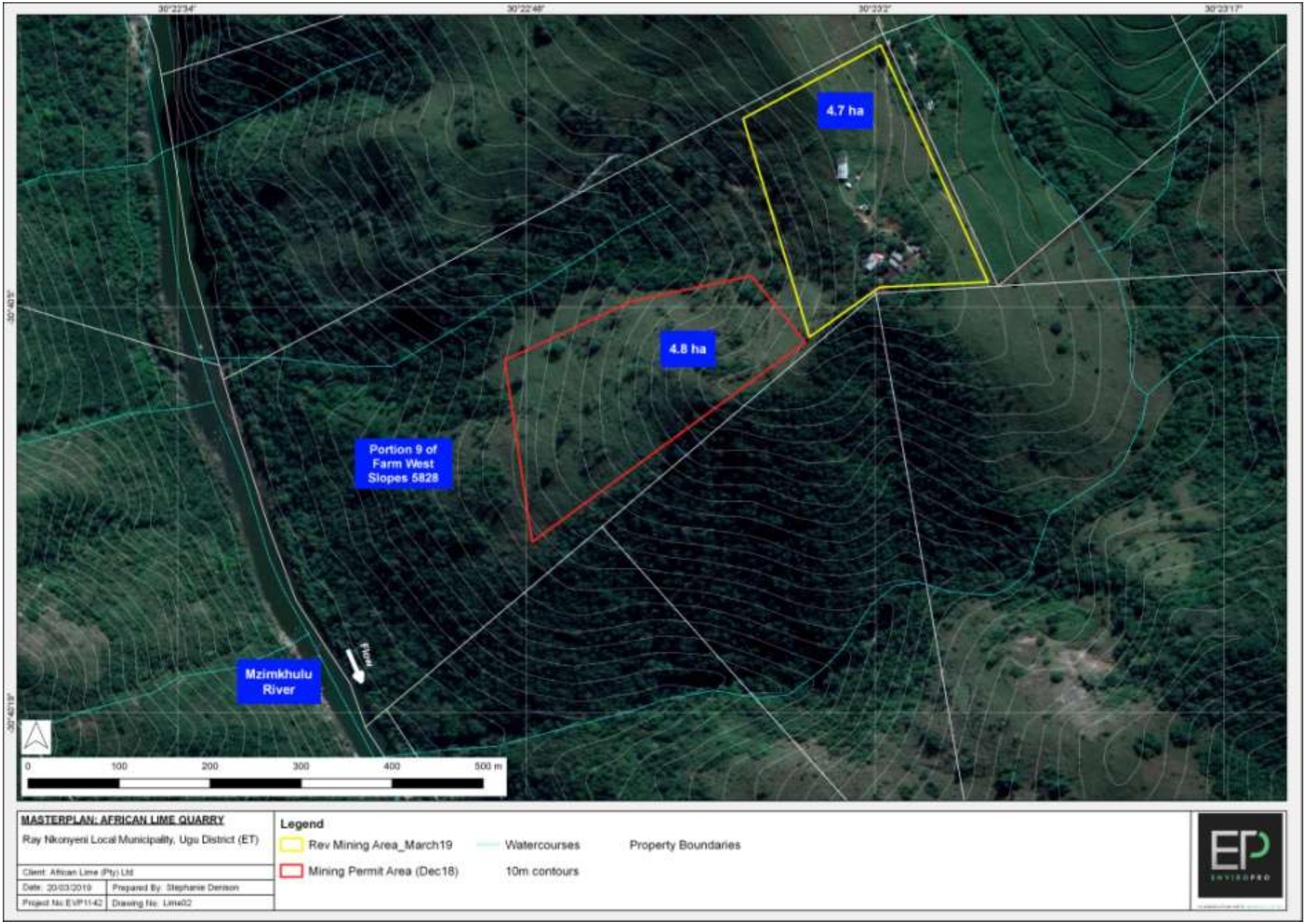
Appendix 1

Maps

Map 1: Location of proposed mining area within Portion 9 of West Slopes 5828 in relation to Rossmin biodiversity offset area (Rem).
Map 2: African Lime proposed mining areas – Option 1 (December 2018) and Option 2 (March 2019).



Map 1: Location of proposed mining area within Portion 9 of West Slopes 5828 in relation to Rossmin biodiversity offset area (Rem).



Map 2: African Lime proposed mining areas – Option 1 (December 2018) and Option 2 (March 2019).

Appendix 2

Photographs

Photo 1: View of proposed mining area (Option 1) from north looking over stream and riparian forest.

Photo 2: View of mining areas, Option 1 (red) and Option 2 (yellow) from north, looking over stream.

Photo 3: View of stream and riparian forest looking from proposed mining area, Option 1.

Photo 4: One of the many clear pools within the stream on the northern edge of the property.

Photo 5: Pool in the stream where Nile Monitor (*Varanus niloticus*) was seen.

Photo 6: Kloof Frog egg clump on *Strelitzia nicolai* leaf above a rock pool in the stream.

Photo 7: Kloof Frog egg clump on twigs above a rock pool in the stream.

Photo 8: Kloof Frog on debris next to rock pool.

Photo 9: Kloof Frog on leaf litter next to rock pool.

Photo 10: Kloof Frog in rock pool.

Photo 11: Snail shells found by previous owner, L Scheepers (*Gulella* spp.).

Photo 12a & b: Snail shells found on the property on field trip of 19 March 2019.

(a) Top left - *Gittenedouardia natalensis;* Top right & bottom left - *Maizania wahlbergi*a; Bottom right - *Nata vernicosa.*

b) *Trachycystis scolopendria*.

Photo 13: ***Doratogonus infragilis*** **on branch in the rocky stream edge.**

Appendix 3

Details of Environmental Assessment Practitioner

Details of Environmental Assessment Practitioner

Brousse-James & Associates is a Close Corporation, registered in 1997 (CK97/57246/23), and jointly owned by Mr Barry Mark James and Mrs Danielle Brousse James. All professional work taken on by Brousse-James & Associates has been conducted by Barry James, with Danielle James providing field assistance, administration and report writing. When required, other specialists are subcontracted. Since 1997, Brousse-James & Associates has been involved in a variety of projects, ranging from wildlife management plans, environmental journalism, specialised computer programming for biological and conservation applications, environmental impact assessments, specialist biodiversity assessments, writing of rehabilitation plans and environmental management plans, and Barry James has also acted as environmental control officer for a number of projects.

Expertise to undertake Environmental Assessment Process
Qualifications and memberships:

- **MSc** (Natal University - 1998); Project Title - Succession and soil properties following the removal of pine plantations on the Eastern Shores of Lake St Lucia, South Africa.
- **BSc (Hons)** (Potchefstroom University - 1995); Stress Physiology (Distinction); Soil Degradation (Distinction) Plant Ecology and Management; Analytical Procedures in Ecology; Reclamation Ecology; Soil Classification; Taxonomy; Modern Systematics; Statistics (Distinction). Project Title - Numerical analysis of the vegetation, its distribution and relation to major environmental gradients in the south-western portion of Umfolozi Game Reserve.
- **BSc** (UNISA - 1994); Majors: Zoology and Botany. Distinctions in Plant Ecology and Animal Physiology.
- **Pr.Sci.Nat.** - Registered with the South African Council for Natural Scientific Professions in the field of Ecological Science (Registration No. 400263/06).
- **MSAIE&ES** - Professional member of the Southern African Institute of Ecologists and Environmental Scientists.
- **EAPSA -** Certified Environmental Assessment Practitioner with Interim Certification Board.
- **Numerous Natal Parks Board In-Service Courses**
- **Short Courses of relevance to the EIA Process:**
    - Geographic Information Systems (GIS) - (Natal University, 1998)
    - Integrated Environmental Management (IEM) - (Natal University, 1998)
    - Crash course in Environmental Auditing - (Eagle Environmental, 1999)
    - Soil Classification and Land Capability - (Cedara, 1999)
    - Environmental Impact Assessment - (Rhodes University, 2006)

Applicable Experience:
A comprehensive list of projects undertaken by Brousse-James & Associates is available as required.

Appendix 4

Specialist Declarations of Independence

SPECIALIST DECLARATION

In terms of the 2014 EIA Regulations, GN R982 regulation 13 and Appendix 6, as amended

I, **Barry Mark James**, declare that:

- I am an independent specialist in the application/matter;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the activity, other than remuneration for work performed in terms of the 2014 EIA Regulations as amended;
- I will perform the specialist work relating to the application/matter 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/matter, including knowledge of the National Environmental Management Act, regulations and any guidelines that are relevant to the proposed activity;
- I will comply with the National Environmental Management Act, regulations and other applicable legislation;
- I have no 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 to influence any decision to be taken by the competent authority with respect to the application/matter;
- All the particulars furnished by me in this report are true and correct.

Signature of the Specialist: 
Date: 15/04/2019

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REF. NO.: 2019/013 **DATE: 5th APRIL 2019**

REPORT ON THE DESKTOP GEOHYDROLOGICAL INVESTIGATION IN SUPPORT OF A WATER USE LICENSE APPLICATION FOR THE PROPOSED AFRICAN LIME QUARRY – UGU DISTRICT MUNICIPALITY

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ENVIROPRO
1A LEINSTER PLACE
GILLITS
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Tel: 031 765 2942
Email: steph@enviropro.co.za

5th April 2019

Attention: Ms. Steph Denison

REPORT ON THE DESKTOP GEOHYDROLOGICAL INVESTIGATION IN SUPPORT OF A WATER USE LICENSE APPLICATION FOR THE PROPOSED AFRICAN LIME QUARRY – UGU DISTRICT MUNICIPALITY

1. INTRODUCTION

As per our accepted budget proposal and the signed Form of Agreement dated 13th March 2019, we have undertaken a desktop geohydrological investigation in support of a Water Use License (WUL) application for the proposed African Lime Quarry in the Port Shepstone area within the Ugu District Municipality.

The findings of this investigation follow below.

2. SCOPE OF WORK

The undertaken scope of work included:

- Review of existing information provided and available
- Preparation of a geohydrological investigation report, detailing:
  - a desktop study of, and collation of information pertaining to, the geohydrology of the study area, including aquifer types
  - the desktop identification and delineation of all known boreholes within a 2 km radius of the site, through the use of the DWS KwaZulu-Natal Groundwater Resource Information Database (KZN GRIP), the DWA National Groundwater Archives (NGA), our in-house borehole database and any information pertaining to possible on-site boreholes supplied by the client, including for an analysis of historical water quality data, if available
  - an assessment of DWS-mapped structures in proximity to the site, in accordance with the regional geological map
  - an assessment of the impacts of the proposed quarry, as well as mitigation measures for any impacts

3. DATA / INFORMATION SOURCES

The following were used as sources of data / information during the formulation of this desktop report:

- Maps:
  - 1: 250 000 topographic map - 3030 Port Shepstone
  - 1: 250 000 geological map - 3030 Port Shepstone
  - 1: 50 000 topographic map - 3030 CB Port Shepstone
  - Google Earth study area imagery

- GIS Databases:
  - DWS KZN GRIP borehole database
  - Geomeasure Group borehole database
  - DWS National Groundwater Archive borehole database
  - DWS digitized KwaZulu-Natal dolerite dykes, geological faults and lineaments

- Published Information:

  - Davies Lynn and Partners (1995). Characterisation and Mapping of the Groundwater Resources of KwaZulu-Natal Province Mapping Unit 4. *Department of Water Affairs and Forestry*, Pretoria, 123 pp.

  - Cornell, D.H., Thomas, R.J, Moen, H.F.G., Reid, D.L. Moore, J.M and Gibson, R.L. (2006). The Namaqua-Natal Province. *In*: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J. (Eds). *The Geology of South Africa*. Geological Society of South Africa, Johannesburg, 325 – 380.

4. SITE LOCATION

The site is located in the Port Shepstone area within the Ugu District Municipality, at the co-ordinates 30° 40’ 07.25” S and 30° 22’ 52.71” E. It is accessed via a series of dirt and sugar cane roads off an unnamed road accessed off the N2 national highway. The site is located approximately 11 km north west (as the crow flies) of Port Shepstone (see attached Locality Plan - Dwg No. 2019/013 Figure 1).

5. TOPOGRAPHY & DRAINAGE

The site is situated at an elevation of between 120 and 240 meters above mean sea level (m AMSL). The topography of the surrounding area can be described as steeply undulating. Natural drainage is likely in a southerly to south-westerly direction towards the Umzimkhulu River, which is located approximately 300 m south west of the western boundary of the site (see attached Area Plan – Dwg No. 2019/013 Figure 2).

6. GEOLOGY & GEOHYDROLOGY

6.1 GEOLOGY

The published 1: 250 000 Geological Sheet, 3030 Port Shepstone, shows that the site and the surrounding areas are underlain by units of the Marble Delta Formation of the Mzimkulu Group (of the Margate Terrane of the Namaqua-Natal Province) (see attached Geological Plan – Dwg No. 2019/013 Figure 3).

The economically important Marble Delta Formation is composed of calcite and dolomite marble, minor quartzite and thin amphibolite layers, with the former marine sedimentary units quarried at the site.

These units have been subjected to faulting and fracturing associated with the breakup of the ancient Gondwana super-continent, as illustrated by the coast-parallel faults and lineaments situated in and around the site. These are attributed to the extraction of the Falkland Plateau past the Natal Valley during the mid-Cretaceous breakup of Gondwana, when during coast-parallel shearing, right-lateral strike-slip movement occurred. However, this tectonic event may also have reactivated east-northeast – west-southwest orientated structures which formed as a series of island arcs were thrust onto the Kaapvaal Craton during the formation of the Margate Terrane of the Natal Sector of the Namaqua-Natal Province in the region.

6.2 GEOHYDROLOGY

The units of the Namaqua-Natal Province, in this area, are essentially secondary or fractured rock aquifers with negligible primary storage and permeability. Groundwater storage and movement is generally confined to fractures, joints and bedding planes within the rock mass.

Typical borehole yields which are to be expected in this area in these units, are marginal and in the range of > 0.0 l/sec – 0.1 l/sec according to published information. However, although elevated yields may be attained from siting boreholes on the numerous structures present in the study area, this has historically not been common practice, and so the degree of success in this regard remains unclear. The water bearing properties of the units of the Namaqua-Natal Province are a function of deep seated fracturing and the intersection of master fracture sets. This, and the highly variable surface elevations, may account for the numerous dry boreholes that have been drilled in the greater study area.

The units of the Namaqua-Natal Province, in this area, typically contain groundwater with dominant anion constituents of sodium (Na) and potassium (K) and dominant cation constituents of bicarbonate (HCO_3) and chloride (Cl). This leads to the hydrochemical signature being defined as Na-HCO_3 to Na-Cl, and so may result in a slightly brackish taste in the water intercepted in these units.

6.3 DESKTOP STUDY

A desktop study of the area was conducted using the DWS KZN GRIP database, DWS National Groundwater Archive (NGA) database, as well as our own in house database (Geom BH Data), which typically represents the most up to date and complete data sets for the study area. The results of this exercise indicated that one (1) borehole / groundwater source occurs within a 2 km radius of the site (see attached Area Plan – Dwg No. 2019/013 Figure 2).

The desktop study borehole data has been presented in Table 1 of Appendix A.

Whilst the data is incomplete, available details of the borehole record are summarised as follows:

Borehole Depth:	66.00 m bgl *
Static Water Level:	39.00 m bgl
Blow Yield:	0.60 l/sec
Water Strike Depths:	37.00 & 62.00 m bgl
Borehole Use:	Unknown

** - m bgl : metres below ground level.*

7. PROJECT INFORMATION & GEOHYDROLOGICAL ASSESSMENT

The proposed site is approximately 4.8 ha in extent and comprises a previously undisturbed area. The site is accessed via a series of dirt and sugar cane roads off the St Faiths road, an unnamed road which is accessed via the N2 National highway. The roads will obviously require upgrade for use by quarry vehicles.

Unfortunately, no details regarding site facilities have been provided at this stage, but it is assumed that the facilities will include the usual site offices, septic tanks and french drain or other sewage management system, quarry area and stockpile area. A basic Site Plan showing the location of the site has been attached as Site Plan – Dwg No. 2019/013 Figure 4. The alternative mining location has also been indicated on the Site Plan.

One of the geohydrological risks in terms of quarries is the possibility of the infiltration of contaminated stormwater run-off, as well as stormwater run-off into the Mzimkhulu River located directly south west of the site. In order to prevent this, a stormwater management plan is required to ensure that stormwater is controlled correctly and is disposed of in an appropriate manner.

Sources of contaminated stormwater could include areas where the servicing, washing or re-fuelling of vehicles would be undertaken, as well as areas where the storage of fuel or any other chemical compounds used in site activities occur.

The main geohydrological risk in terms of quarries would be related to blasting and the effects of it on the geological structures in the vicinity and to a lesser extent, possible effects on groundwater quality.

Although no groundwater boreholes were identified directly down-gradient of the proposed site at a desktop level, this does not confirm that none exist. A site walkover and field hydrocensus should be undertaken to confirm whether any down-gradient users / boreholes exist in the immediate vicinity of the site and to determine any existing geohydrological constraints on-site. Should any boreholes be identified in the immediate vicinity of the site, then baseline information should be attained prior to the commencement of activities at the proposed quarry. This includes pump testing and groundwater sampling of the closest identified borehole to determine its sustainable yield and baseline water quality. As mentioned, this data would be used as baseline data for comparison to data gathered once activities such as blasting have commenced at the proposed site.

8. CONCLUSIONS

Based upon the above report, the following can be concluded:

- As part of the water use license application process, Geomeasure Group has undertaken the desktop geohydrological investigation for the proposed African Lime Quarry located in the Port Shepstone area within the Ugu District Municipality.
- The site is underlain by Marble Delta Formation of the Mzimkulu Group (of the Margate Terrane of the Namaqua-Natal Province).
- The aquifers in the Namaqua-Natal Province can generally be described as marginal fractured rock aquifers with typical borehole yields ranging between > 0.00 l/sec and 0.1 l/sec.

- The findings of the desktop and field hydrocensus indicated that only one (1) borehole record exists within a 2 km radius of the site.

- The site is approximately 4.8ha in extent and from google earth imagery, appears to be previously undisturbed land.

- No site layout plan or sewage management system information was provided.

9. RECOMMENDATIONS

Based upon this report, the following is recommended:

- A storm water plan should be prepared for the site by a suitably qualified and competent hydrologist so as to ensure that storm water generated on the site is controlled and discharged in an appropriate manner.

- An environmental control officer should be appointed to oversee the construction of the proposed development so as to ensure that the nearby watercourses are not impacted as a result of this development, as well as its initial operations.

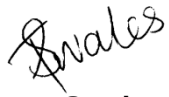
- The design and placement, as well as the supervision of the construction of the septic tank and french drain or other sewage management system should be undertaken by a suitably qualified engineer.

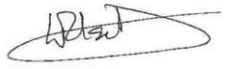
- A site walkover and field hydrocensus should be undertaken to identify any existing geohydrological constraints and to determine whether existing groundwater users / boreholes exist down-gradient of the site. Should any existing boreholes be identified, the closest identified borehole should be subjected to a pump test to determine the sustainable yield of the borehole prior to the commencement of site activities. A groundwater sample should also be taken in order to attain baseline groundwater quality data. This baseline data would be used for comparison of pump test and water quality data attained following commencement of on-site activities.

- Should no groundwater users / boreholes be identified, then surface water monitoring would suffice, unless the Department of Water and Sanitation specifically requests the installation of on-site monitoring boreholes.

We trust that this report meets your immediate requirements in this matter. Please do not hesitate to contact the undersigned if you require any further information.

Prepared by:





Taryn Swales
Senior Geohydrologist

Lynn Fitschen
Principal Engineering Geologist

GEOMEASURE GROUP (PTY) LTD.

FIGURES

GEOMEASURE GROUP
Groundwater, Environmental & Geotechnical Consultants

0 2,5 5 10 15 20 25 30 35 40 45 50 55 60 Kilometers

1 : 250 000 Digital Coverage From Cheif Directoraste: Surveys and Mapping

LEGEND:

N

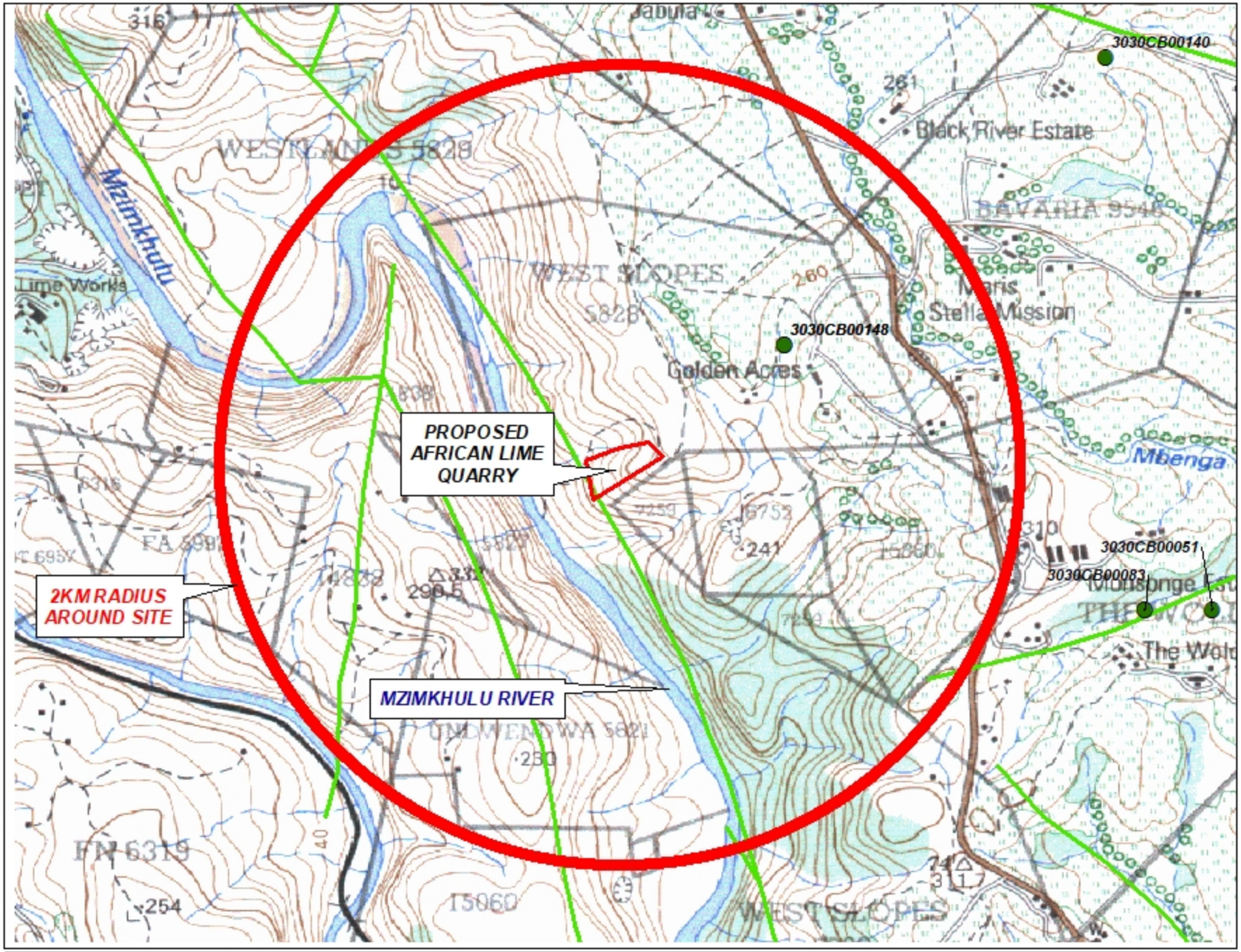
Site Location

GEOMEASURE GROUP

PROPOSED AFRICAN LIME QUARRY DESKTOP GEOHYDROLOGICAL INVESTIGATION

LOCALITY PLAN

DWG NO. 2019/013
FIGURE 1



LEGEND:

N

- Specialist Invest Area
- NGA Data
- Dolerite Dykes
- Geological Faults
- Lineaments

GEOMEASURE GROUP
Groundwater, Environmental & Geotechnical Consultants

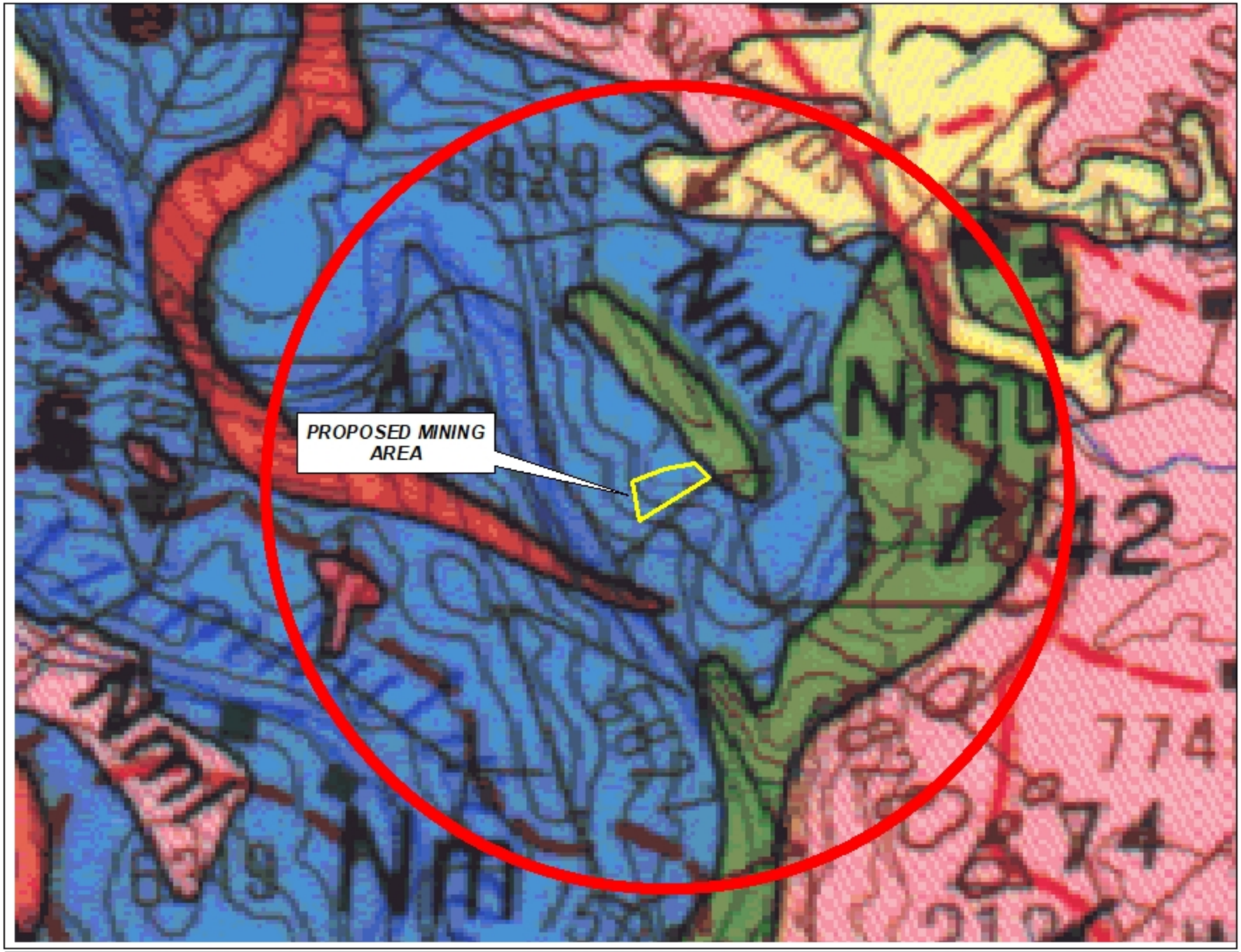
PROPOSED AFRICAN LIME QUARRY DESKTOP GEOHYDROLOGICAL INVESTIGATION

AREA PLAN SHOWING GEOLOGICAL STRUCTURES & AVAILABLE DESKTOP HYDROCENSUS DATA

0 0,5 1 2 3 4 5 Kilometers

1 : 50 000 Digital Coverage From Cheif Directoraste: Surveys and Mapping

DWG NO. 2019/013
FIGURE 2



LEGEND:

N

- Proposed Mining Area
- Alluvium
- No — Oribi Gorge Granite
- Nml — Margate Leucogranite
- Nmu — Mucklebraes Gneiss
- Nm — Marble Delta Calcite / Dolomite Marble

GEOMEASURE GROUP
Groundwater, Environmental & Geotechnical Consultants

PROPOSED AFRICAN LIME QUARRY DESKTOP GEOHYDROLOGICAL INVESTIGATION

GEOLOGICAL PLAN

0 0,5 1 2 3 4 5 Kilometers

1 : 250 000 Digital Coverage From Council of Geoscience

DWG NO. 2019/013
FIGURE 3

0 KM 1.00 KM 2.00 KM

Imagery from Google Earth 2019

Legend

N

Preferred Proposed Mining Area

Alternate Proposed Mining Area

GEOMEASURE GROUP
Groundwater, Environmental & Geotechnical Consultants

PROPOSED AFRICAN LIME QUARRY DESKTOP GEOHYDROLOGICAL INVESTIGATION

AERIAL PLAN SHOWING PROPOSED MINING AREA & PROPOSED ACCESS

DWG NO: 2019/013
FIGURE 4

APPENDIX A

TABULATED DESKTOP HYDROCENSUS DATA

GEOMEASURE GROUP
Groundwater, Environmental & Geotechnical Consultants

TABLE 1 : NGA BOREHOLE DATA WITHIN 2KM RADIUS

GeositeInf	GeositeI_1	GeositeI_2	GeositeI_3	Constructi	WaterLevel	WaterLev_1	DischargeR	Discharg_1	DepthToBot	Casing_Dep	WaterStrik	TotalBlowY
3030CB00148	Borehole	-30,663320	30,388710	1993/08/30	Static Water Level	39.00	1993/08/30 0:00	0.580 l/s	66.00	22,000000	37.00 & 62	0.6001

SAKHELA CONSULTING (PTY) LTD

REPORT OF SITE VISIT FOR AFRICAN LIME (PTY) LTD

TO PROPOSED QUARRY SITE 29 MARCH 2019

Contents

1. General Information

The proposed mining area is located at the coordinates **30°40'0.56"S 30°23'1.64"E** in the Ray Nkonyeni local municipality and is approximately 14 km from the N2 Umtentweni Toll Plaza Turnoff on the N2. The location of the site is given in **Figure 1 Locality Plan**

2. Topography and Drainage

The proposed mining area straddles the top of the hill adjacent to the Mzimkulu River on portion 9 of the farm West Slopes 5828. The general topography has a mixture of concave and convex conformations. The limits of the proposed mining area comprise virgin slopes. The slopes are very steep with the elevation difference from the crest of the hill to the Mzimkulu River approximately 220m. Stormwater management of the mining runoff water will have to be carefully controlled and a detailed drainage plan will have to be developed. The 3D modelling was carried out on Google Satellite Digital Elevation Data. For more accurate modelling a topographical site survey will have to be conducted.

The 3D modelling is shown in **Figure 2 3D site model**.

3. General Site Observations and Comments.

The site is located over a limestone ridge on the farm West Slopes 5828. The slopes are very steep and as such will prove difficult to mine, as the property boundaries preclude establishing a haul road along a contour. The best option is to start mining the top of the ridge to create a level platform that will be lowered with each successive mining bench.

Because there are existing structures that can be utilised for site mining offices and workshops, it makes mining the top of ridge difficult and it is proposed to start mining on the slope opposite the Umzimkulu River. The preservation of these structures and the position of the mining benches are very much dependent on the geological report.

The on-site inspection reveals outcroppings of limestone on the surface of the ridge and the overburden depth on the slopes will determine where the first mining benches are located. Mine layout and planning will be critical to reduce future costs of mining and it is recommended that the crushing plant be located adjacent to the haul road.

The proposed mining block layout is shown in **Figure 3**

Figure 1 Locality Plan

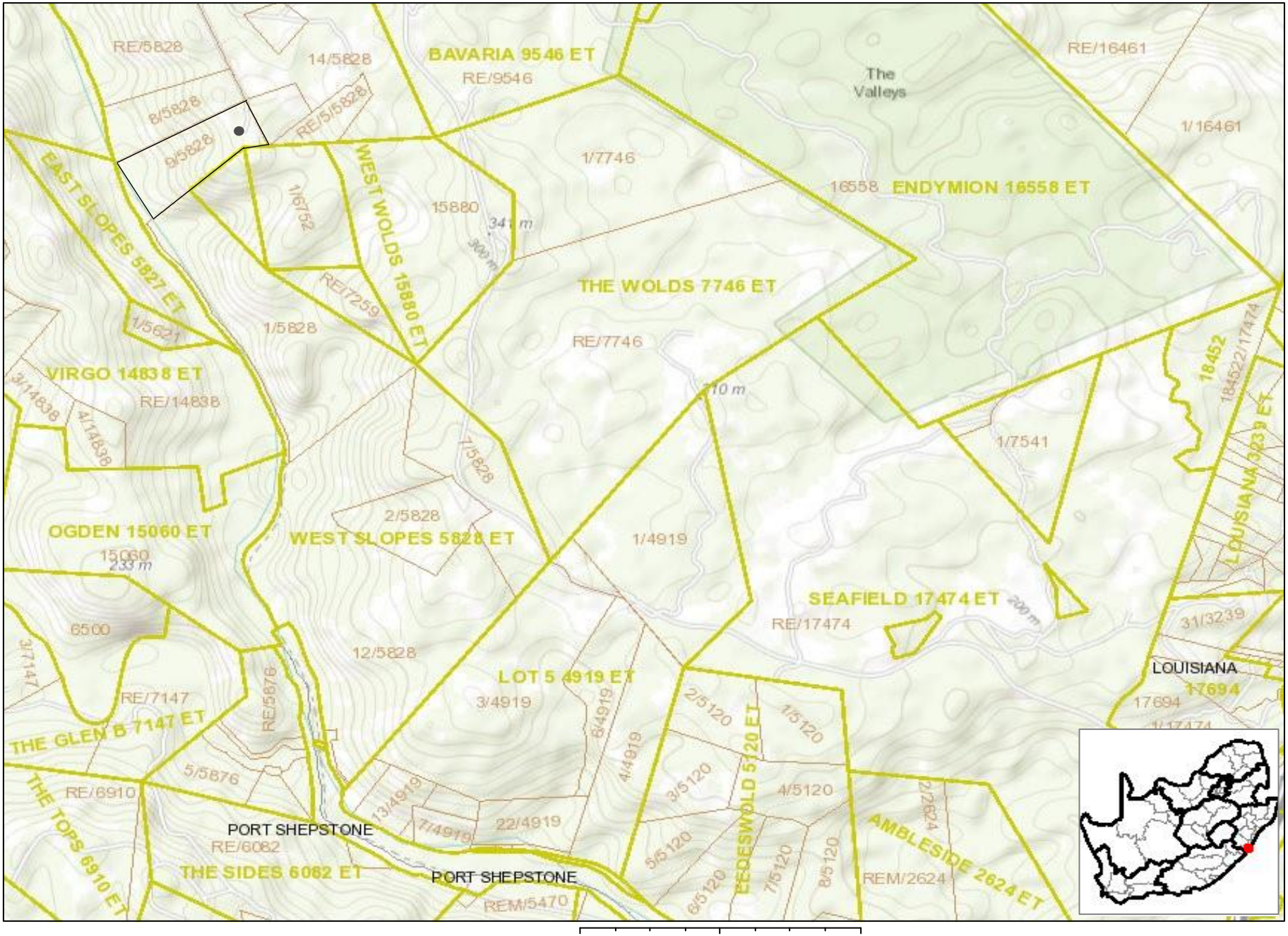
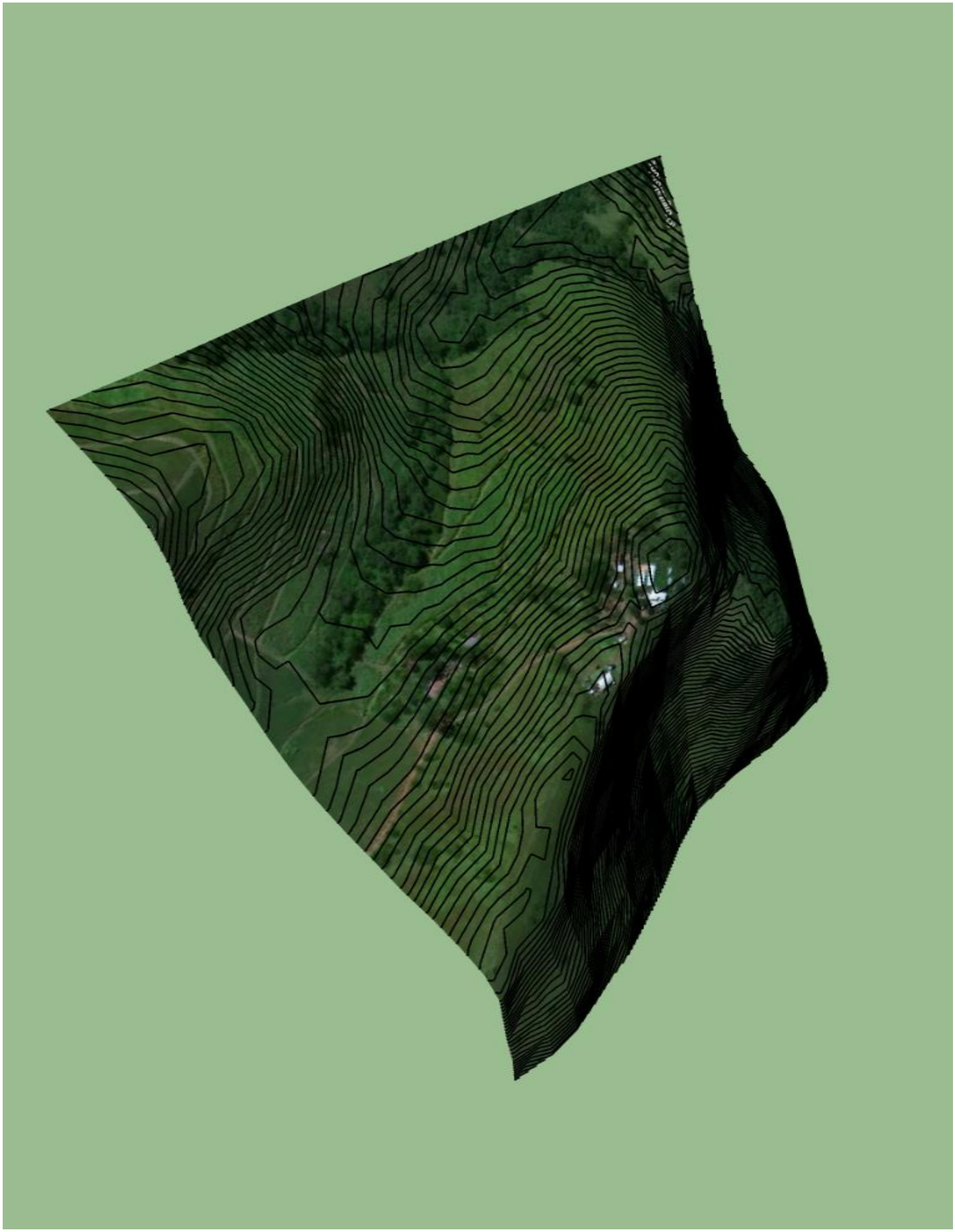

RE/5828
14/5828
BAVARIA 9546 ET
RE/9546
The Valleys
RE/16461
1/16461
8/5828
9/5828
RE/5828
EAST SLOPES 5827 ET
1/16752
WEST WOLDS 15880 ET
15880
341 m
300 m
1/7746
16558 ENDYMION 16558 ET
THE WOLDS 7746 ET
RE/7746
RE/7259
1/5828
1/5621
VIRGO 14838 ET
RE/14838
3/14838
4/14838
10 m
1/7541
18452
184522/17474
LOUISIANA 3239 ET
7/5828
2/5828
OGDEN 15060 ET
15060
233 m
WEST SLOPES 5828 ET
1/4919
SEAFIELD 17474 ET
RE/17474
200 m
31/3239
6500
3/7147
RE/7147
12/5828
LOT 5 4919 ET
3/4919
LOUISIANA
17694
17694
THE GLEN B 7147 ET
RE/5876
5/5876
RE/6910
THE TOPS 6910 ET
13/4919
7/4919
22/4919
6/4919
4/4919
2/5120
1/5120
3/5120
4/5120
EDESWOLD 5120 ET
2/2624
AMBLESIDE 2624 ET
5/5120
6/5120
7/5120
8/5120
REM/2624
PORT SHEPSTONE
RE/6082
THE SIDES 6082 ET
PORT SHEPSTONE
REM/5470

Figure 2 3D Site Model



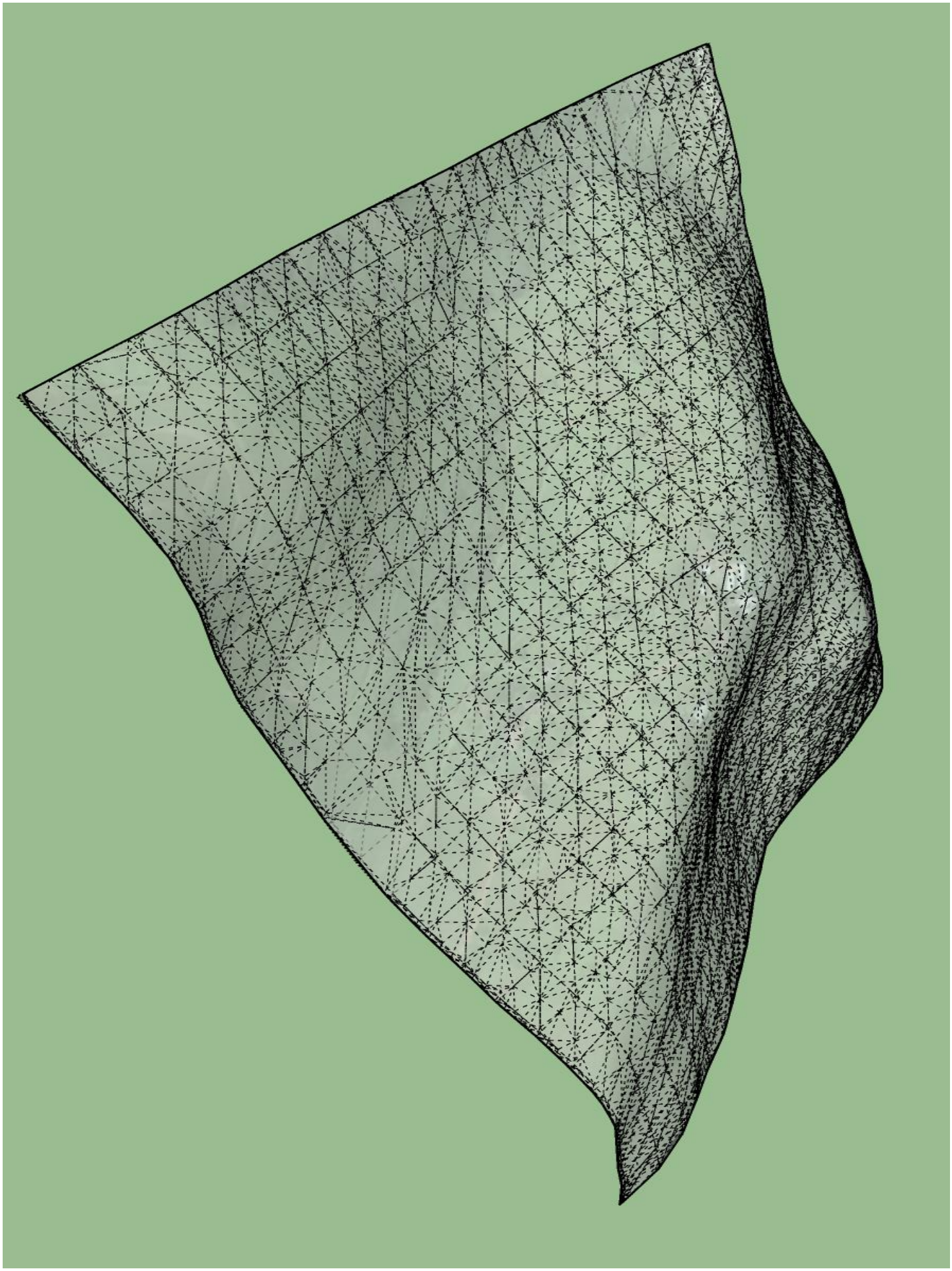


Figure 3 Proposed Mining Block Layout

NOTES

REV:	DESCRIPTION:	BY:	DATE:

STATUS:

SAKHELA CONSULTING
8 PADLEY PLACE
PINETOWN
3610

0824410622

CLIENT: AFRICAN LIME (PTY) LTD

ARCHITECT:

SITE: ST FAITHS SITE
UGU DISTRICT (ET)

TITLE: PROPOSED LIMESTONE MINING AREA

SCALE AT A3:	DATE:	DRAWN:	CHECKED:
N T S	APR 2019	PLP	PLP

PROJECT NO:	DRAWING NO:	REVISION:
	AL 1	

Office 6, Staffordshire Place
Coniston Road
Shelly Beach, 4265
Cell 1: 081 722 8954
Office: 039 315 6737
Email: prince@telkomsa.net

KINGDOM
BUSINESS SOLUTIONS

11 December 2017

Mr Ebrahim Moosa & Mr Muhammed Moosa
Alpine Group
24 Riley Road
Durban, 4000

cc The Board – Alpine Group

Dear Ebrahim and Muhammed,

Subject: Pre-Feasibility Study for the establishment of a limestone Surface Mining and Production Facility on the KZN South Coast

We are pleased to submit herewith our **Pre-Feasibility Study** for the Limestone Mining and Production facility as mandated by the Alpine Board on 23 November 2017.

This pre-feasibility study had been conducted in terms of the KBS proposal and subsequent acceptance by the Alpine Group board. 2 visits to the site were undertaken and discussions held with key people in the completion of it. A very conservative approach has been taken to ensure that a very objective result has been obtained.

Our principal conclusion as stated within the report include:

- The Project, with respect to the purpose of serving to produce limestone products and extenders (for the cement industry), is technically very attractive.
- There are certain risks involved e.g. Determining the extent and composition of rock reserves. This can only be determined if rock cores are examined. This is a component of a full feasibility study.
- Various key factors are in place.

We greatly appreciate the opportunity to work with you on this project. If you have any questions regarding the subject report, be sure to give us a call. I will also avail myself to present a synopsis of this report to the board and answer questions.

Yours truly,

Ivan Naidoo
MD & Senior Consultant

Alpine Group

Pre-feasibility Study for the establishment of a limestone surface mining operation and production facility on the KZN South Coast.

Prepared *by*

KINGDOM BUSINESS SOLUTIONS

December 2017

Table of Contents

1. Introduction

The purpose of this pre-feasibility study is to direct the Alpine Group on whether a venture into the limestone industry will be a profitable venture and if it will complement their existing business model.

The treatment in the pre-feasibility is expansive but not necessarily in-depth. A further full feasibility study will unpack certain aspects that will further assist the Alpine Group on its decision-making process.

The property described as Sub3 of Westslopes (indicated as 9/5828 on the municipal aerial map) is approximately 29.7 Ha in size and is owned by Lukas Scheepers. As a livestock farmer, Lukas Scheepers has expressed an intent to relocate to his other interests in the Western Cape. Therefore, he has put up his farm for sale.

It so happens that the above-mentioned property is located on the fringe of one of the richest limestone deposits in the world ie. at a triangulated area known as the Marble Delta.

3 companies of national stature currently have their operations established in the Marble Delta and they supply their customers nationally. These companies have largely bought off much of the property in the delta. There is just two known available properties in the Marble Delta viz. Sub3 of Westslopes and an adjacent 10Ha property. Sub 3 of Westslopes is the subject of this pre-feasibility study. There may be other farmlands adjacent to the Marble Delta that could be available and such property plays into the strategic positioning of any enterprise that was looking to be established on the targeted location.

This pre-feasibility study is the preliminary assessment of whether the acquisition of Sub3 of Westslopes will allow the Alpine Group to mine this limestone reserve to serve their current interest in the cement industry where they will

1) use limestone as an extended to create different strengths of cement to meet the needs of their customers, and/or
2) produce limestone products to meet the growing demand in industry and the agricultural sector and/or
3) find other business opportunities, preferably aligned to their current industry, where limestone products can be sold.

In addition to the operations itself, this pre-feasibility study also brings into focus the other necessary aspects that are required by any establishment of this nature to meet the requirements of the Mining Charter.

2. Geological Study, Field Reconnaissance & Cadastral Description: Sub3 of Westslopes

This section of the report comprises the results of comprehensive research, consultation with key experts and refers to mapping exercises carried out on the site by these experts that confirm the findings of the desk top study.

The calcium carbonate and dolomite deposits of the Marble Delta are currently the purest source of calcium carbonate in South Africa. They are currently being mined by NPC InterCement and Idwala Carbonates on the south side; and by Rossmin on the north side of the Umzimkulu River, one of the major regional drainage channels. The rocks of the Marble Delta form part of the Margate Terrane which is the southern subdivision of the mid to late Proterozoic Natal Metamorphic Province. The southernmost Margate Terrane is characterised by a lack of metalliferous mineralisation, but hosts the extensive, and economically important, limestone deposits of the Marble Delta (Hira, 1998).

2.1 CADASTRAL DESCRIPTION

The proposed quarry area is located at the following co-ordinates:
A S30° 40’ 06.7 E30’ 22’ 34.4’’
B S30° 39’ 54.9’’ E30° 23’ 02.8’’
C S30° 40’ 04.1’’ E30’ 23’ 07.9’’
D S30° 40’ 04.3’’ E30’ 23’ 02.8’’
E S30° 40’ 12.7’’ E30’ 22’ 51.1’’
F S30° 40’ 20.3’’ E30’ 22’ 41.1’’
G S30° 40’ 13.3’’ E30’ 22’ 39.5’’

These coordinates have been derived from the Mapsource software and are therefore approximate and do not accurately reflect the cadastral boundaries of the property.

The location of the site is shown in the aerial picture on Page 6. Access is via a network of farm roads leading off the P68 District Road linking Umtentweni to St Faiths. The proposed quarry area occupies an area of approximately 29.78 Ha and is bounded to the east, north and south by adjacent farm land, and to the west by the Umzimkulu River. Due to Post Gondwana downcutting of the Umzimkulu River the entire area is deeply incised with associated steep

topography. The property slopes towards the west at gradients in the order of 1 vertical in 2.5, with elevations ranging from approximately 240m in the eastern corner of the site to less than 20 m at the Umzimkulu River. A small, westward flowing stream drains the site, debauching into the Umzimkulu River immediately upstream of the eastern extremity of the property.

Adjacent properties

Properties that bound Sub3 of Westslopes can be seen in the map below. The neighbouring properties are numbered as:

8/5828, 11/5828, 1/6752, R/7259, 1/5828, 1/5827, R/5829

Background to Sub 3 of Westslopes, otherwise described as Portion 9 of 5929

According to Lukas Scheepers, there has been no prospecting or mining permit that has been taken on his land since his occupation of the land over 10 years ago. If any such permit was taken since his acquisition of the land, it would have since expired.

The property also has 3 dwellings, some out buildings, a borehole from which water is pumped for domestic use. In general, the property is largely virgin land, untouched by development.

The main building is in poor condition and is currently being used as a domestic dwelling by the two foremen employed by Lukas Scheepers. The floor area of the main building is about 300 square meters and was apparently built to be used as office space.

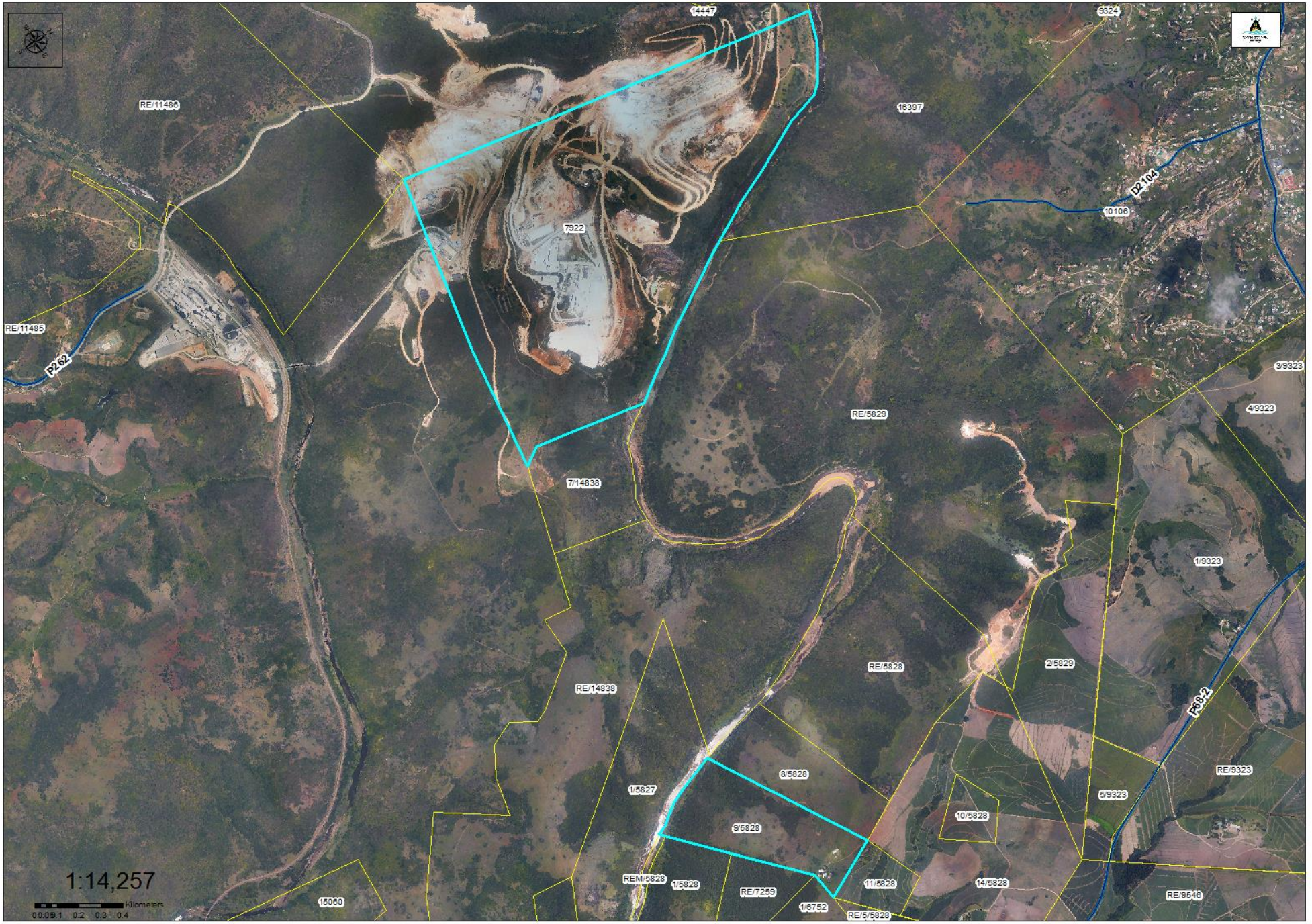
A second set of buildings has 3 adjoining dwelling units, each of 80 square meters. Two of these units are 90% complete and the third is about 50% complete. Depending on the proposed mine plan, these could either be used or demolished.

The third building was previously used as horse stables but is now being used as an abattoir.

In total there are 3 boreholes on the site of which one is in use. The functional borehole produces about 2000 liters per day. The other 2 boreholes may have to be unblocked as they did cave in at about 35 meters below ground.

Lukas undertook the drilling of the boreholes himself and had the drilling company take samples of the rock at every 6 meters. These samples are available for analysis.

There is road access to get to the river. The Umzimkulu, which is the largest river in KZN, has never run dry and has its origins in the southern Drakensberg.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RE/11486
P262
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4/9323
RE/5829
7/14838
1/9323
RE/5828
2/5829
RE/14838
P36-2
8/5828
RE/9323
1/5827
5/9323
10/5828
9/5828
1:14,257
Kilometers
REM/5828
1/5828
RE/7259
11/5828
14/5828
RE/9546
15060
1/6752
RE/5/5828

2.2 GEOLOGICAL RESEARCH AND FINDINGS

The site lies within the bounds of the Marble Delta which forms part of the Margate Terrane which is a subdivision of the mid to late Proterozoic, Natal Metamorphic Province which is exposed in the deep river valleys which drain the province. The supracrustal, granulite facies dolomitic and calcitic marbles of the Marble Delta Formation (Thomas and Otto, 1991, cited in Hira, 1998), are highly deformed and extensively intruded by various granitoids and charnockites (Hira, 1998).

Figure 1: Locality of the Study Area

The Marble Delta

The complete stratigraphic succession is not present as the marble formations have been enveloped by granites in such a manner that neither the base nor the top is exposed. The sediments were furthermore subjected to repeated folding and were also rendered mobile during several stages of recrystallization so that most of the primary sedimentary structures were obliterated. (Otto, 1973)

The Marble Delta (in blue) and its relationship with the surrounding geology is shown in Figure 2. Structurally the geology of the area is complex, the broad outlines of which are shown in Figure 3.

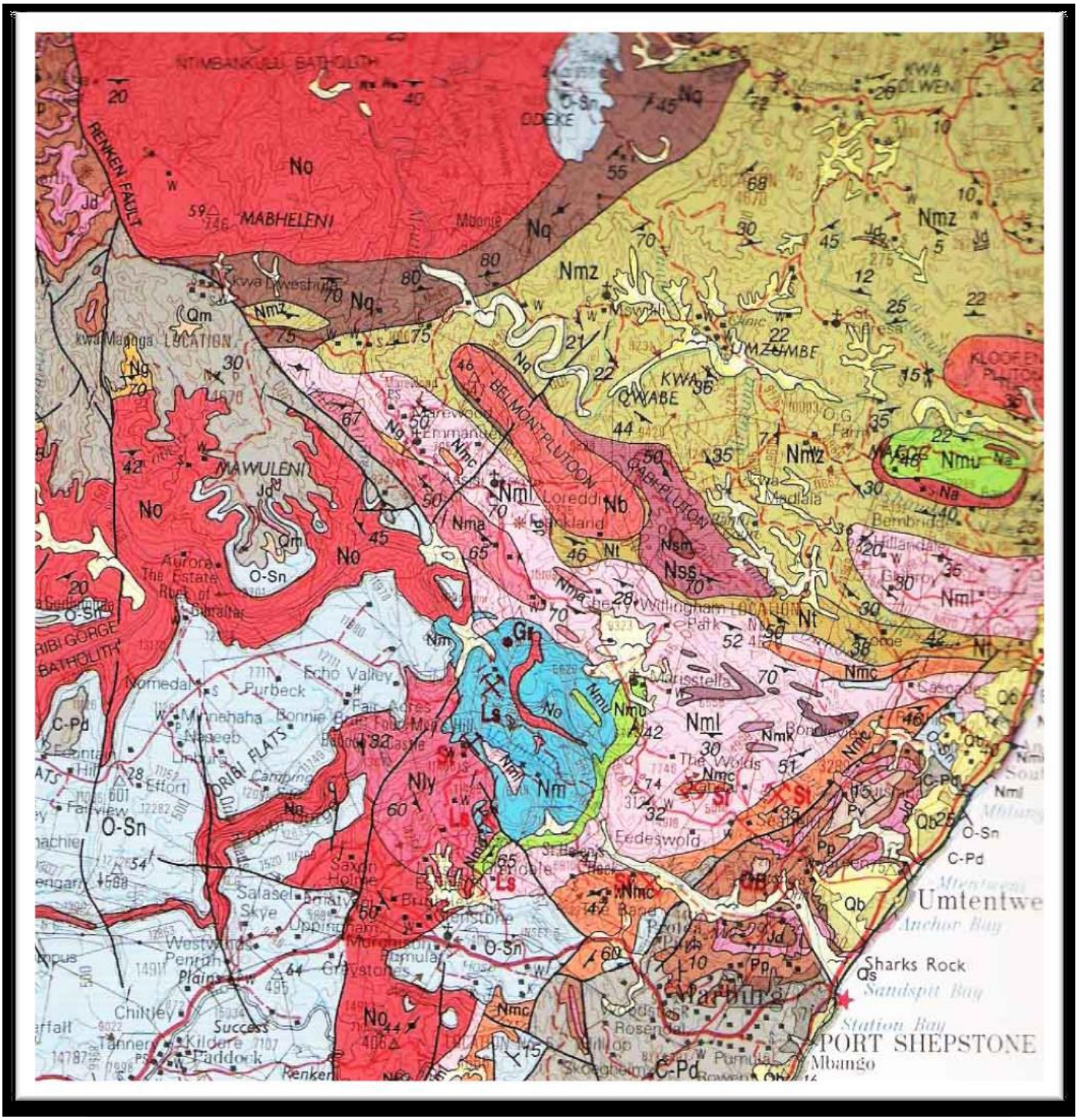


Figure 2: The Marble Delta in relation to the regional geology

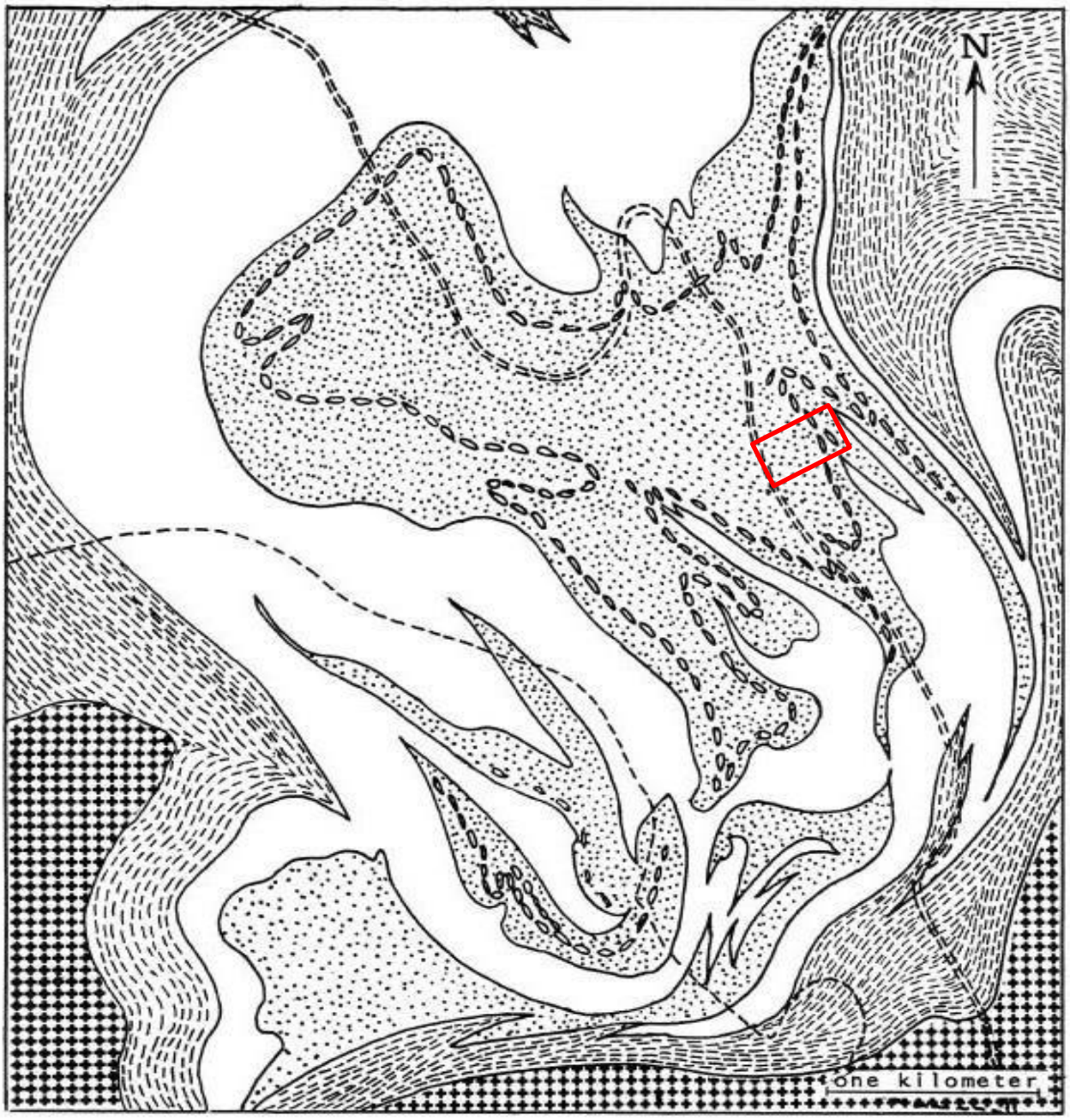


Figure 3 STRUCTURAL SKETCH MAP SHOWING RECONSTRUCTION OF THE MAIN FOLD TREND (F_2)

CHERRYWILLINGHAM FORMATION

ORIBI FORMATION

LE JONCQUET FORMATION (with quartzite marker)

THE WOLDS GRANITE

After Otto, 1973

The intrusion of granite into the calcitic country rock appears to have significantly diluted the amount of economically exploitable calcite. Rough estimates are that the calcite surface exposure in only approximately 25 percent of entire property. Taking into account the probable presence of dolomitic calcite, this number may be further diluted. However, this is based on surface mapping of the site both during previous studies and from the work of Otto, 1973 and some additional exploratory drilling may prove that there are additional resources at depth.

2.3 FIELD RECONAISSANCE

Two site visits were conducted and discussions held at different times with Lukas Scheepers and a geologist who undertook a study of the area in 2014.

Photograph taken from the property showing Idwala Carbonates in the distance. Note the Umzimkulu River at the bottom.

Looking east from the property.

Taken from about 150m away from the main building. The buildings in the distance are on the property.

3. BUSINESS POTENTIAL

The South African government is actively looking to increase the black mining ownership component in the country. To this end, the government has made the mining sector accessible to black companies that would have previously not entered the sector. This accessibility is in the form of revised regulations and incentives. (These aspects are covered later in this document).

Through these incentives, the mining industry presents an excellent business case. In this particular exercise, the market for limestone is very wide and various entry points into this sector presents itself.

3.1 Limestone – Aggregates and Powders

The demand for limestone in its variety of forms is growing in South Africa. As can be seen below, it is used in a multitude of industries; often as a filler but also as the main ingredient.

Limestone Uses

Limestone, in its various grades on fineness, is used usually used in the following areas:

- Adhesives & Sealants
- Agricultural Lime
- Animal Feed
- Carpets and Backing
- Cement
- Construction Aggregate
- Decorative
- Fertilizers
- Food Additive
- Food Supplements
- Fungicides
- Glass Manufacture
- Mortars
- Paint & Coatings
- Plastics
- Putty
- Rayon Processing
- Rubber
- Tile Adhesive
- Tile Manufacture
- Vinyl Flooring

Other uses e.g. Flue Gas Desulphurisation, Mining, Roads, Steel Refining and Water Treatment are also recorded, although is limited quantities.

Some of the above uses require the limestone to meet certain quality specifications and the limestone reserves that we are targeting may not necessarily meet those standards. However, the scope of its uses gives a clear indication that there is market potential. A full feasibility study will examine the market in much more detail to determine the products, specifications and volumes that they use. Based on the initial market response, market entry strategies can be set.

3.2 Extenders in the cement industry

This option remains the backup option for the Alpine Group. As most inert substances with the appropriate physical characteristics could serve as extenders in the cement industry, limestone and other inert rock formations suits that purpose very effectively.

Extenders in cement are described as:
A chemical additive or inert material used to decrease the density or increase the yield of a cement slurry. The slurry yield is typically expressed in cubic feet of slurry per sack of cement. Increasing the yield reduces the cost per volume of cement slurry, while reducing the slurry density reduces the hydrostatic pressure of the cement column, enabling weak zones to be successfully cemented and isolated.

The Concrete Institute offers the following information: (Engineering News, July 2015)
Including extenders to the concrete mix offers several important advantages, says Bryan Perrie, managing director of The Concrete Institute. Among the benefits derived from the now widespread practice of adding ground granulated blast-furnace or corex slag, fly ash, or silica fume, to the concrete mix are :

- Cost savings: Extenders are generally cheaper than Portland cement;
- Technical benefits: Extenders improve impermeability and durability of the hardened concrete and often improve the properties of concrete in the fresh state.
- Significant benefits to reducing greenhouse gas emissions as most extenders are secondary products from other processes.

"Portland cement extenders are all less reactive than portland cement. This can affect the rate of early-age strength gain, causes a 'fine-filler' effect, which affects the rate of heat development due to cementing reactions. Substituting a Portland cement extender for part of the cement in a concrete mix, may reduce the rate of strength gain at early ages. The extent of the reduction increases with increasing substitution level. "Extremely fine extender particles act as nuclei for the formation of calcium silicate hydrate which would otherwise form only on the cement grains. This fine-filler effect brings about a denser and more homogeneous microstructure of the hardened cement paste and the aggregate-paste interfacial zones, resulting in improved strength and impermeability. "The extent of the fine filler effect depends on the content of extremely fine particles in the extender. Fine particles of filler materials, such as limestone, can also exhibit the fine-filler effect," Perrie explains.

He says concrete in which part of the Portland cement is replaced by an extender produces heat at a rate slower than that of a similar concrete made with only Portland cement. The slower the rate of heat development, the lower the temperature rise and therefore the smaller the likelihood of thermal cracking.

"However, it should be remembered that improvements to the properties of hardened concrete brought about by the use of extenders, can be fully realised only if the concrete is properly cured," Perrie cautions.

Currently, the large cement producers in South Africa are:

Lafarge Industries SA (Pty) Ltd - Lichtenberg
Sephaku Cement (Pty) Ltd – Delmas, Mpumalanga
PPC South Africa Holdings (Pty) Ltd – 11 operations in Africa
AfriSam (SA)(Pty) Ltd – various operations in South Africa
Mamba Cement – Northam, Limpopo
NPC InterCement – Marble Delta, KZN

Of the above cement manufacturers, only NPC Cement is based in KZN; and at the Marble Delta.

3.3 Other business opportunities

Downstream industries

All of the industries in which limestone is used represents a downstream industry. While some of the industries are very specialised and are capital intensive, others are easy to enter and are generally aligned to the building, construction and hardware sector and will therefore be complimentary to the Alpine Group range of products.

River Rocks

While still to be verified, Lukas Scheepers has advised that there is apparently an abundant supply of river rocks of all sizes which lends itself to the a potentially strong income stream should this opportunity be exploited. It should be seen as a complementary business opportunity for the hardware and landscaping sector.

River rocks have various uses e.g. Decorative River Rock Stones, Natural Polished Mixed Color Stones for Aquariums, Landscaping, Vase Fillers, Succulent, Tillandsia, Cactus pot, Home Decoration, etc. It can be used in various types of crafts projects, beach wedding, fountain, fish tank, flower pot, vase, pebble road, wall or decoration.

Competitor Analysis

Idwala Carbonates (Marble Delta, KZN)

Idwala Carbonates is an open cast mining operation in the Oribi Gorge area of the Kwa-Zulu Natal South Coast. Having started in the 1930's, it is one of the oldest limestone quarries in the country. It is estimated to have limestone reserves for the next 75 – 100 years.

This operation mines a deposit of scarce, white calcitic and dolomitic limestone which then goes through various processes of quarrying, crushing, screening, milling and beneficiation through floatation and fine milling (micronising) to produce the end product.

The company manufactures both floated and unfloated products. Unfloated (unrefined) products primarily supply the fertilizer, animal feed, glass, paint and related industries. Floated products are highly refined and milled to very fine powders for use in high quality papers and related products.

The limestone powders manufactured by Idwala Carbonates are graded to exacting standards and this is checked by a highly specialised laboratory on a continuous basis.

Idwala Carbonates has been struggling to meet the increasing demand for its products over many years.

Its main competition for unfloated products is the newly opened Rossmin Mining operation on the north side of the Umzimkulu River.

Rossmin (Marble Delta, KZN)

Umzimkhulu Industrial Holdings (Pty) Ltd, trading as Rossmin is an open cast mining operation, mining a high quality limestone deposit near Port Shepstone known as the Marble Delta. Rossmin was established in 2010 to mine calcitic and dolomitic limestone. Rossmin uses the most advanced systems to process the minerals to produce products of a high quality.

Rossmin is part of the Durban-based JT Ross Group who have interest in property, property development and mining.

As a new entity, Rossmin currently mills unrefined powders in various grades for the industry. They opened their doors for business earlier this year and present strong competition to Idwala Carbonates' unrefined products. The location of Rossmin provides a strategic cost advantage over Idwala Carbonates as it is closer to the main arterial roads which saves on transport costs and time.

SA Lime and Gypsum (Western and Northern Provinces)

A leading manufacturer and distributor of calcium, magnesium, gypsum and silicon related agricultural products in South Africa.

SA Lime & Gypsum Industrial Products (Pty) Ltd was formed in 2008. The Company started trading in 2009 and now specialises in the production and marketing of the full range of value added Calcium and Magnesium products.

The formation of the Company was a natural progression for our group, following a history as market leader of SA Lime & Gypsum (Pty) Ltd in the Agri Lime industry, which started trading in 2003 and grew into the biggest Agri lime company in Africa, focussing on agricultural lime and gypsum.

Extracted from their website:

"Following exceptional year-on-year growth since its inception in 2003, SA Lime & Gypsum (Pty) Ltd had advanced to become the supplier of choice to the agricultural lime and gypsum market in Southern Africa, delivering in excess of 750 000 tons of quality products to the doorsteps of its customer base across the length and width of the region.

SA Lime & Gypsum (Pty) Ltd's objective is to promote the use of calcium and magnesium plant nutrients on a national level. The strategy to improve unproductive acidic soils by corrective liming is geared to maximise South African crop yields. Established by Carl Taljaard and Hendrik Heyl, SA Lime & Gypsum (Pty) Ltd has develop into the largest supplier of premium quality agricultural lime and gypsum in the country, with a presence in all nine provinces in South Africa and with over 40 years' experience in the industry."

P&B Lime Works [Bontebok Lime Works Pty Ltd] – (Bredasdorp, Western Cape)
Since 1998 the Company has been using modern, environmentally friendly technology to calcine the limestone, which is mined on the premises. It is an open-cast mine. There are sufficient deposits of calcium carbonate to ensure supplies for the next 300 years.

In 2001 new rotating horizontal kilns were constructed for the calcining of limestone with a hydration plant which entered production during June 2008.

They produce a high quality agricultural lime, building lime, water purification and stabilization lime, roadmaking lime and other lime products

Inca Mining (Mokopane, Limpopo)
Mining and processing of limestone, dolomite and clay (attapulgite) in the Immerpan area, which is located 40km Southeast of Mokopane (approximately 230km North of Johannesburg) in the Limpopo Province of South Africa.

Inca Mining (Pty) LTD was incorporated in 1991 and commenced exploration of the carbonates and underlying clay around Immerpan in 1993.

In 1997 INCA commenced mining and processing limestone after the necessary permitting allowed the construction of a new crushing and screening plant. Sales of high quality limestone products average around 15,000t per month with adequate mining and processing facilities in place to accommodate market growth.

In 2008 PBD Holdings (Pty) Ltd purchased a 75% share in INCA Mining. Since the purchase capital investments were made to improve the quality of products as well as the production efficiency. Included in the investments is a new dryer plant as well as improved crushing and screening technology.

Cape Lime
Cape Lime is a full subsidiary of Afrimat Ltd since April 2016. The history of Cape Lime dates back to 1946 when the first vertical shaft kiln was commissioned by Cape Lime Company Ltd on the farm Langevallei near Robertson. Today Langvlei has three kilns in operation, calcining dolomite. It also boasts with the only pressure hydrator in South Africa.

Resellers

Kalkor is a dominant player in the supply of Lime and Gypsum in the Agricultural and Industrial sectors. They are essentially resellers of limestone products and they source their supplies from about 20 different mines across the country. A list of their products and prices are provided as an annexure.

According to their website:" Kalkor was registered in 1988 and acquired in 2001 by current owner, David Serfontein. The company has been involved in the Agricultural industry since 1964 and played a role in the founding of Sasol Fertilizer.

Kalkor is an advocate of quality and integrity in the market and is therefore a member of the Fertilizer Association of Southern Africa (FERTASA), which is subject to a strict code of conduct.

In 2012 Kalkor took a major step in forming a partnership with another major player in the market, H Pistorius & Co, to became involved in the production and processing of Lime and Gypsum across Southern Africa to the Agriculture and Industrial sectors.

Through the partnership we have committed to engage in research in order to make a contribution to the improvement and advancement of the agricultural sector in Southern Africa."

They are located at: 1 Verona Office Park, 11 MacArthur Avenue, Robindale, 2194

Research Findings

Desktop and secondary research provides a clear perspective of the scope and expanse of limestone reserves in the country. Limestone is relatively common in the world and there are various quarries that mine various types of limestone.

Our focus is on the scope and opportunity that presents itself in South Africa.

General

Limestone products are used in five principal industries in South Africa: Cement manufacturing, metallurgy (steel refining), agriculture (fertilisers, fungicides, animal feed), aggregate and lime manufacture.

Unique characteristics of the South African limestone and lime market include the following:

1) Isolated large high-grade deposits of limestone;
2) cement production being the largest limestone consumer;
3) large changes in lime consumption patterns (shrinking gold, uranium and calcium carbide uses and an increase in the ferro-alloy and water treatment sectors);
4) the dominance of foreign companies in the local cement industry; and
5) the superior grade of local ground calcium carbonate (GCC) products.

Production

The South African limestone industry comprises 24 groups or controlling companies and 41 quarries – 27 limestone quarries, 4 operations mining limestone and dolomite and 4 major lime manufacturers. South Africa's share of the world lime and cement output is about 0,8% and 0,7% respectively.

The average mine has been operating for 39,2 years, whilst 11 quarries have been operating for more than 50 years and 8 for less than 20 years. Good recovery rates, extensive mineral reserves and LOM plans, remotely located deposits, short-range selective mining, campaign mining, some hand-sorting, minimal overburden, dry processing, average to excellent product specs, low effluent discharge and moderate rehabilitation costs epitomise the mine and plant aspects of local limestone mining.

Sustainable growth in the local limestone industry is dependent on the development of niche markets and growth in both the national economy and end consumer markets. External factors such as toll fees and high transport and energy costs remain a real concern to all producers.

Demand

Expected growth in the industry has been forecast at 4,0 %, based on strong growth in the construction sector, aggregates and specific non-ferrous uses. Further contraction in lime consumption; and more strategic acquisitions (both locally and abroad) are expected in the industry.

Several new growth markets include special cements, fire-retardants, admixtures, sealants, new concrete products, new water and effluent treatment recipes, coal dusting uses, glass manufacture and functional fillers.

Through the investment of global cement companies in South Africa, there has been a strong improvement in quality control and safety implementation.

Recycling, re-use, regenerating, substitutes (particularly fly-ash and other spent materials) and a greater efficiency regarding carbonate material consumption may dampen local demand in pelletising, water treatment, chemical manufacture and some non-ferrous uses. However, the overall industry risk, in terms of production factors, policy, strategy and positioning, remains low.

Uses

Construction and Aggregates

Limestone has been used directly in buildings as load bearing walls and also in facades. Crushed limestone, also called aggregate, is used as a filler in concrete, as a base in road construction, and as a filler in asphalt.

Steelmaking

Limestone is used in making steel. The limestone is mixed with iron ore and coke, a form of coal, and all are melted in and converted to lime, CaO, combines with the impurities, mostly silicon dioxide, in the iron ore or hot molten metal to form a material called slag which has a general formula of caclium silicate, $CaSiO3$. The slag which now is in the form of a calcium silicate floats on top of the molten metal because it is lighter. Then the molten iron which sinks to the bottom of the furnace. About 100 pounds of limestone are needed to make a ton of iron.

Lime and Cement

Limestone is converted to lime, CaO, calcium oxide, or also called “quicklime” by heating the limestone rock to about 800 degrees Celsius. Lime may be used on an industrial scale as an inexpensive base to adjust pH in chemical processes, water treatment, and adjusting soil pH.

Chemicals

Calcite and Dolomite, when heated and in some cases slurried or combined with salt, are used in making many common everyday products such as paper, glass, paint and varnish, soap and detergents, textiles, refractories, baking powder, and pharmaceuticals, including milk of magnesia and bicarbonate of soda. Finely ground, they are used to control coal mine dust, to collect sulphur dioxide from power plant exhaust, to sweeten soils, and as ingredients in fertiliser and stock feeds, to name a few.

Feasibility

Financial.

The Alpine Group has indicated that it has sufficient strength to commence such an operation. However, should it be necessary or as a strategy to gear the company optimally, several debt and equity funding opportunities are available.

Notwithstanding this financial capability, there is the opportunity for the new enterprise to access grants and other sources of preferential funding instruments should it wish to leverage its capital investment in such a venture.

Possible grant opportunities:

Black Industrialist Scheme (BIS): The BIS offers a cost-sharing grant ranging from 30% to 50% to approved entities to a maximum of R50 million. The quantum of the grant will depend on the level of black ownership and management control, the economic benefit of the project and the project value.

It is the opinion of the Kingdom Business Solutions that the profile of the entity to be formed will attract a grant portion closer to 45% or 50%.

TIKZN Technical Assistance Fund: This fund assists companies to undertake technical studies on a rand-for-rand basis up to R250000. It is proposed that, should the Alpine board decide to go ahead with the feasibility, this fund be accessed to cover the cost of specialist studies.

Various other establishment and capital funding is available should the Alpine Group wish to consider this option. Funding agencies which as the KZN Growth Fund and the NEF amongst others will be willing to look at any feasible proposal.

Manpower

One of the key factors for the success of a new mining venture is the recruitment of experienced and capable top management and key operational staff.

While some specialised can be outsourced e.g. Drilling and blasting, it is important to retain operational staff who will be responsible for operating the plant and equipment to ensure optimum output.

While such staff can be trained, the South Coast has some key individuals who have been involved in this industry and who may be currently retired or have left the industry for personal reasons. It is very possible to access the services of these individuals, even if it is for a season while new recruits are trained into key positions.

Plant and Equipment

The plant and equipment required for the operations falls into one or more of the following categories:

- Drilling and Blasting (Drill rigs, etc)
- Sorting (Hydraulic Rock Breaker, jack hammers)
- Loading (Front end loaders – track and/or wheeled)
- Hauling (25 – 50 ton haulers)
- Crushing and milling (crushers and mills)
- Conveyors and Storage silos

All of the above plant and equipment is readily available both as new or used equipment. Plant design and equipment matching is a technical exercise to ensure that all plant can work effectively with each other.

For this purpose, operations design must be done carefully with technical aspects taking precedence over financial considerations at this stage. An important factor will be the service, maintenance, backup and spares availability.

Electricity

Eskom electricity is available at the property. An exercise must be undertaken to measure the electricity consumption at the proposed operation and to ensure that Eskom provides adequate capacity.

Water

The mining process required for this operation is not water-intensive. Notwithstanding, an accurate assessment of water needs must be done and storage must be able to accommodate water needs for ideally a week.

Water may be accessed from the borehole (existing and operational) or, with the necessary water licence, from the river.

Environmental Feasibility

Trumpet Mouthed Hunter Snail

This recently discovered, the trumpet mouthed Hunter Snail is known only from a single limestone outcrop of the Marble Delta in the KwaZulu-Natal province of South Africa. The KwaZulu-Natal south coast is a relatively well studied area, but the species has not been found at any other locations in the region. All the specimens collected to date have come from an area of less than an estimated 1,000 square metres, but the total area of the limestone outcrop to which it is probably restricted is around 40 km².

As a recently discovered species, relatively little is known about this snail's biology. Unusually for snails, however, it is known to be ovoviviparous, with developing eggs brooded internally within the uterus before hatching. The female then 'gives birth' to minute juvenile snails.

The 'hunter' part of this species' common name refers to its carnivorous habits, a behaviour that is common to the whole Streptaxidae family, which primarily feed upon soft-bodied invertebrates such as other snails and worms.

Due to the presence of this snail in the Marble Delta, it may present an environmental dilemma. However, as other mines are operating in the area, one can expect that a requirement will be placed on any mining operation in the area to mitigate its damage to the environment by establishing a nearby conservancy area in which the habitat can be preserved.

For the prospecting permit, it is a requirement that an environmental management plan (EMP) be prepared. Should the board decide that it wants to go ahead, then a full environmental impact assessment must be done which is a requirement for a mining licence.

Market Feasibility

The supply of limestone products to date has been dominated by the limestone mining companies mentioned earlier in this document.

In a free-market economy, this presents an opportunity as the widespread demand and the multiplicity of its uses makes new entrants into this market very viable.

The 3 factors that will govern the breakthrough and sustainability in this market are:

- *Product availability*
  While there is sufficient rock in the ground, a good mine plan and production plan will ensure that sufficient rock is mined and product of the required specifications are produced.

- *Product quality*
  A geological survey and ongoing visual and laboratory analysis will give clear indications of how the mine plan must be executed to ensure that the correct quality of rock is mined to meet the required product specifications. At this stage, the quality of rock has not yet been determined.

- *Product price*
  While market forces and competitor comparisons may indicate where the final sale price of the products are fixed, the critical indicator is profitability and return in investment. Profitability largely rests with costs of production. The onus is therefore on the Alpine Group to find the lowest cost of establishment and the most cost-effective way of mining and milling.

Based on the above 3 factors, it is product quality that is a largely unknown variable. Availability will remain a production factor and price will be a trailing factor ie. being dependent on the other two factors. Arguably, the selling price of the product can also be manipulated if it is to be used as a market entry advantage. This may be a necessity to gain a foothold in the industry.

The high capitalization of the larger companies in this sector require that they factor these costs into their selling prices. With regard to local (KZN and Eastern Cape) in particular, Idwala Carbonates is not only highly capitalized, it has a location disadvantage in that vehicles have to travel an addition 50 – 60km on a round trip to pick up this product. Where Idwala Carbonates will sell delivered product, these costs are factored into the price.

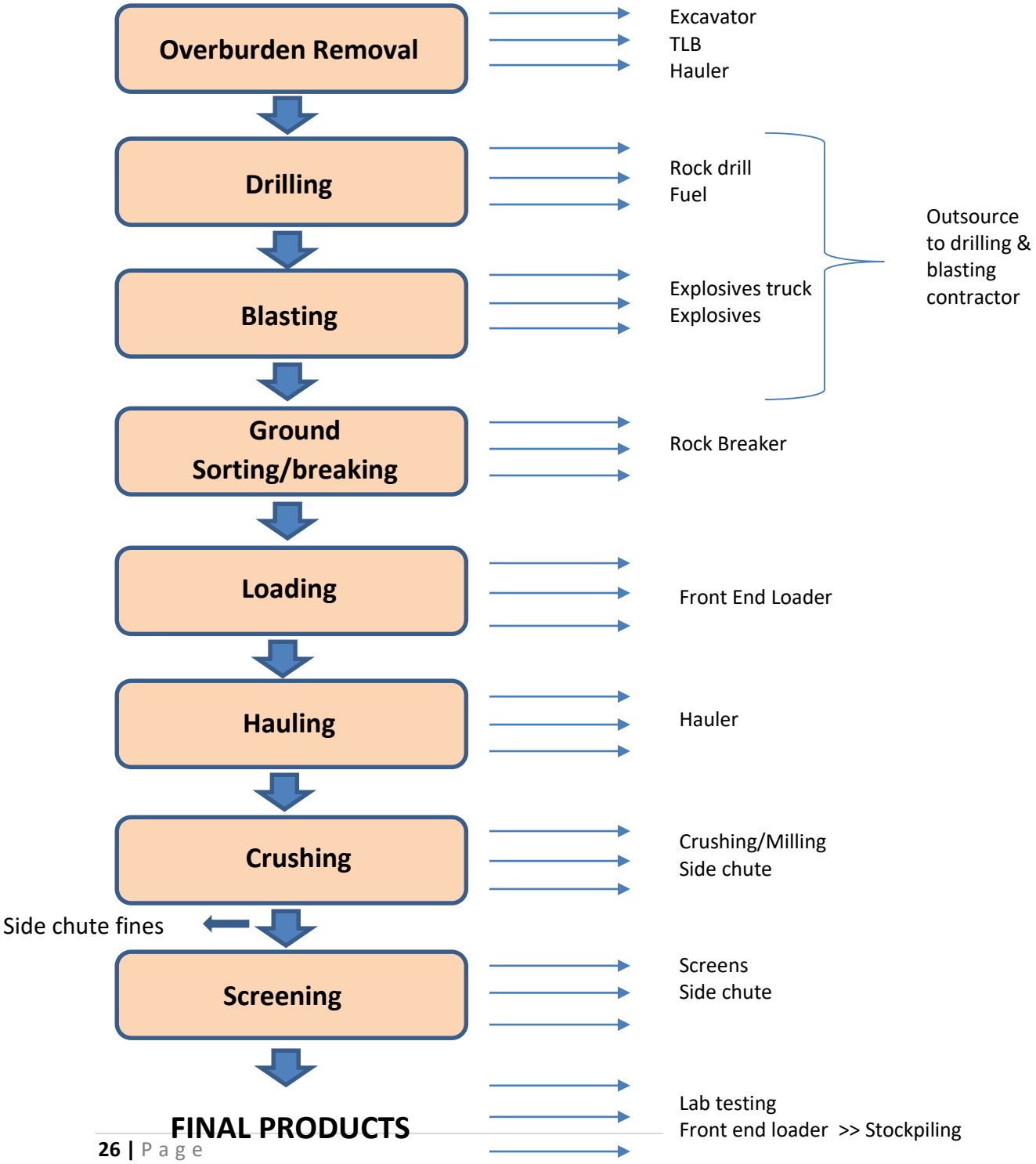
This particular disadvantage does not exist with Rossmin which mines on the north bank of the Umzimkulu River; adjacent to the proposed location of the Alpine Mine.

At inception, it is likely that the range of products that the Alpine Group would produce will be close to that produced by Rossmin ie. unrefined milled limestone of various grades. This will pitch Rossmin as the Alpine Group's main competitor.

All other market factors are equal amongst the various players in the market.

7.1 Possible plant configuration & Process flow options

There are a multitude of plant design and process flow options that could be considered; each being specific to the layout of the land and operational requirements.



Discussion on Process

While the machinery resources are indicated at each stage in the process, various other resources and cost-bearing activities are also a necessary part of the process, e.g. manpower, fuel, repairs and maintenance, pop blasting, new road construction, etc.

It must be noted that while some of the same large equipment is used at different places, the work schedule must be done to ensure maximum utilisation of the machinery. This will mean that the loader at the loading phase may be the same loader used to build the stockpile of final product.

It will be noted that the drilling and blasting components of the process are indicated as processes that could be outsourced. There are 3 primary reasons for this:

- These are specialised tasks and a blasting licence is required to do blasting.
- Blasting may be done as and when required. Many quarries only blast once a week of lesser.
- There are specialised local blasting companies who may give a very competitive rate which will translate into cost savings.

It has been mentioned previously regarding the importance of plant matching. Each machine capacity, height-reach, etc. must be carefully considered before committing to the purchase of any plan. It is for this reason that machinery ideally should not be bought in isolation without due consideration of these factors. Equipment sales-people must be knowledgeable about these matter and must be able to advise accordingly.

Mine Planning

All activities on the mining operations must take place in terms of a mine plan. Mine planning is a specialised task and should be undertaken by an accredited person. A mine engineer and mine manager is usually the individual responsible to ensure that all considerations are taken into account; ultimately to ensure that the mine profitability is maximised without compromising on the science involved in all of the process plus the various other circumstantial aspects that are specific to every mine.

A mine plan is a strategic document which encompasses:

- Geological resource
- Drill samples,

- ore body models and block modelling
- Quarry optimisation
- Physical quarry design
- Equipment optimisation and requirements
- Production schedule
- Mining cost modelling
- Mining capex and opex
- Drilling and blasting for stable quarry walls
- Mine water risk in slope stability
- Monitoring and maintaining roads and slopes
- Assessing the risks

7.2 Main Building: Services & Utilities

The access to electricity and water has been discussed previously in the document. An important aspect of services is that of sanitation.

The main building is functional and is currently being used as a domestic dwelling by Lukas Scheepers. It is currently serviced with:

- 3-phase electrical supply
- Borehole water
- Long-drop toilet system

While 3-phase electricity is connected to the property, it will have to be upgraded to the correct amperage. This must be undertaken by Eskom after an accurate assessment by a qualified electrical engineer/competent electrician. Such supply must have sufficient spare capacity to accommodate any short or medium-term expansion of the operation.

A conservancy tank or other suitable toilet system must be installed.

The borehole capacity is currently estimated at 2000 litres per day. This must be evaluated in terms of the expected water use and upgraded if necessary. As the operations is not water-intensive, it is not expected that this will pose a serious problem.

7.3 Community Involvement

Any mining operation will, of necessity, need to fulfil its commitment to the local community through the development of a Social and Labour Plan which is a prerequisite to getting a mining licence from the Department of Mineral Resources.

The Social and Labour Plan has the primary objective of mine community development. This objective plays out in the form of a structured programme for internal staff development as we as that of the local community in which it operates.

This community development component will necessitate engagement with the local traditional authority viz. The Lushaba Traditional Council.

A consultative process must be conducted in which the project to be embarked on may be based on a capped budget. The project must be endorsed by the DMR prior to commencement. Community project in the Social and Labour Plan have to be ongoing ie. new project must be embarked on in every SLP cycle.

Some of the other local mines have embarked on projects such as:

- Agricultural projects
- Crèche buildings and upgrades
- School upgrades
- Educational programmes
- Etc.

7.4 Prospecting Permit / Mining Licence

A prospecting right is a permit which allows a company or an individual to survey or investigate an area of land for the purpose of identifying an actual or probable mineral deposit. It is not known at this stage if any other person has mining rights to the property. To determine this conclusively, an access to information process has to be engaged with the DMR and this information will cost R35. The application for is provided as an annexure. According to the DMR, the process takes 30 days.

Lukas Scheepers has indicated that he has not been approached by any person or entity with regard to prospecting rights on the land. It is therefore most probable that there is no current prospecting permit taken on the land as a prospecting licence has a limited life and the land-owner must be consulted as part of the process.

As indicated on the Department of Mineral Resource's website, the prospecting right will be granted if the following requirements are met:

The applicant has:

- Access to financial resources and expertise to conduct the proposed prospecting operation optimally
- Financing plan is compatible with the intended prospecting operation and for the duration thereof
- Applicant is able to comply with the Mine Health and Safety Act
- Applicant is not contravening the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- No other person holds a prospecting right, mining right mining permit or retention permit of the same mineral and land
- No unacceptable pollution or damage to the environment will occur as a result of the prospecting operation.

Trade and Investment KZN (TIKZN) has been approached and in line with the service to expedite investment in the province, they will assist with the process of applying for a prospecting right and the other regulatory processes that go with it.

TIKZN has indicated that the process of getting this prospecting permit will be quicker if the Alpine Group worked through them instead of going directly to the DMR.

7.5 Regulatory Framework

The regulatory framework will be given full treatment in the feasibility report. For the purposes of this exercise it must be noted that the Department of Mineral Resources is the regulatory authority in the mining industry.

Various aspects of compliance must be met prior, during establishment and during operations. In no order of priority, the following Acts will apply at different times:

- Mineral and Petroleum Resources Development Act, 2002 (Act 28 Of 2002)
- Occupational Health and Safety Act (No. 85 of 1993)
- National Environmental Management Act 107 Of 1998
- Basic Conditions of Employment Act, No 75 of 1997
- The Labour Relations Act (LRA), Act 66 of 1995

8. Analysis of findings

In terms of the purpose of this pre-feasibility study, it has already been established by the evidence at hand that there is a substantial amount of limestone and other types of rock on the property. What has not been established is the quality of the rock/limestone.

In addition, the establishment of a mining operation could be a very capital-intensive exercise and a careful exercise must be undertaken to measure the rate of return on such an investment. This therefore requires that the feasibility study examine this aspect in great detail to ensure that such an operation can break even in the shortest time possible and thereafter earn profits for the owners.

We have largely determined that the market is available; whether directly through the Alpine Group for its cement operation or the sale of limestone products to the wider market.

Possible Additional Property Option

In the process of preparing the pre-feasibility it had come to light that an adjacent property (marked 11/5929 on the aerial site photo on page 6) was available for purchase. This property is approximately 10Ha in size and is perfectly located to serve as an area where operations could be located.

Contact has been made with the owners and it is proposed that an offer to purchase be made should the Alpine Group decide to go ahead with the project.

Possible Strategic Approach to the Business Model

Based on the preliminary findings as given in the report, the Alpine Group may want to consider taking advantage of one of the only known limestone deposits in the province.

The best advantage will be to use the rock, in whichever geological type that it is found, to be processes as extended in the cement industry as was originally planned. This will be viewed as beneficiation and will more easily unlock other forms of grant support that may be available.

However, the limestone industry is also a natural extension to the business model and the type and quality of limestone will allow the operation to produce a range of products that can supply the industry.

Conclusion and Recommendations

It is therefore recommended, as a result of this study that, the Alpine Group take a closer look at the reserve through a full-scope feasibility study. While such a study will require the use of specialists to examine the geology, TIKZN has indicated that a grant of up to R250000 can be accessed on a rand-for-rand basis from them for feasibility studies.

A pre-emptive visit to TIKZN, especially in their role as custodians of the newly-formed One-Stop Shop which allows them to expedite new investment in the province, has seen them warmly embrace the proposed project and they have indicated that they will engage with the DMR on behalf of the Alpine Group so that the required prospecting permit can be expedited. TIKZN also leverages various other types of support should this be needed.

A geological services company will be needed to determine the siting of the cores to be drilled. They will also supervise the drilling and logging of the cores and preparing the detailed geological report should the drilling option be exercised. This report will form a critical component of the full feasibility study. The examination of rock cores across the site will allow for a more detailed understanding of how the various geological formations which underlie the property intersect and allow for a more detailed assay of the encountered materials. However, the decision to drill rests with the Alpine Group.

Implicit in this recommendation is the purchase of the property Sub3 of Westslopes (9/5828 on the municipal map) and 11/5828 (if this is available).

As with all projects of this nature, there is an element of risk. The proposed feasibility study will give a very clear picture of the prospects of success; notwithstanding the pre-feasibility indicating as such.

Kingdom Business Solutions is well positioned to undertake the feasibility study which includes the engagement with the specialist services and the various role players in the process. We await your instruction.

Ivan Naidoo

PHASE ONE HERITAGE IMPACT ASSESSMENT OF THE PROPOSED AFRICA LIME QUARRY NEAR PORT SHEPSTONE, HIBISCUSS COAST LOCAL MUNICIPALITY, KZN

ACTIVE HERITAGE cc.

For: EnviroPro

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27 March 2019

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University of KwaZulu-Natal, Honorary Lecturer (School of Anthropology, Gender and Historical Studies).
Association of Southern African Professional Archaeologists member

Frans received his MA (Archaeology) from the University of Stellenbosch and is presently a PhD candidate on social anthropology at Rhodes University. His PhD research topic deals with indigenous San perceptions and interactions with the rock art heritage of the Drakensberg.

Frans was employed as a junior research associate at the then University of Transkei, Botany Department in 1988-1990. Although attached to a Botany Department he conducted a palaeoecological study on the Iron Age of northern Transkei - this study formed the basis for his MA thesis in Archaeology. Frans left the University of Transkei to accept a junior lecturing position at the University of Stellenbosch in 1990. He taught mostly undergraduate courses on World Archaeology and research methodology during this period.

From 1991 – 2001 Frans was appointed as the head of the department of Historical Anthropology at the Natal Museum, Pietermaritzburg. His tasks included academic research and publication, display conceptualization, and curating the African ethnology collections of the Museum. He developed various displays at the Natal Museum on topics ranging from Zulu material culture, traditional healing, and indigenous classificatory systems. During this period Frans also developed a close association with the Departments of Fine Art, Psychology, and Cultural and Media Studies at the then University of Natal. He assisted many post-graduate students with projects relating to the cultural heritage of South Africa. He also taught post-graduate courses on qualitative research methodology to honours students at the Psychology Department, University of Natal. During this period he served on the editorial boards of the *South African Journal of Field Archaeology* and *Natalia*.

Frans left the Natal Museum in 2001 when approached by a Swiss funding agency to assist an international NGO (Working Group for Indigenous Minorities) with the conceptualization of a San or Bushman museum near Cape Town. During this period

he consulted extensively with various San groupings in South Africa, Namibia and Botswana. During this period he also made major research and conceptual contributions to the Kamberg and Didima Rock Art Centres in the Ukhahlamba Drakensberg World Heritage Site.

Between 2003 and 2007 Frans was employed as the Cultural Resource Specialist for the Maloti Drakensberg Transfrontier Project – a bilateral conservation project funded through the World Bank. This project involved the facilitation with various stakeholders in order to produce a cultural heritage conservation and development strategy for the adjacent parts of Lesotho and South Africa. Frans was the facilitator for numerous heritage surveys and assessments during this project. This vast area included more than 2000 heritage sites. Many of these sites had to be assessed and heritage management plans designed for them. He had a major input in the drafting of the new Cultural Resource Management Plan for the Ukahlamba Drakensberg World Heritage site in 2007/2008. A highpoint of his career was the inclusion of Drakensberg San indigenous knowledge systems, with San collaboration, into the management plans of various rock art sites in this world heritage site. He also liaised with the tourism specialist with the drafting of a tourism business plan for the area.

During April 2008 Frans accepted employment at the environmental agency called Strategic Environmental Focus (SEF). His main task was to set-up and run the cultural heritage unit of this national company. During this period he also became an accredited heritage impact assessor and he is rated by both Amafa and the South African Heritage Resources Agency (SAHRA). He completed almost 50 heritage impact assessment reports nation-wide during an 18th month period.

Frans left SEF and started his own heritage consultancy called “Active Heritage cc” in July 2009. Although mostly active along the eastern seaboard his clients also include international companies such as Royal Dutch Shell through Golder Associates, and UNESCO. He has now completed almost 1000 heritage conservation and management reports for various clients since the inception of “Active Heritage cc”. Amongst these was a heritage study of the controversial fracking gas exploration of the Karoo Basin and various proposed mining developments in South Africa and proposed developments adjacent to various World Heritage sites. Apart from heritage impact assessments (HIA’s) Frans also assist the National Heritage Council (NHC) through Haley Sharpe Southern Africa’, with heritage site data capturing and analysis for the proposed National Liberation Route World Heritage Site and the national intangible heritage audit. In addition, he is has done background research and conceptualization of the proposed Dinosaur Interpretative Centre at Golden Gate National Park and the proposed Khoi and San Interpretive Centre at Camdeboo, Eastern Cape Province. During 2009 he also produced the first draft dossier for the nomination of the Sehlabathebe National Park, Lesotho as a UNESCO inscribed World Heritage Site.

Frans was appointed as temporary lecturer in the department of Heritage and Tourism, UKZN in 2011. He is also a research affiliate at the School of Cultural and Media Studies in the same institution.

Frans's research interests include African Iron Age, paleoecology, rock art research, San ethnography, traditional healers in South Africa, and heritage conservation. Frans has produced more than fourty publications on these topics in both popular and academic publications. He is frequently approached by local and international video and film productions in order to assist with research and conceptualization for programmes on African heritage and culture. He has also acted as presenter and specialist for local and international film productions on the rock art of southern Africa. Frans has a wide experience in the fields of museum and interpretive centre display and made a significant contribution to the conceptual planning of displays at the Natal Museum, Golden Horse Casino, Didima Rock Art Centre and !Khwa tu San Heritage Centre. Frans is also the co-founder and active member of "African Antiqua" a small tour company who conducts archaeological and cultural tours world-wide. He is a Thetha accredited cultural tour guide and he has conducted more than 50 tours to heritage sites since 1992.

Declaration of Consultants independence

Frans Prins is an independent consultant to EnviroPro and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair renumeration for work performed in connection with the activity, application or appeal. There are no circumstances whatsoever that compromise the objectivity of this specialist performing such work.

Frans Prins

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LIST OF ABBREVIATIONS AND ACRONYMS

EIA	Early Iron Age
ESA	Early Stone Age
HISTORIC PERIOD	Since the arrival of the white settlers - c. AD 1820 in this part of the country
IRON AGE	Early Iron Age AD 200 - AD 1000 Late Iron Age AD 1000 - AD 1830
LIA	Late Iron Age
LSA	Late Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998 and associated regulations (2006)).
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999) and associated regulations (2000))
SAHRA	South African Heritage Resources Agency
STONE AGE	Early Stone Age 2 000 000 - 250 000 BP Middle Stone Age 250 000 - 25 000 BP Late Stone Age 30 000 - until c. AD 200

EXECUTIVE SUMMARY

A phase one heritage survey of the proposed Limestone Quarry near Port Shepstone, KZN identified no archaeological or heritage sites on the footprint. The greater area is also not part of any known cultural landscape. However, a qualified palaeontologist will need to conduct a desktop survey of both proposed development plots before development may proceed. Attention is drawn to the South African Heritage Resources Act, 1999 (Act No. 25 of 1999) and the KwaZulu-Natal Heritage Act (Act No. 4 of 2008), which requires that operations that expose archaeological or historical remains as well as graves and fossil material should cease immediately, pending evaluation by the provincial heritage agency. It is important to note that all graves in KwaZulu-Natal, including those younger than 60 years, are protected by provincial heritage legislation.

1 BACKGROUND INFORMATION ON THE PROJECT

Table 1. Background information

Consultant:	Frans Prins (Active Heritage cc) for EnviroPro
Type of development:	Proposed Limestone Quarry
Rezoning or subdivision:	Rezoning
Terms of reference	To carry out a Phase One Heritage Impact Assessment
Legislative requirements:	The Heritage Impact Assessment was carried out in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and following the requirements of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) and the KwaZulu-Natal Heritage Act, 1997 (Act No. 4 of 2008)

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1.1. Details of the area surveyed:

The project area falls within topocadastral sheet 3030CB Port Shepstone. The plots identified for proposed state mining activity is situated approximately 14 km to the east of Port Shepstone (Figs 1 & 2) in an area dominated by commercial farms, communal land, and limestone mining activities. The application covers two areas, situated adjacent to each other, of approximately 4.8 ha and 4.7 ha each. These plots are situated on undeveloped land almost immediately adjacent to the existing Rossmin Mine Property. Plot 1 consists of indigenous grassland with some woody vegetation (Figs 4 & 5). Plot 2 is situated on the ridge overlooking Plot 1 (Figs 2, 6 & 7). It contains some residential dwellings and associated outbuildings (Figs 7 & 8). The GPS coordinates for the centre point of these plots are:

Plot 1: S 30° 40’ 01.25” E 30° 23’ 03.69”.

Plot 2: S 30° 40’ 00.49” E 30° 23’ 01.63.54”

2 BACKGROUND TO ARCHAEOLOGICAL HISTORY OF AREA

2.1 Archaeology

The project area has never been systematically surveyed for archaeological sites in the past. However, the coastal areas of the greater Hibberdene and Port Shepstone areas to the east of the project area has been surveyed by archaeologists of the then Natal Museum in the 1970's and 1980's. Further inland the greater Oribi Gorge, situated to the south west of the project area, has also been intensively surveyed. These surveys were originally conducted by staff associated with the then Natal Parks board in the 1970's. However, more professional surveys were conducted by archaeologists such as J. H. Cable in the early 1980's (Cable 1984) and later by various archaeologists attached to the Natal Museum (Mazel 1989; Mitchell 2005). The available evidence, as captured in the KwaZulu-Natal Museum heritage site inventories, indicates that the greater Port Shepstone areas contains a wide spectrum of archaeological sites covering different time-periods and cultural traditions. These include Early, Middle and Later Stone Age sites, Early Iron Age sites, Later Iron Age sites, and some historical sites. Various buildings and farmsteads belonging to the Victorian and Edwardian periods occur in the area. These would also be protected by heritage legislation.

Stone Age sites of all the main periods and cultural traditions occur along the coastal cordon in the immediate vicinity of Hibberdene and Port Shepstone. Most of these occur in open air contexts as exposed by donga and sheet erosion. The occurrence of Early Stone Age tools in the near vicinity of permanent water resources is typical of this tradition. These tools were most probably made by early hominins such as *Homo erectus* or *Homo ergaster*. Based on typological criteria they most probably date back to between 300 000 and 1.7 million years ago. The presence of the first anatomically modern people (i.e. *Homo sapiens sapiens*) in the area is indicated by the presence of a few Middle Stone Age blades and flakes. These most probably dates back to between 40 000 and 200 000 years ago. The later Stone Age flakes and various rock painting sites identified in the area are associated with the San (Bushmen) and their direct ancestors. These most probably dates back to between 200 and 20 000 years ago.

The San were the owners of the land for almost 30 000 years but the local demography started to change soon after 2000 years ago when the first Bantu-speaking farmers

crossed the Limpopo River and arrived in South Africa. By 1500 years ago these early Bantu-speaking farmers also arrived in the project area. Due to the fact that these first farmers introduced metal technology to southern Africa they are designated as the Early Iron Age in archaeological literature. Their distinct ceramic pottery is classified to styles known as “Msuluzi” (AD 500-700), Ndondondwane (AD 700-800) and Ntshekane (AD 800-900). Most of the Early Iron Age sites in the greater Ugu District Municipality belong to these traditions (Maggs 1989:31; Huffman 2007:325-462). These sites characteristically occur on alluvial or colluvial soil adjacent to large rivers below the 1000m contour. The Early Iron Age farmers originally came from western Africa and brought with them an elaborate initiation complex and a value system centred on the central significance of cattle.

Later Iron Age sites also occur in the greater Hibberdene and Port Shepstone areas. These were Bantu-speaking agropastoralists who arrived in southern Africa after 1000 year ago via East Africa. Later Iron Age communities in KwaZulu-Natal were the direct ancestors of the Zulu-speaking people (Huffman 2007). Many African groups moved through the study area due to the period of tribal turmoil as caused by the expansionistic policies of king Shaka Zulu in the 1820’s and subsequent civil wars in Zululand to the north. It is known from oral history that the greater project area was inhabited by Zulu refugees in the 19th century (Bryant 1965) especially by members of the abakwaCele and Lushaba clans. These clans arrived in the project area around 1828 soon after the murder of King Shaka when they were being pursued by supporters of King Dingane (ibid). However, it appears that the lower densely wooded valley areas, i.e. the present footprint, were only occupied later. According to oral history most of the historical settlement of the area took place on the higher altitude grassland areas.

Archaeological sites in the near environs of the project area include 2 Middle Stone Age sites and 11 Later Stone Age rock art sites situated within the greater Oribi Gorge and adjacent areas. The rock art sites form part of the eastern seaboard coastal rock art zone. Most of these occur in sandstone shelters and depict red monochrome paintings. None, however, have been recorded in the project area. No Iron Age sites were identified in the project area although there is a high probability that Early Iron Age sites could occur on the alluvial and colluvial soils adjacent to the Umzimkhulu and Umzimkhulwane Rivers. However, these areas has not been systematically surveyed as yet.

2.2 Historical Period

It was not until the late 1820's that European traders first appeared bartering beads and guns for ivory and Henry Francis Fynn, co-founder of Durban, entertained Shaka, King of the Zulu's, at Marburg near Port Shepstone in 1828. Natal became a Colony to the British Empire in 1845 and although the greater Port Shepstone saw no military action leading to this event it is nevertheless significant that the grave of Dick Kings assistant Ndogeni is located near the confluence of the Mzimkhulu to the Mzimkulwana River – a few km from the project area. The area south of the Mzimkulu River, traditionally named 'No Man's Land' was incorporated into the Colony of Natal by the Governor, Lt Col. Bisset in 1866 when the idea of establishing a township at the mouth of the river was mooted. It was to be called Shepstone after the Secretary of Native Affairs, Sir Theophilus Shepstone and was eventually laid out in 1882. Missionary work was soon launched amongst the local Zulu-speaking inhabitants and various well known Mission Stations came to be established in the greater Port Shepstone Area. These include the Maria Stella Mission (situated about 500m to the east of the footprint) (Fig), Sister Dominique Mkhize Assisi Hospital and Convent, Emanuel Mission, St Theresa Mission and St Faiths Mission Station. The colonial authorities encouraged English, German and Norwegian families to settle in the area and they grew tea, coffee and conveniently, sugar. Indentured Indian labour was introduced to work on the plantations, railways, marble and limestone quarries - still the key commercial activities in the area. They were followed by Indian traders in the 1880's. Construction on the harbour at the mouth of the Umzimkulu River, essentially to stimulate trade and commercial development was begun in the 1880's. The fact that the river was navigable for some 8km up to St Helen's Rock (also a heritage feature) was a great boon to the marble and limestone industries. Today there are various buildings and farmsteads in the area that are older than 60 years and are also protected by heritage legislation (Derwent 2006). Perhaps the best-known buildings are the Port Shepstone Light House and the Port Shepstone Hotel.

3 BACKGROUND INFORMATION OF THE SURVEY

3.1 Methodology

A desktop study was conducted of the archaeological databases housed in the KwaZulu-Natal Museum. The SAHRIS website was consulted for previous heritage surveys and heritage site data covering the project area. Various CRM surveys have been conducted in the greater Port Shepstone area. However, none of them covered the actual project area. Recent surveys by Prins (2017, 2018) covered sections of Rosmin Mine, the neighbouring property to the footprint. In addition, the available archaeological and heritage literature covering the greater Port Shepstone area was also consulted. Aerial photographs covering the area were scrutinised for potential Iron Age and historical period structures and grave sites. A ground survey, following standard and accepted archaeological procedures, was conducted on 22 March 2019. Particular attention was focused on the occurrence of potential grave sites and other heritage resources on the footprint.

3.1.1 Assumptions and limitations

- The desktop study suggests that Stone Age Sites of all periods and traditons may occur in the greater project area.
- Middle Stone Age tools have been found in dongas and erosion gullies at various locales in southern Kwa-Zulu Natal, including the coastal areas. These sites are usually out of context and of little research value. Some Middle Stone Age surface scatters occur near Southport approximately 6km to the east of the project area. However, no erosion gullies or suitable rocky outcrops that may harbour shelters with deep cave deposits occur in the project area.
- Later Stone Age sites are more prolific in the coastal areas of KwaZulu-Natal including the greater Port Shepstone area. The best known concentration of such sites occur at the Oribi Gorge approximately 10 km to the west of the project area. However, there are no suitable rocky outcrops on the footprint that may harbour shelters with Later Stone Age deposits.
- Early Iron Age Sites typically occur along major river valleys below the 700 m contour in KwaZulu-Natal. It is possible that early Iron Age sites may be located adjacent to the Mzimkhulu River in the near vicinity of the project area.

- Later Iron Age sites do occur at various localities in southern KwaZulu-Natal. Some of these have been investigated by archaeologists attached to the KwaZulu-Natal Museum (Huffman 2007; Maggs 1989). These sites were occupied by the ancestors of the first Nguni-speaking agriculturists as well as their descendants who settled in these areas (Bryant 1965). Some Later Iron Age sites occur to approximately 6km to the east of the project area. It is possible that such sites may also occur in the project area.
- Historical buildings, structures and farmsteads as well as mission stations do occur throughout southern KwaZulu-Natal. Historical era buildings and structures could occur at or near the project area.

3.2 Restrictions encountered during the survey

3.2.1 Visibility

Visibility was good. However, the grassland vegetation is dense at places and these areas may obscure potential heritage sites (Figs 5 & 6).

3.2.2 Disturbance

No disturbance of any potential heritage features was noted.

3.3 Details of equipment used in the survey

GPS: Garmin Etrek
Digital cameras: Canon Powershot A460
All readings were taken using the GPS. Accuracy was to a level of 5 m.

4 DESCRIPTION OF SITES AND MATERIAL OBSERVED

4.1 Locational data

Province: KwaZulu-Natal
Closest Towns: Port Shepstone
Municipality: Hibiscus Coast Local Municipality

4.2 Description of the general area surveyed

4.2.1 Backgound

The desktop study could not find any heritage sites or features on any of the proposed plots. This conclusion was supported by the ground survey of the project area. No heritage features or sites occur on Plot 1. This plot is situated near the Umzimkhulu River and is characterised by dense grassland and indigenous woody vegetation (Figs 4 – 6). Some residential buildings are situated on Plot 2 which is situated on a ridge overlooking Plot 1 (Figs 7 & 8). However, none of these residential buildings are older than 60 years old and they have no heritage value.

The desktop study indicates the presence of a Mission Station approximately 1 km to the east of Plot 2 (Fig 9). However, there is no need for mitigation as this heritage site is not threated by the proposed development.

The footprint is not part of any known cultural landscape.

The consultant could not find evidence for any 'living heritage site' on the footprint.

4.2.2 Stakeholder Consultation

The consultant was assisted by the past landowner of the property who kindly showed him around both proposed development plots. He was not aware of any heritage sites on the property. Some local community graves do occur on the adjacent Rossmin Mine property approximately 2km to the north of the footprint (Prins 2017, 2018) but none are known to occur on the actual footprint.

4.2.3 Desktop Paleontology Assessment

A preliminary investigation suggests that the project area will need a desktop paleontological assessment by an Amafa registered palaeontologist. According to the SAHRIS fossil sensitivity map the footprint falls within a white coloured and a grey coloured zone (Fig 3). Grey coloured areas indicate no fossil sensitivity, however, no paleontological information is available for the white coloured areas. According to SAHRA guidelines these white coloured areas would need a minimum of a desktop paleontological assessment, by a qualified palaeontologist, before prospecting activity may commence.

5 STATEMENT OF SIGNIFICANCE (HERITAGE VALUE)

5.1 Field Rating

Not applicable as no heritage sites are known to occur on the footprint.

Table 2. Field rating and recommended grading of sites (SAHRA 2005)

Level	Details	Action
National (Grade I)	The site is considered to be of National Significance	Nominated to be declared by SAHRA
Provincial (Grade II)	This site is considered to be of Provincial significance	Nominated to be declared by Provincial Heritage Authority
Local Grade IIIA	This site is considered to be of HIGH significance locally	The site should be retained as a heritage site
Local Grade IIIB	This site is considered to be of HIGH significance locally	The site should be mitigated, and part retained as a heritage site
Generally Protected A	High to medium significance	Mitigation necessary before destruction
Generally Protected B	Medium significance	The site needs to be recorded before destruction
Generally Protected C	Low significance	No further recording is required before destruction

No heritage sites occur on or adjacent (within 50m) from the project area including both Plots. The footprint has no heritage value (Table 3).

Table 3. Evaluation and statement of significance.

Significance criteria in terms of Section 3(3) of the NHRA		
	Significance	**Rating**
1.	**Historic and political significance -** The importance of the cultural heritage in the community or pattern of South Africa's history.	None.
2.	**Scientific significance** – Possession of uncommon, rare or endangered aspects of South Africa's cultural heritage.	None.
3.	**Research/scientific significance** – Potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.	None.
4.	**Scientific significance** – Importance in demonstrating the principal characteristics of a particular class of South Africa's cultural places/objects.	None.
5.	**Aesthetic significance** – Importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.	None.
6.	**Scientific significance** – Importance in demonstrating a high degree of creative or technical achievement at a particular period.	None.
7.	**Social significance** – Strong or special association with a particular community or cultural group for social, cultu-ral or spiritual reasons.	None.
8.	**Historic significance** – Strong or special association with the life and work of a person, group or organization of importance in the history of South Africa.	None.
9.	The significance of the site relating to the history of slavery in South Africa.	None.

6 RECOMMENDATIONS

As no heritage sites, features or graves occur on the footprint, there is no reason why the proposed development may not proceed form a general heritage perspective. Both proposed plots are equally suitable for development from a general heritage perspective. The area is also not part of any known cultural landscape. However, the phase 1 desktop paleontological assessment indicates that both plots will require a desktop paleontological assessment by a qualified palentologist before any development may proceed. It is important to take note of the KwaZulu-Natal Heritage Act that requires that any exposing of fossils, graves and archaeological and historical residues should cease immediately pending an evaluation by the heritage authorities.

7 MAPS AND FIGURES

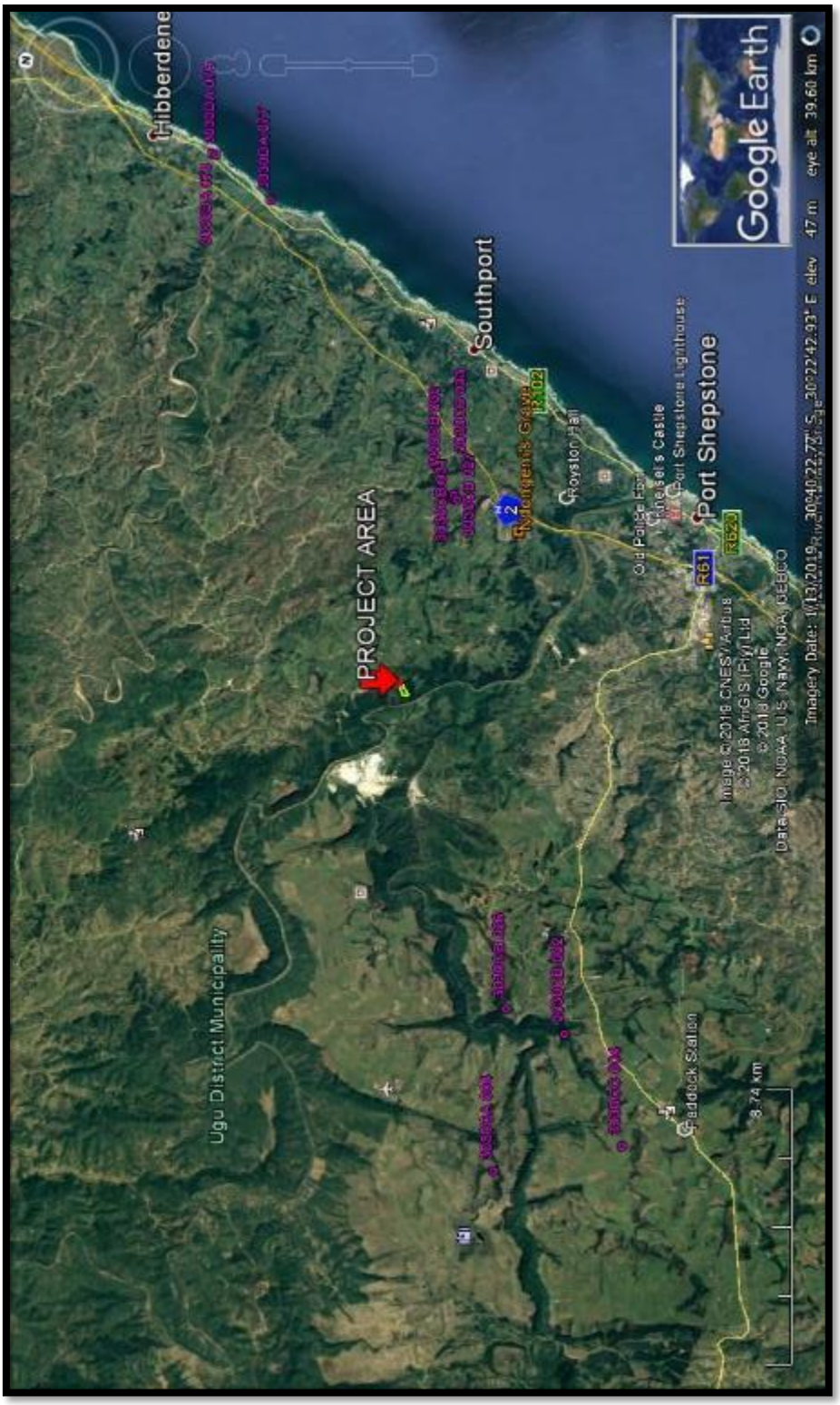


Figure 1. Google Earth Imagery the location of the project area near Port Shepstone. The purple markers indicate known archaeological sites in the greater area. None occur on the actual footprint

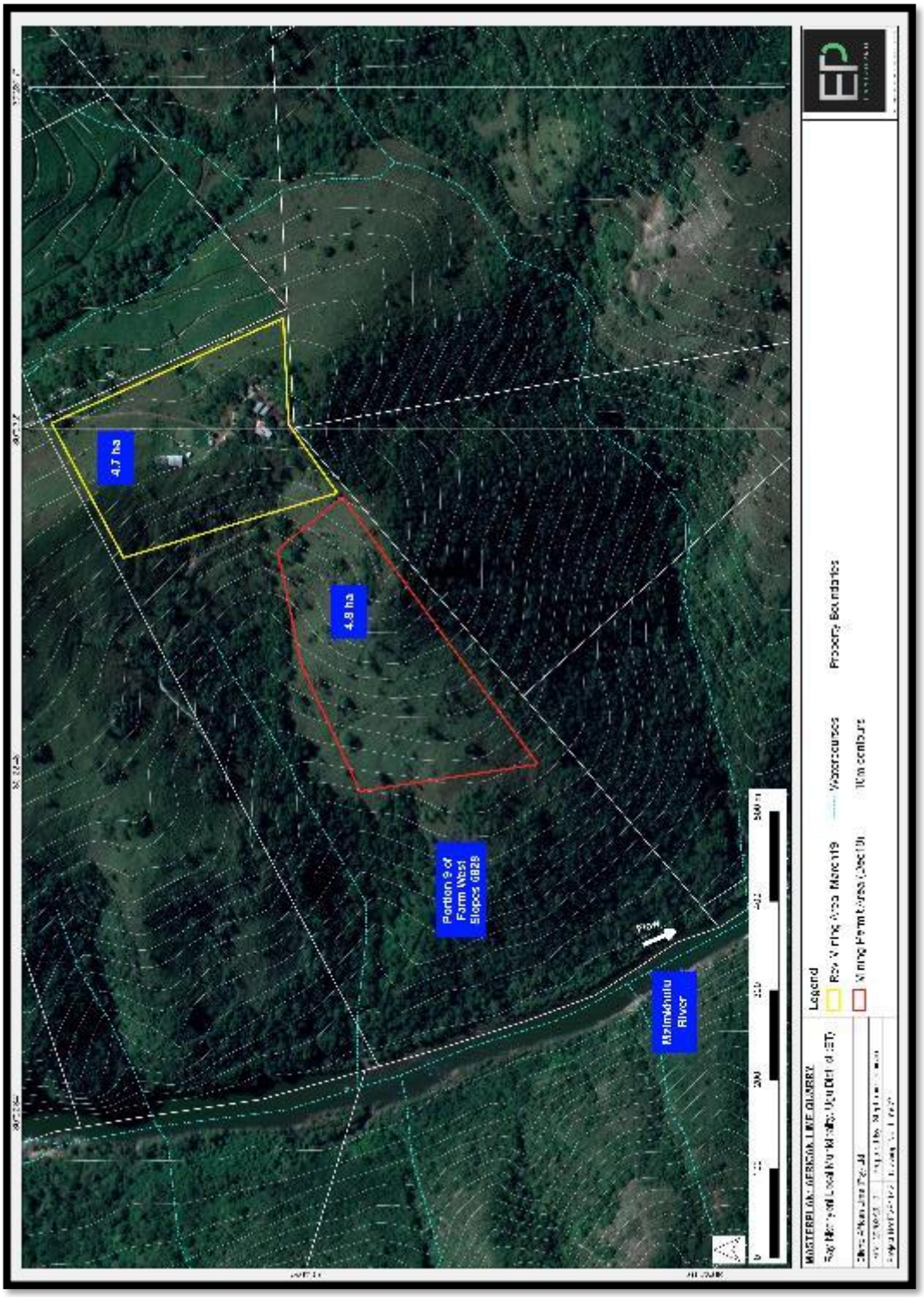
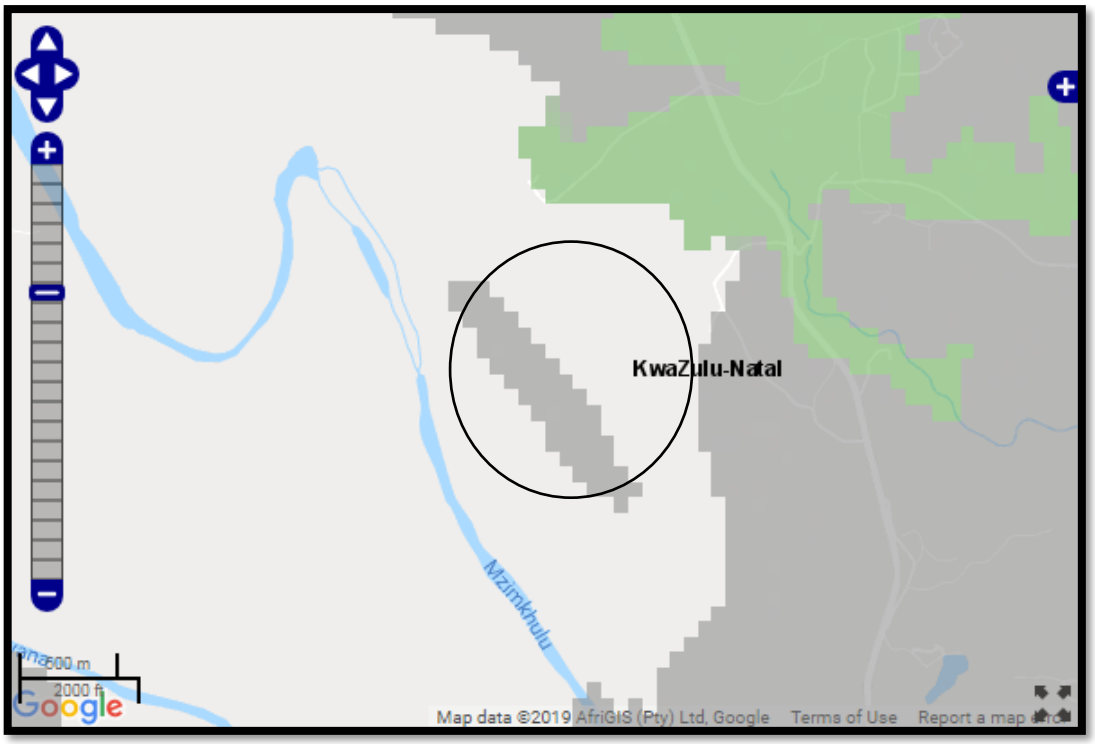


Figure 2. Map showing the two proposed plots identified for limestone mining. Plot 1 (near the Umzimkhulu River) covers and area of 4.8 ha and Plot 1 (on the ridge) covers an area of 4.7 ha (Source: EnviroPro).



1 in 250 000 geological formation layers are courtesy of the Council for GeoScience
For more information, go to How to Use the Palaeontological (fossil) Sensitivity Map

Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

Figure 3 SAHRIS Fossil Sensitivity Map of the project area (indicated by the black polygon). The white background colour indicates that these areas will require a minimum of a desktop study by a qualified palaeontologist.

Figure 4. Plot 1 situated on a lower altitude close to the Umzimkhulu River. No heritage sites or features occur on this plot.

Figure 5. Dense vegetation may have compromised heritage site visibility on Plot 1.

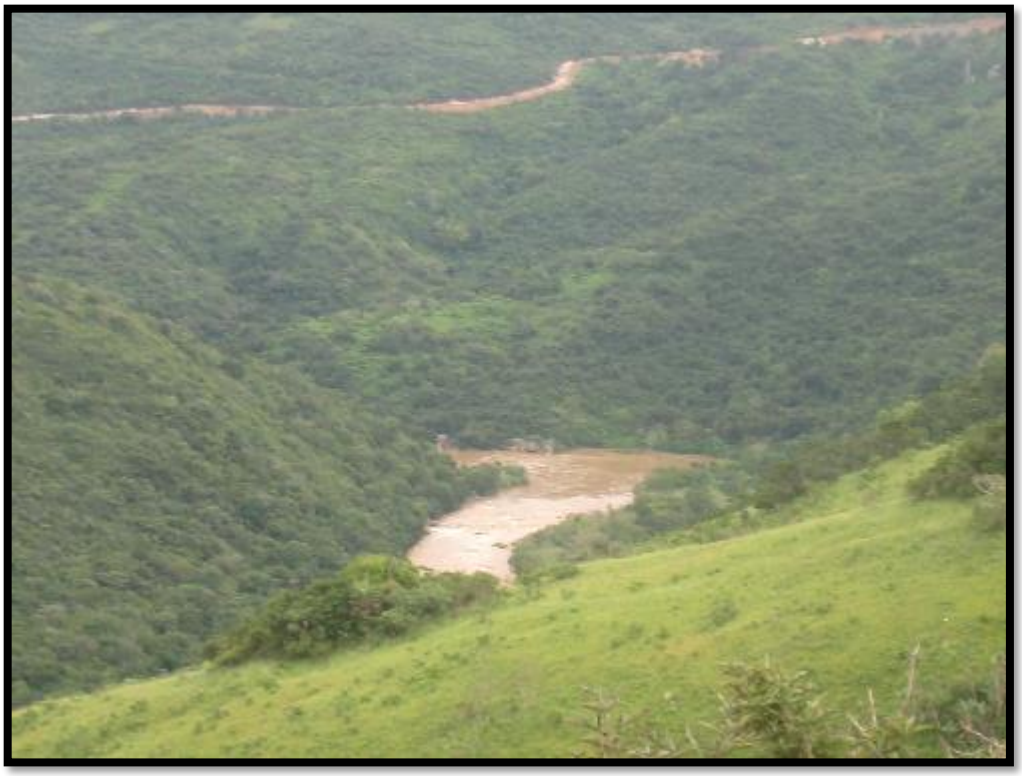


Figure 6. View over the Mzimkhulu River as seen from Plot 1.

Figure 7. Plot 2 is situated on a ridge overlooking Plot 1.

Figure 7. Residential buildings on Plot 2. None of these have any heritage value.

Figure 8. The Maris Stella Mission is situated more than 1km to the east of the proposed prospecting area at S 30° 39' 30.06" E 30° 23' 46.47". It is not threatened and there is no need for mitigation.

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Vegetation Impact Assessment for the proposed African Lime Quarry above the Mzimkulu River, inland of Port Shepstone

Performed for Enviropro

14 October 2019

Declaration of independence by specialist consultant

Contact person:	David Styles		
Postal address:	27A Regina Road, Umbilo		
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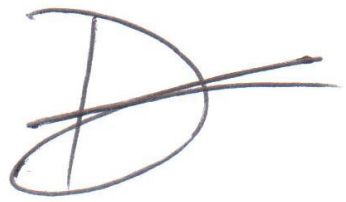
Educational qualifications:	MSc (Environmental Science) UKZN		
Professional affiliations	SACNASP – Professional Natural Scientist (Pri.Sci.Nat.) – Reg. No. 120066		

I, David Styles, declare that I:

- am an independent specialist consultant in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2010;
- 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;
- have appropriate expertise in conducting biodiversity assessments;
- will provide the competent authority with access to all information at my disposal regarding this application, whether such information is favourable to the applicant or not;
- declare that all the particulars furnished by me in this form are true and correct;
- realise that a false declaration is an offence in terms of regulation 71 of the EIA Regulations, 2010 and is punishable in terms of section 24F of the National Environmental Management Act, 1998 (Act 107 of 1998); and
- will comply with all the requirements as indicated in the National Environmental Management Act, 1998 (Act 107 of 1998) and Environmental Impact Assessment Regulations, 2010.



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Signature of the specialist consultant

David Styles

9 October 2019

Expertise

David Styles has more than 13 years of experience conducting vegetation surveys and assessments in the summer-rainfall region of South Africa. During this time he has collected more than 5 000 herbarium specimens, and authored or co-authored 36 popular and scientific articles and papers including six new plant species descriptions, and issued more than 200 reports on botanical subjects. Between 2003 and 2012 he edited the botanical journal *PlantLife* (www.plantlife.co.za). His MSc in Environmental Science by thesis comprised a floristics study of the grasslands of Cato Ridge inland of Durban, at the University of KwaZulu-Natal. A complete curriculum vitae is provided in Appendix 9.

Summary

A quarry is proposed on sites above the Mzimkulu River inland of Port Shepstone. The lower (westernmost site) which is not preferred, comprises grassland which is Pondoland-Ugu Coastal Sourveld, which is not accurately mapped at this locality in national vegetatio mapping (SANBI 2019). Most of this is still primary. The site which is now preferred comprises an area of habitation surounded by alien invasive and secondary vegetation. However, a large part of the site is also primary grassland. Large numbers of plants protected by the provincial conservation ordinance (many hundreds) and some red listed species occur on both sites. They also flank an extensive seam of dry Scarp Forest.

Quarrying of the lowermost site is not supported. If buffers are applied to the better quality vegetation and also on a good practice basis to the dry Scarp Forest, the quarry area reduces by approximately half. This is the only part of the site recommended for quarrying by the vegetation specialist. Consideration should be given to utilizing some of the adjacent cultivated land, if it provides yields of the type needed. It is also pointed out that the 30 metre illustrative buffer shown is a small buffer given the high imact nature of quarrying, and an even large buffer of 50 metres or more would better protect conservation important vegetation.

If quarrying occurs it is important that vegetation is then managed well, according to an approved conservation management plan. This should include controlling alien vegetation up to 100 metres around the quarry area. As a quarry will further enclose and isolate grassland further down the slope, increasing the possibility of scrub encroachment, regular burning will be required. However, there may be difficulty in implementing this mitigation once the quarry is decommisioned.

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9 October 2019

Stephanie Denison
Lead Environmental Consultant
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Dear Steph

VEGETATION IMPACT ASSESSMENT FOR THE PROPOSED AFRICAN LIME QUARRY ALONG THE MZIMKULU RIVER, INLAND OF PORT SHEPSTONE

1. Introduction

I am instructed by Enviropro to provide a vegetation impact assessment for a proposed lime quarry above the Mzimkulu River inland of Port Shepstone. Two areas have been considered for mining as shown in Appendix 1. The higher site, more distant from the river is preferred and is therefore carried forward. Hereinafter, the proposed quarry areas are referred to as "the sites". The fieldwork for this survey was completed at the beginning of September 2019. Note should be taken of limitations encountered during fieldwork as described under the heading "Provisos" below.

2. Methodology

The following high-level work occurred in order to establish broad vegetation types and conservation significance:

- *Vegetation types:* The latest national provincial mapping (SANBI 2019) and provincial vegetation mapping (Scott-Shaw & Escott 2011) were consulted.

- *Conservation significance:* Ezemvelo KwaZulu-Natal Wildlife's biodiversity spatial planning data (EKZNW 2016, 2010) were consulted.

- *Aerial photography from 2005 was also examined.* This assisted with the mapping of vegetation boundaries and understanding continuities or changes in vegetation, together with surrounding settlement impacts which have occurred in the past 14 years.

The proposed quarry areas was well walked on 1 September 2019. Notes, GPS positions and photographs were taken of vegetation and conservation important features.

3. Provisos

In grassland and open vegetation, plants senesce and may have no above-ground presence in the winter months. In the coastal and semi-coastal parts of KwaZulu-Natal, best visibility and flowering is in the summer between the months of October and January. On the date of visiting, a fire had recently burned through much of the grassland, which served to remove most above ground plant material, but little rain had yet fallen. Only some of the earliest flowering species were in flower. In order to remedy this and report in more comprehensive fashion, parts of the proposed quarry area which include better quality grassland and conservation important species should be revisited in October and November, if they are not going to be now excluded from the mining footprint.

4. General comments about the proposed quarry area and environs

Altitude within the proposed quarry area is between approximately 100 to 220 metres asl (lower site, not preferred) and 230 to 250 metres asl (higher site, preferred). The sites overlook and are in close proximity to the Mzimkulu River.

The area forms part of the coastal escarpment comprised mainly of Msikaba Formation sandstone, well evident at the nearby Oribi Gorge. Although cliffs to not occur on the sites, parts are steep and rocky, with extensive rocky exposures. Msikaba Formation sandstone is associated with high endemism and comprises the unique geology of the Pondoland Centre of Plant Edemism.

5. Vegetation type

National vegetation mapping (SANBI 2019) shows the lower site comprising KwaZulu-Natal Coastal Belt Thornveld (CB 6). Some KwaZulu-Natal Coastal Belt Thornveld is also shown on the upper preferred site. One of the problems with KwaZulu-Natal Coastal Belt Thornveld, is that although introduced as a "new" type by Scott-Shaw & Escott (2011), no information on its floristics in available (i.e. its species composition is apparently unknown, or if known has never been publicly communicated). As a result, and particularly where mapping is poorly resolved (as appears to be the case in proximity to these sites), it is difficult to refer vegetation of particular species composition back to this type. It is also, given the absence of floristic information, hard to understand why and how a "new" vegetation type can be authoritatively introduces on this basis, as a vegetation type contains at minimum important and some characteristic species or associations, which make it distinct from other types.

The information about this vegetation type on the SANBI BGIS website is exactly the same as Scott-Shaw & Escott, and appears to be no more than a restatement of this.

KwaZulu-Natal Coastal Belt Thornveld (CB 6)

Distribution: KwaZulu-Natal Province from near Mandini in the north to Oribi Gorge in the south. Altitude 30-500 m.
Vegetation and Landscape Features: Steep valley sides and hilly landscape mainly associated with drier larger river valleys in the rain shadow of the rain bearing frontal

weather systems from the east coast. Bushed grassland, bushland and bushland thicket and open woodland.
Climate: Summer rainfall with some rain in winter. MAP about 740 to 940 mm. Summers are hot and humid and winters mild. Frost does not occur.
Conservation: Statutorily conserved in Harold Johnson Nature Reserve.
Remarks: This vegetation unit grades into the SVs 6 Eastern Valley Bushveld and SVs 3 KwaZulu-Natal Hinterland Thornveld in the larger river valleys.

KwaZulu-Natal Coastal Belt Grassland (KZN 29)

The upper preferred site is shown as mainly comprising mostly this vegetation type. KwaZulu-Natal Coastal Belt Grassland comprises highly "dissected undulating coastal plains which presumably used to be covered by coastal grassland and various types of subtropical coastal forest" between about Mtunzini and Port Edward. Most of this vegetation is now transformed or disturbed to some degree and includes much secondary and alien vegetation. It is considered Critically Endangered (Mucina & Rutherford 2006), with conservation of remaining natural vegetation considered important. The grassland component of this vegetation type is poorly resolved probably due to so few remaining instances which can be used as a reference point.

Irrespective of problems with this vegetation type, it seems to me that mapping in proximity to the sites is poorly resolved. Instead, it appears as if the vegetation is the following instead:

- Pondoland-Ugu Coastal Sourveld (the grassland component), shown in the national mapping as occurring about 4 km to the east;
- Dry Scarp Forest, grading into Eastern Valley Bushveld, with Scarp Forest shown in national mapping approximately 2 km to the east, and Eastern Valley Bushveld shown along the Mzimkulu River approximately 4 km to the east
- Some detached or semi-detached bush clumps or more diffuse woody growth, some of which, if species composition was reported by Scott-Shaw & Escott (2011) and SANBI (2019), might be found to contain species considered important in KwaZulu-Natal Coastal Belt Thornveld.

The conservation target for this vegetation type is 25%. As this is the same conservation target for Pondoland-Ugu Coastal Sourveld, it is reasonable to infer that it is similarly a Vulnerable vegetation type

Pondoland-Ugu Sandstone Coastal Sourveld (CB 4)

There is a good correlation between species composition of the natural grassland parts of the sites and Pondoland-Ugu Sandstone Coastal Sourveld (CB 4). The species composition is described in Mucina & Rutherford (2006) (p. 579).

Distribution: Eastern Cape and KwaZulu-Natal Provinces: Elevated coastal sandstone plateaus from Port St Johns on the Pondoland coast (Eastern Cape) to the vicinity of Port Shepstone (Ugu District, KwaZulu-Natal), including the sourveld of the well-known Oribi Gorge. Altitude ranges from about 0–600 m.

Vegetation and Landscape features: Coastal peneplains and partly undulating hills with flat table-lands and very steep slopes of river gorges. These sites support natural, species-rich

grassland punctuated with scattered low shrubs or small trees (sometimes with bush clumps, especially in small gullies). Rocky outcrops and krantzes are common and dramatic sea-cliffs occur. Proteaceous trees (*Protea, Faurea)* can be locally common where conditions allow. Although less important here, the geoxylic suffrutex growth form (so typical of CB 2 Maputaland Wooded Grassland), is also represented in this sourveld.

Conservation: Vulnerable, with a target of 25%. Only 7% conserved, 29% transformed, and a large amount in communal areas where degraded.

Scarp Forest (FOs 5)

More information is provided in Mucina & Rutherford (2006) (p. 602) including on species composition.

Distribution: Eastern Cape, KwaZulu-Natal and Mpumalanga Provinces as well as in Swaziland (and possibly also in Mozambique): An archipelago of scattered patches (some of them large, such as Ongoye) spanning southern Mpumalanga (Crocodile River Gorge), the southern part of Lebombo Mountains (KwaZulu-Natal) and reaching nearly as far as Kei River Mouth on the Transkei coast. Patches of this forest lie as far as 140 km inland (Mpumalanga), but extend increasingly closer to the sea in a southward direction—in Pondoland, and southern Transkei they occur at the coast or in deep gorges, often associated with krantzes, scarps and coastal platforms. Most of the patches occur at low altitudes between 50 and 600 m.

Vegetation and Landscape features: Tall (15–25 m), species-rich and structurally diverse, multi-layered forests, with well-developed canopy and understory tree layers, but a poorly developed herb layer. Buttressed stems are common in the Scarp Forest. The most conspicuous trees are *Buxus macowanii, B. natalensis, Drypetes gerrardii, Englerophytum natalense, Harpephyllum caffrum, Heywoodia lucens, Memecylon natalense, Millettia grandis, Oricia bachmannii, Philenoptera sutherlandii, Rinorea angustifolia, Rothmannia globosa* and *Umtiza listeriana.*

Conservation: Least threatened in protected areas, but exposed to over-exploitation elsewhere. Target 40%. More than 20% statutorily conserved.

Eastern Valley Bushveld (Svs 6)

Distribution: KwaZulu-Natal and Eastern Cape Provinces: Deeply incised valleys of rivers including the lower reaches of the Thukela, Mvoti, Mgeni, Mlazi, Mkhomazi, Mzimkulu, Mzimkulwana, Mtamvuna, Mtentu, Msikaba, Mzimvubu (and its several tributaries), Mthatha, Mbhashe, Shixini, Qhorha and Great Kei. Very seldom extending to the coast. Altitude 100–1 000 m.

Vegetation and Landscape features: Semi deciduous savanna woodlands in a mosaic with thickets, often succulent and dominated by species of Euphorbia and Aloe. Most of the river valleys run along a northwest-southeast axis which results in unequal distribution of rainfall on respective north-facing and south-facing slopes since the rain-bearing winds blow from the south. The steep north-facing slopes are sheltered from the rain and also receive greater amounts of insulation adding to xerophilous conditions on these slopes.

Conservation: Least Concern

6. Threatened and rare species

Large numbers of rare and red listed species are known to occur within Pondoland-Ugu Coastal Sourveld and Scarp Forest within the Pondoland Centre of Plant Endemism. The Oribi Gorge and Oribi Flats localities (the plateau above and inland of the gorge and including above the gorges of the Mzimkulu River), from which numbers of such species are known, are just to the east. Many of the Pondoland Centre endemics are represented differently in this area, due to drier conditions at the northern edge of the Pondoland Centre. Some of these endemics are only known from this northern edge including: *Aspalathus abbottii, Brachystelma tenellum, Plectranthus oertendahlii* and *P. oribiensis*. Much of the area outside of formal conservation areas (Oribi Gorge, Lake Eland and a small number of Oribi Flats farms), is botanically unexplored or poorly explored.

Two red listed species were found on the sites as described further below. More may be found if surveyed further into the summer flowering window. IUCN red list categories/categories used by SANBI are set out below.

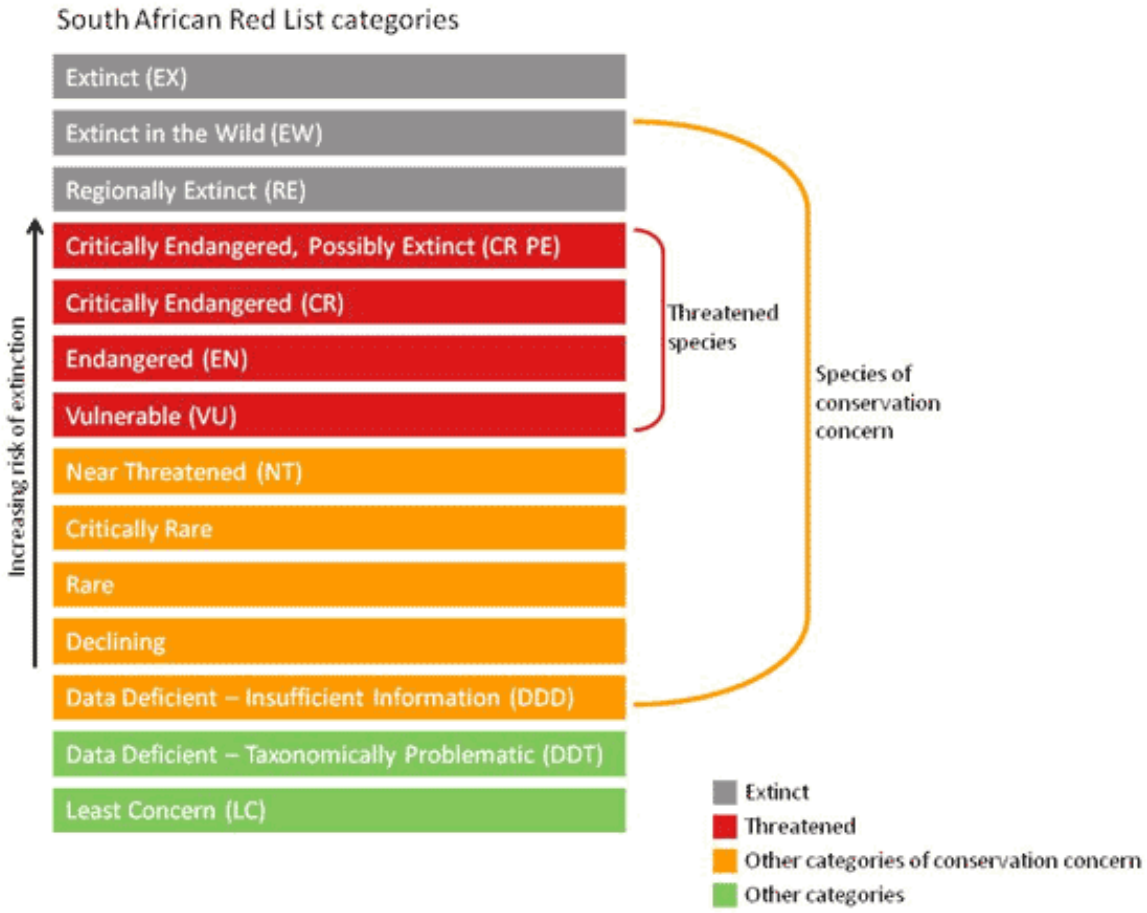


Figure 1. South African red list categories.

The categories are explained further as follows. Non-IUCN categories are indicated with an asterisk:

Extinct (EX): A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.

Extinct in the Wild (EW): A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.

Regionally Extinct (RE): A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.

Critically Endangered, Possibly Extinct (CR PE): Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.

Critically Endangered (CR): A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.

Endangered (EN): A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.

Vulnerable (VU): A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.

Near Threatened (NT): A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable, and is therefore likely to become at risk of extinction in the near future.

*** Critically Rare:** A species is Critically Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.

*** Rare:** A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows:

Least Concern: A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.

7. Ezemvelo KwaZulu-Natal Wildlife's KwaZulu-Natal Systematic Conservation Plan

The proposed mining areas are designated in EKZNW's KZN Systematic Conservation Plan (SCP) as Irreplaceable Critical Biodiversity Areas – in other words areas that have the highest importance and are considered essential for meeting conservation targets.

8. Relevant laws and regulations

8.1 Environmental assessment practitioners (EAPS) and specialists

The following is extracted from the National Environmental Management Act, Act 108 of 1998 (NEMA). The relevant sections are section 12 & 13 and are included below.

Appointment of EAPS and specialists

12.

(1) A proponent or applicant must appoint an EAP at own cost to manage the application.

(2) In addition to the appointment of an EAP, a specialist may be appointed, at the cost of the proponent or applicant, if the level of assessment is of a nature requiring the appointment of a specialist.

(3) The proponent or applicant must-

- (a) take all reasonable steps to verify whether the EAP and specialist complies with regulation 13(1)(a) and (b); and
- (b) provide the EAP and specialist with access to all information at the disposal of the proponent or applicant regarding the application, whether or not such information is favourable to the application.

General requirements for EAPs and specialists

13.

(1) An EAP and a specialist, appointed in terms of regulation 12(1) or 12(2), must-

- (a) be independent;
- (b) have expertise in conducting environmental impact assessments or undertaking specialist work as required, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity;
- (c) ensure compliance with these Regulations;
- (d) 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 application;
- (e) take into account, to the extent possible, the matters referred to in regulation 18 when preparing the application and any report, plan or document relating to the application; and
- (f) disclose to the proponent or applicant, registered interested and affected parties and the competent authority all material information in the

possession of the EAP and, where applicable, the specialist, that reasonably has or may have the potential of influencing-

(i) any decision to be taken with respect to the application by the competent authority in terms of these Regulations; or

(ii) the objectivity of any report, plan or document to be prepared by the EAP or specialist, in terms of these Regulations for submission to the competent authority; unless access to that information is protected by law, in which case it must be indicated that such protected information exists and is only provided to the competent authority.

(2) In the event where the EAP or specialist does not comply with sub regulation (1)(a), the proponent or applicant must, prior to conducting public participation as contemplated in chapter 5 of these Regulations, appoint another EAP or specialist to externally review all work undertaken by the EAP or specialist, at the applicant's cost.

(3) An EAP or specialist appointed to externally review the work of an EAP or specialist as contemplated in sub regulation (2), must comply with sub regulation (1).

8.2 National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA requires, inter alia, that:

"Development must be socially, environmentally, and economically sustainable."

"Disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimized and remedied."

"A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions."

NEMA also states that:

"The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage."

8.3. National Environmental Management: Biodiversity Act (Act No. 10 of 2004)

In terms of the Biodiversity Act, developers and land managers have a responsibility to limit further loss of biodiversity and conserve endangered ecosystems.

The first national list of threatened terrestrial ecosystems for South Africa was gazetted on 9 December 2011 (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (GN 1002, 9 December 2012). The purpose of listing is stated to be reduction of the rate of "ecosystem and species extinction" and to preserve sites of high conservation value. This is achieved primarily by the

requirement that environmental impact assessments be followed when more than 300 m^2 of indigenous vegetation in critically endangered or endangered ecosystems may be transformed by development (Activity 12 of 985), together with the requirement that threatened ecosystems be appropriately considered and treated by organs of government in the drafting of spatial plans.

The proposed mining areas fall within a threatened ecosystem, namely Interior South Coast Grasslands (KZN 7), which is considered Critically Endangered. Summary information on the ecosystem is provided below.

- Remaining natural area of ecosystem: 9 %
- Proportion of ecosystem protected: 2% of original area
- Known number of species of special concern: 24 threatened or endemic plant and animal species including those listed below.
- Key biodiversity features include three millipede species including *Centrobolus anulatus, Doratogonus infragilis* and *Doratogonus montanus*; seventeen plant species for example *Begonia rudatisii, Crassula streyi, Craterostigma nanum var nanum, Diaphananthe millarii, Eugenia simii, Helichrysum woodii, Huernia hystrix parvula, Kniphofia pauciflora, Kniphofia rooperi, Phylica natalensis, Plectranthus ernstii, Rhynchocalyx lawsoniodes, Streptocarpus primulifolius, Watsonia confusa, Watsonia inclinata*; four reptile species including *Bradypodion angustiarum, Bradypodion caeruleogula, Bradypodion melanocephalum* and *Bradypodion wezae*; and six vegetation types including KwaZulu-Natal Coastal Forest, KwaZulu-Natal Sandstone Sourveld, Ngongoni Veld, KwaZulu-Natal Coastal Belt, Pondoland Scarp Forest, Pondoland-Ugu Sandstone Coastal Sourveld.

8.4 National Forests Act (Act No. 84 of 1998)

According to the Act:

"No person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister."

Disturbance, removal, pruning or transplanting of such a protected tree species requires a license from the administrators of the National Forests Act, in this case the Department of Agriculture, Forestry and Fisheries (DAFF) based in Pietermaritzburg.

Communities of indigenous trees where the crowns are contiguous are considered forest in terms of the act and are similarly protected. Vegetation that can be described as forest immediately adjacent to the sites.

The Act also protects certain tree species, which also require license authorization prior to disturbance or destruction. Protected trees were not seen on the sites, but one example of the protected tree *Sideroxylon inerme* (White Milkwood) was seen on the site boundary.

8.5 Provincial conservation ordinance

Separately of the National Forests Act, a KwaZulu-Natal provincial conservation ordinance provides special protection to a range of other indigenous plant species, including other trees and smaller herbs. These plants may not be disturbed, damaged, destroyed or relocated without permit authorization from provincial conservation authority Ezemvelo KwaZulu-Natal Wildlife. A large number of such plants were found on both sites.

8.6 Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001

Declared weeds and invader plant species are categorized in this legislation as follows:

- **Category 1:** These plants are prohibited and must be controlled.
- **Category 2:** These plants are used commercially and can be grown in demarcated areas, providing that there is a permit and that steps are taken to prevent their spread.
- **Category 3:** These plants have been used ornamentally, but may no longer be planted. Existing plants may remain, as long as all reasonable steps are taken to prevent their spreading, except if they occur within the flood line of watercourses and wetlands (in which case they must also be removed).

Extensive alien plant invasion occurs on the higher, preferred site, close to dwellings and away from the natural grassland.

9. Vegetation according to observations on site

Based on fieldwork, vegetation is mapped in Appendix 1 as follows.

9.1 Primary grassland

Nearly the entirety of the lower site, which is not preferred, comprises Pondoland-Ugu Coastal Sourveld. Possibly due to being enclosed between arms of forest or woodland, and bounded by dwellings and agriculture above, this grassland has not been regularly burned and comprised a large amount of scrubbier grassland, particularly the grass *Cymbopogon nardus*. A large number of *Protea caffra* shrubs occur within this grassland. However, it appears as if a hot fire recently burned through the grassland, incinerating much scrubby encroachment. The grassland is also species diverse, primary (albeit some slightly degraded) and contains rare, red listed and protected species. Red listed species include *Helichrysum pannosum* (Endangered, but more widespread than herbarium records indicate) and the Pondoland Centre endemic *Kniphofia coddiana* (Near Threatened). Protected species include *Albuca setosa, Aloe ferox, Boophone disticha, Dierama igneum, Eulophia ovalis, E. parviflora, Watsonia* sp. (probably *densiflora* but not in flower) and *Merwilla plumbea* (robust plants previously referred to as *Scilla natalensis*). *Kniphofia coodiana* is both red listed and protected).

The grassland comprised of Pondoland-Ugu Coastal Sourveld within the higher, preferred site shows greater sign of degradation, particularly close to dwellings, but is still primary. It remains moderately species diverse and includes rare, red listed and a large number (several hundred examples) of different protected plant species.

A more notably degraded area of Pondoland-Ugu Coastal Sourveld is shown in Appendix 1, but even this retains some species diversity, together with some protected species (A few *Aloe maculata* plants and the orchid *Eulophia ovalis*).

Typical species (note that due to the recent burn, most species were just growing out and only some of the herbaceous diversity was likely evident):

Acalypha villicaulis
Aeschynomene micrantha
Afrodsciadium caffrum
Argyrolobium rotundifolium
Aster harveyanus
Barleria meyeriana
Berkheya insignis
Berkheya speciosa
Chaetacanthus burchellii
Clutia cordata
Eriosema cordatum
Eriosema salignum
Gerbera ambigua
Graderia scabra
Helichrysum allioides
Helichrysum appendiculatum
Helichrysum auriceps
Helichrysum herbaceum
Helichrysum nudifolium var. pilosellum
Helichrysum pannosum
Helichrysum spiralepis
Indigofera sp. cf. hilaris
Ipomoea crassipes
Lasiosiphon anthylloides
Ophrestia oblongifolia
Osteospermum grandidentatum
Plectranthus hadiensis
Hypericum aethiopicum subsp. sonderi
Kohautia amatymbica
Ocimum obovatum subsp. obovatum
Pentanisa prunelloides
Rhynchosia cooperi
Rhynchosia totta
Senecio coronatus
Senecio glaberrimus
Senecio latifolius
Senecio oxyriifolius
Senecio polyanthemoides
Senecio rhyncholaenus
Thunbergia atriplicifolia
Vernonia capensis

9.2 Secondary grassland

The preferred site includes some parts which are secondary or nearly secondary grassland. Weedy or undesirable grass species (particularly dominance by *Cymbopogon nardus*) indicate this grassland is infrequently burned. There appear to be few herbaceous species amongst the grass except for a small number of more robust species (*Berkheya bipinnatifida*, *Leonotis leonorus* and *Pseudarthria hookeri*), but most also comprise weedy species.

9.3 Scarp Forest

The Scarp Forest contains xeric elements, but is certainly best categorized as forest, even if there is some graduation into Eastern Valley Bushveld.

Acridocarpus natalitius (Moth-fruit)

Allophyllus dregeanus (Simple-leaved Allophyllus)

Apodytes dimidiata (White Pear)
Burchellia bubalina (Wild Pomegranate)
Chaetacme aristata (Thorny Elm)
Combretum kraussii (Forest Bushwillow)
Dracaena aleriformis (Large-leaved Dragon Tree)
Gymnosporia harveyana
Harpephyllum caffrum (Wild Plum)
Heteropyxis natalensis (Lavender Tree)
Hippobromus pauciflorus (False Horsewood)
Maerua racemulosa
Mimusops obovata (Red Milkwood)
Monanthotaxis caffra (Dwaba-berry)
Protorhus longifolia (Red Beech)
Rapanea melanophloeos (Cape Beech)
Rhoicissus rhomboidea
Rhoicissus tomentosa
Scolopia zeyheri (Thorn-pear)
Scutia myrtina (Cat-thorn)
Trimeria grandifolia (Wild Mulberry)
Vepris lanceolata (White Ironwood)

Herbaceous species include: *Dietes grandiflora* and *Isogloss* sp.

All the forest next to the sites is protected by the National Forests Act and may not be disturbed except with license authorization from the Department of Forestry and Fisheries (DAFF). On a good practice and common-sense basis, development activity should be set back/buffered from the forest edge by at least 30 metres if this is to be prevented.

Some semi-detached and more diffuse bush clumps and patches occur away from the scarp forest. Typical species are *Apodytes dimidiata, Rapanea melanophloeos, Strelitzia nicolai* and some species not usually found within forest, including *Senegalia (Acacia) caffra* and *Cussonia spicata*.

Indicative of the rocky nature of the sites are *Coddia rudis* (Small Bone-apple)*, Diospyros scabrida, Ficus glumosa (Mountain Rock Fig), F. ingens* (Red-leaved Rock Fig) all in freestanding or in bush clumps, and *Maytenus acuminata* (in forest). Large, if localized occurrences of *Protea caffra* shrubs and small trees occur on the lower (not preferred site).

9.4 Alien and secondary vegetation

A discrete area around the habitation on the preferred site includes some planted species but a much larger amount of alien invasive vegetation. The most notable species in this area are:

Arundo donax
Chromolaena odorata
Furcraea foetida
Lantana camara
Melia azedarach
Ricinus communis
Solanum mauritianum
Tagetes minuta

10. Red Listed species

Red listing follows Raimondo et al. (2009). The following red listed species were seen.

Lower site, not preferred:

- *Helichrysum pannosum* (Endangered, but in my experience more frequent than reported) – at least 10 plants, but as just emerging from burned grassland, there may be more still to be seen.
- *Kniphofia coddiana* (Near Threatened) – More than 100 plants, over a wide area.
- *Merwilla plumbea* (Near Threatened, Pondoland Centre near-endemic) – At least 50 plants).

Upper site, preferred:

- *Kniphofia coddiana* (Near Threatened) – 100 plants, over a wide area in the remaining.
- *Merwilla plumbea* – At least 10 plants).

Greater numbers of all these species may be seen as the summer progresses.

11. Protected plants

The KwaZulu-Natal provincial conservation ordinance provides blanket protection for whole plant families or genera. For this reason, protected plants are not always rare or threatened. The following ordinance-protected plants species occur:

Albuca setosa	Lower site (not preferred)	Upper site (preferred)
Aloe ferox	100 +	
Aloe maculata		5-10
Boophone disticha	50 +	5-10
Dierama igneum	1000 +	200 +
Kniphofia coddiana	100 +	30 +
Merwilla plumbea	50 +	5-10
Watsonia cf. densiflora	1000 +	100 +

A single example of *Sideroxylon inerme* (White Milkwood) was found along the forest edge

12. Sensitivity rating

The mapped vegetation on the proposed site is allocated as follows:

1. (High) – Pondoland-Ugu Coastal Sourveld in good condition, including Scarp Forest. This vegetation should be avoided.
2. (Intermediate) – All other vegetation that is not transformed, secondary or heavily alien invaded.
3. (Lowest) – Secondary and invaded vegetation which is transformed, secondary or heavily alien invaded. This is most suitable for mining.

13. Mitigations

Mining will cause direct destruction of vegetation and habitat. The following impacts can also occur:

- Physical disturbance – particularly from pedestrian and vehicle traffic if not confined to work areas.
- Dust, which is greater from heavy vehicles, coats and contributes to ill health and deterioration of roadside vegetation.
- Percolation of waste and refuse.

The impacts of the quarry and any other development that may occur in future can be mitigated through the following measures.

- Highest value vegetation on the site, as noted above, should be avoided and protected from mining-related disturbance. This includes Scarp Forest, woody vegetation close into the intermittent stream and the cliff edges and 50 metres above and below.
- An alternate and smaller footprint is suggested to protect valuable vegetation and habitats. This provides a 30 metre buffer between this vegetation and footprint and proposed quarrying. This smaller footprint is shown in Appendix 1, but this does not leave much mining area. If possible, the adjacent land under cultivation should be considered for inclusion, together with other seral or secondary indigenous plant growth along the same contour as that under cultivation.
- Controlling vehicle and pedestrian traffic, ensuring it is kept away from the Scarp Forest, KwaZulu-Natal Sandstone Sourveld and the drainage line and confined to designated roads and work areas.
- Controlling dust generated by vehicles, especially heavy vehicles.
- Controlling alien plants.
- Ensuring that waste material or refuse does not percolate into the remaining natural area and to ensure that it does not, make regular checks and clean ups as necessary.
- Livestock should be excluded from grazing the grassland on the site. These animals will in any event pose a hazard if mining is taking place.
- A conservation management plan including more detail on alien plant control should be drawn up by a suitably qualified specialist for the site and an area of 100 metres around, based on elements outlined above, and which sets out specific milestones, timeframes and reporting to ensure that this management is implemented.

14. Vegetation Impact Assessment

A proposed quarry will cause direct destruction or degradation of vegetation. Unless a smaller area is mined, there will be destruction of some Pondoland-Ugu Coastal Sourveld, a Vulnerable type, and of red listed species. Furthermore, without buffering, the forest and its edge are likely to be disturbed, requiring license authorisation from the Department of Forestry and Fisheries (DAFF). As a result a smaller mining area is recommended and shown in Appendix 1. The proposed mining sites are also within an area assessed by Ezemvelo KZN Wildlife as Critical Biodiversity Area – Irreplaceable, which are considered essential to meeting conservation targets. They also fall within a Critically Endangered national threatened ecosystem.

The following indirect impacts can also be expected, all of which can be controlled:

- Isolation of the grassland below the preferred quarry site and reducing egress by fire. this increases the possibility of all the grassland below being lost to scrub and woody plant encroachment, over time. This can be mitigated through managed burning, but will probably not continue once the quarry is decommissioned.
- Physical disturbance – from vehicles and pedestrians if not strictly confined to access routes and the work footprint areas.
- Dust, which is greater from heavy vehicles, coats and causes the deterioration of roadside vegetation.
- Percolation of waste and refuse.
- Risk of greater alien plant invasion.

The impacts are assessed according to the impact assessment methodology in Appendix 7 as follows.

Probability	Definite	5
Duration	Permanent (the vegetation is not likely to recover to natural condition except very possibly over very long time frames)	5
Scale	Likely to extend outside the study area, but otherwise local	2
Magnitude	Medium but possibly high if impacts outside the proposed quarry area are not controlled.	8

According to the formula SP = (magnitude + duration + scale) x probability, the result is 75 which falls within the range of a medium to high negative impact. The negative impact is considered most likely a medium impact if the footprint is reduced as recommended and mining activity is well controlled so as to not disturb vegetation beyond the reduced footprint, but high if not.

There are no positive impacts on vegetation on the site, unless an alien plant control programme is implemented for vegetation surrounding the quarry. This should be done in terms of a conservation management plan drawn up by a suitably qualified specialist, with milestones, timelines, monitoring and reporting to the competent authority. It is accepted that decisions authorizing development are made taking into account a number of factors, including economic benefit, but this is not the purview of a vegetation specialist.

If smaller protected plants are affected, they can be relocated. However, this can result in high mortality. The following guidelines are provided.

- Relocation must be carried out by a qualified horticulturist or specialist, who has good, prior experience of relocating indigenous, protected species.

- Natural grassland within the proposed mining area should be searched on a systematic basis for such plants, from later October and before the end of the summer. This also has implications for scheduling, as if mining will commence before the next summer, relocation should occur now or at least before the arrival of winter. This is because most grassland herbaceous plants are deciduous or inconspicuous in the winter, and little or lower rainfall in this season affect subsequent survival.

- One of the main criteria enabling successful relocation is excavation of plants with due care to minimize disturbance and damage to roots. Plants with damaged roots are not as resilient and are much more likely to perish. As a result, any workers involved in excavation and relocation must be well supervised to ensure that roots are well protected.

- It will be necessary to provide at least initial watering of the plants and allow some monitoring thereafter to ascertain whether there is a need for further watering.

- If it is not possible to effect the relocation of aloes and bulbs during the summer, it will be better to avoid planting at this time. Plants should then be carefully excavated to minimise disturbance to roots, bagged up in a holding nursery, maintained in healthy condition, and planted out the next summer.

- These options need to be settled quickly, given the project time frames. It is recommended that after an initial discussion with the mine representatives to establish what can be provided for and within what times frames, a comprehensive but concise and easy-to-understand method statement and programme needs to be developed that will guide and address all aspects of the relocation requirements. This will include a statement and programme that may need adjustment and amendment as it is carried out. The aspects of this method statement and programme include:

    - Excavation of the plants;

    - Establishment or location of the holding nursery, which will be of larger or smaller size, depending on whether aloes and *Ledebouria* species can be quickly relocated or not, and whether this will be more feasibly achieved on- or off-site (again partly informed by the speed with which the aloes and *Ledebouria* species can be relocated);

    - Bagging and subsequent maintenance of the plants in the nursery.

    - Replanting, including post-planting watering;

    - Specific habitat requirements of each species.

    - Timeframes in which objectives need to be achieved.

- Notwthstanding what is provided in a method statement, the advice of a specialist needs to be obtained to identify them in the field and later planting out in suitable habitat.

15. Conclusion and recommendations

Due to limitations (seasonality and recent burning of grassland) this vegetation impact assessment is provisional). If the areas of Pondoland-Ugu Coastal Sourveld in better condition are to be mined, they should be reassessed for possible occurrence of more or a greater number of red listed species further into the summer.

As a vegetation specialist my concern is only for impacts on vegetation. If it is only vegetation is considered, no specialist should support development that will transform valuable vegetation unless there is an offset or other benefit such as improved management of other similar vegetation nearby or of the same kind.

I do not recommend a mining of the lower site, which is not preferred. I do not support full extent of mining of the higher, preferred site. This is not only because it contains primary vegetation including grassland and some red listed species, but because it is assessed as being part of an Ezemvelo KZN Wildlife Critical Biodiversity area. I am also concerned about longer term loss of grassland below any quarry due to increased isolation and reduced fire frequency.

On a good practice basis, it is preferable for mining to be set back at least 30 metres from the forest edge and the better quality Pondoland-Ugu Coastal Sourveld avoided. However, 30 metres is a small buffer for a quarry, which is a high impact activity and an even larger buffer will be preferable to minimize disturbance. This will reduce the available quarry area, which unless extended into cultivated land may be too small to be viable. Consideration should therefore be given to whether, under these constraints, the sites are fit to purpose.

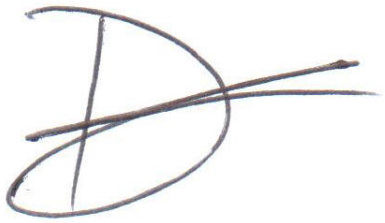
I support the proposed development on the basis that the lower site does not occur, that the primary Pondoland Coastal Sourveld is protected, and that an alien plant control plan be set in place. The alien plant control plan mentioned above should be included within a management plan approved by and audited for the competent authority for the site and include all the valuable vegetation identified above and within an at least 100 metre proximity. It is essential that such a plan include burning off of the grassland beneath any quarry every two years. If any red listed or protected plants are at risk of disturbance, they should be relocated.

In order to confirm whether there are no more red listed species in close proximity to the footprint, which if present will likely be within the area mapped as Pondoland-Ugu Coastal Sourveld in better condition, as shown in Appendix 1, unless avoided and buffered by a distance of at least 30 metres, it should be visited again and a follow-up report made later in the summer.

If any of the closed woody vegetation adjacent to the sites will be disturbed, degraded or destroyed (i.e. included within the quarry footprint or disturbance area) a license will need to be obtained from the Department of Forestry and Fisheries (DAFF). If any species protected by the KwaZulu-Natal provincial conservation ordinance will be disturbed or destroyed, permit authorization will need to be obtained from Ezemvelo KZN Wildlife.

Should you have any queries please do not hesitate to contact me through details below.

Yours sincerely



David Styles

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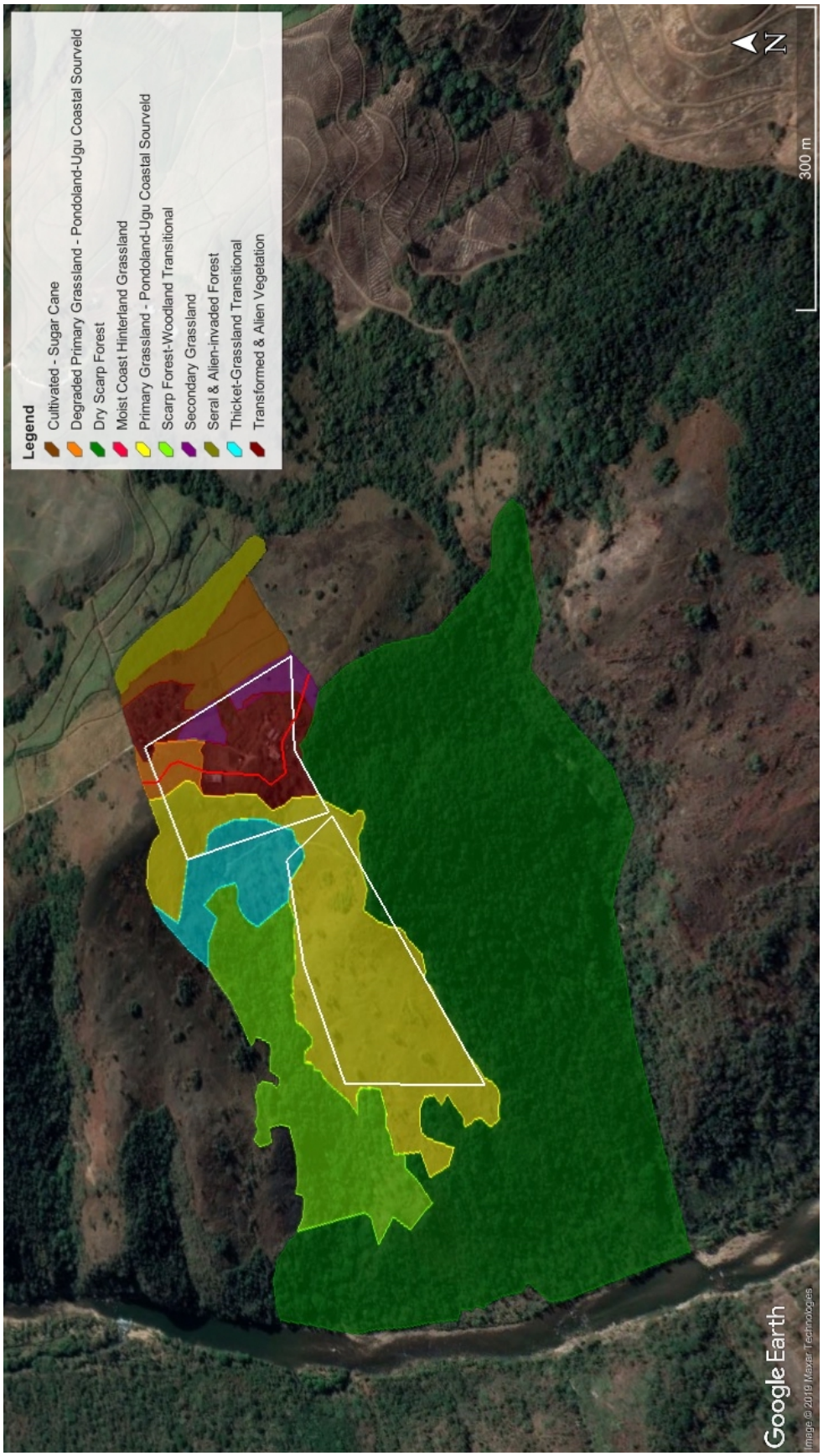
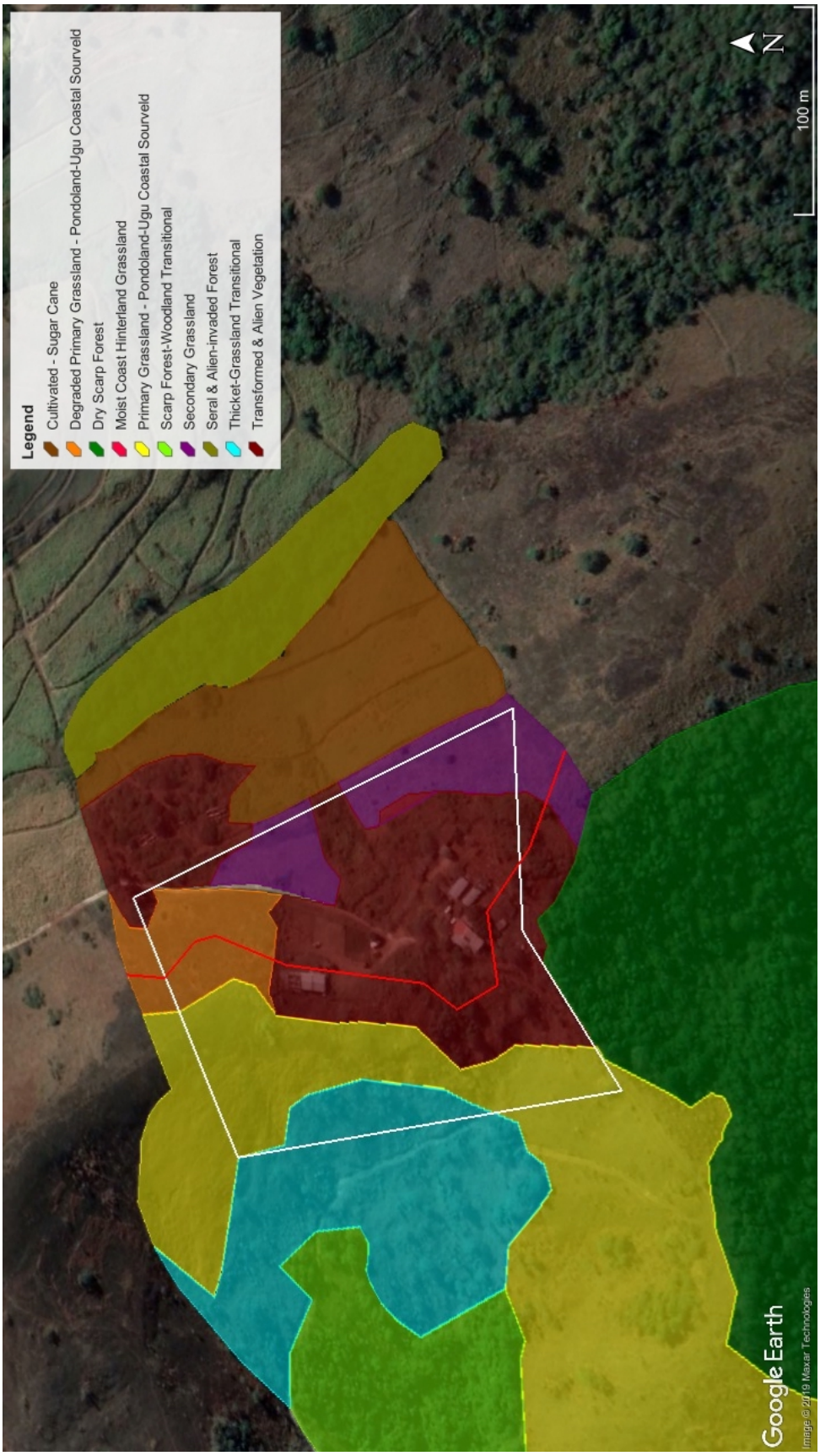
Raimondo, D.; Von Staden, L.; Foden, W.; Victor, J.E.; Helme, N. A.; Turner, R. C.; Kamundi, D. A. & Manyama, P. A. (eds) 2009. Red list of South African plants. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria.

Appendix 1.1: Vegetation mapping

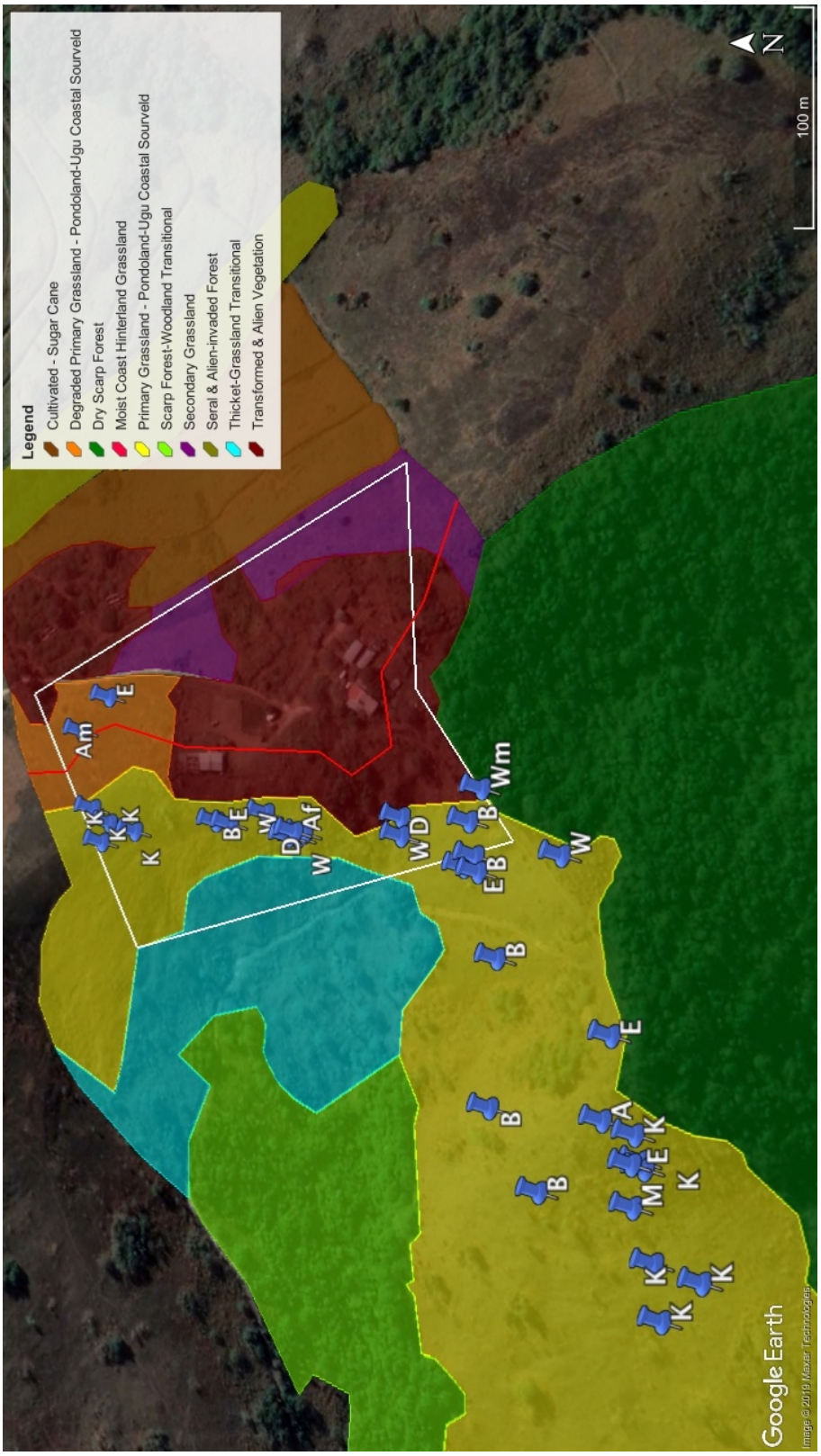


Appendix 1.2: Vegetation mapping – closer view of preferred site



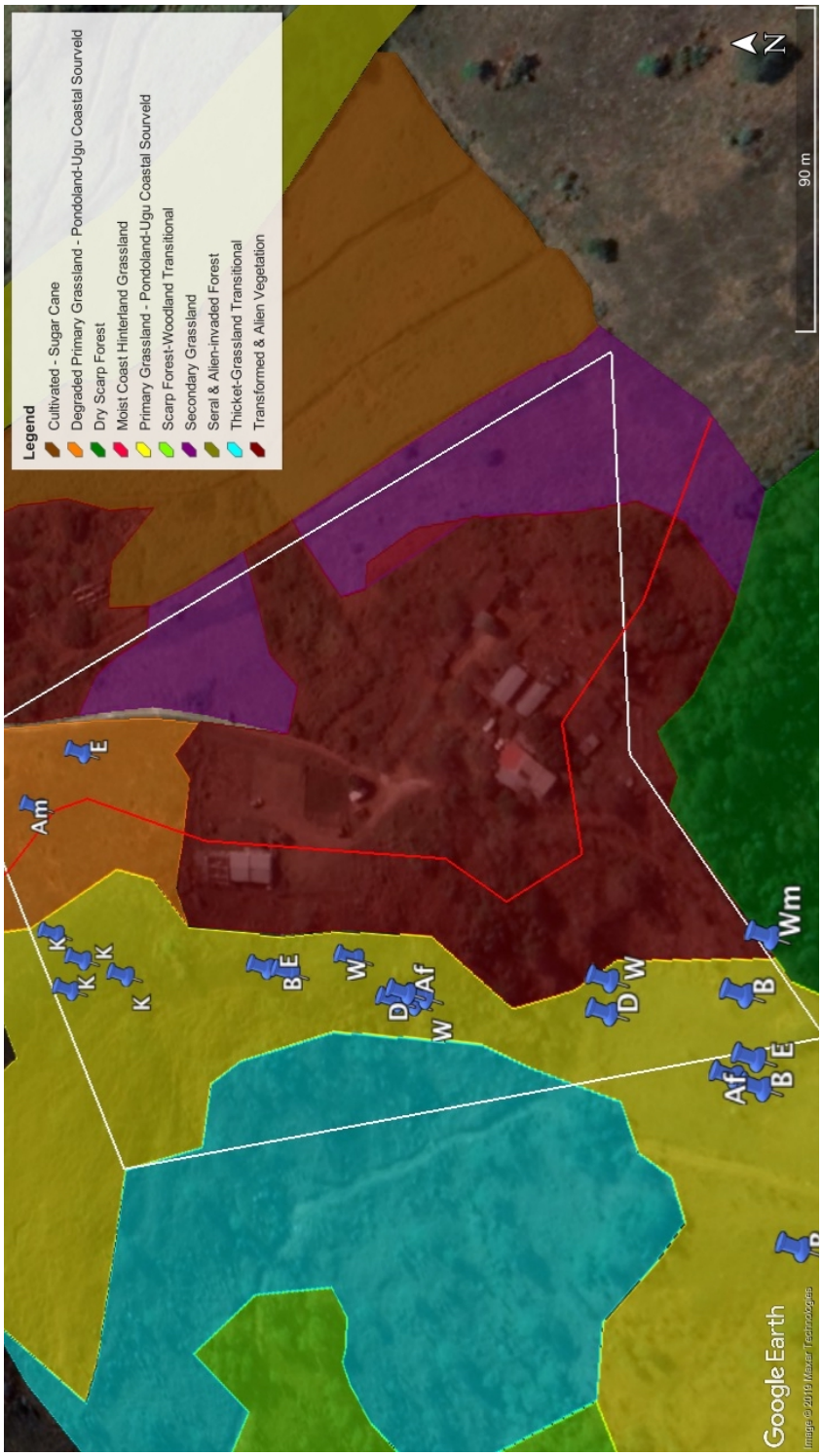
Appendix 2.1: Protected Plants

KEY: A = *Albuca setosa*, **Af** = *Aloe ferox* (many more than mapped), **Am** = *Aloe maculata*, **B** = *Boophone disticha*, **D** = *Dierama igneum*, **E** = *Eulophia* spp. (*parviflora* & *ovalis*), **K** = *Kniphofia coddiana*, **M** = *Merwilla plumbea*, **W =** *Watsonia* sp. cf. *densiflora*, **Wm** = *Sideroxylon inerme* (White Milkwood). Points usually indicate multiple occurrences.



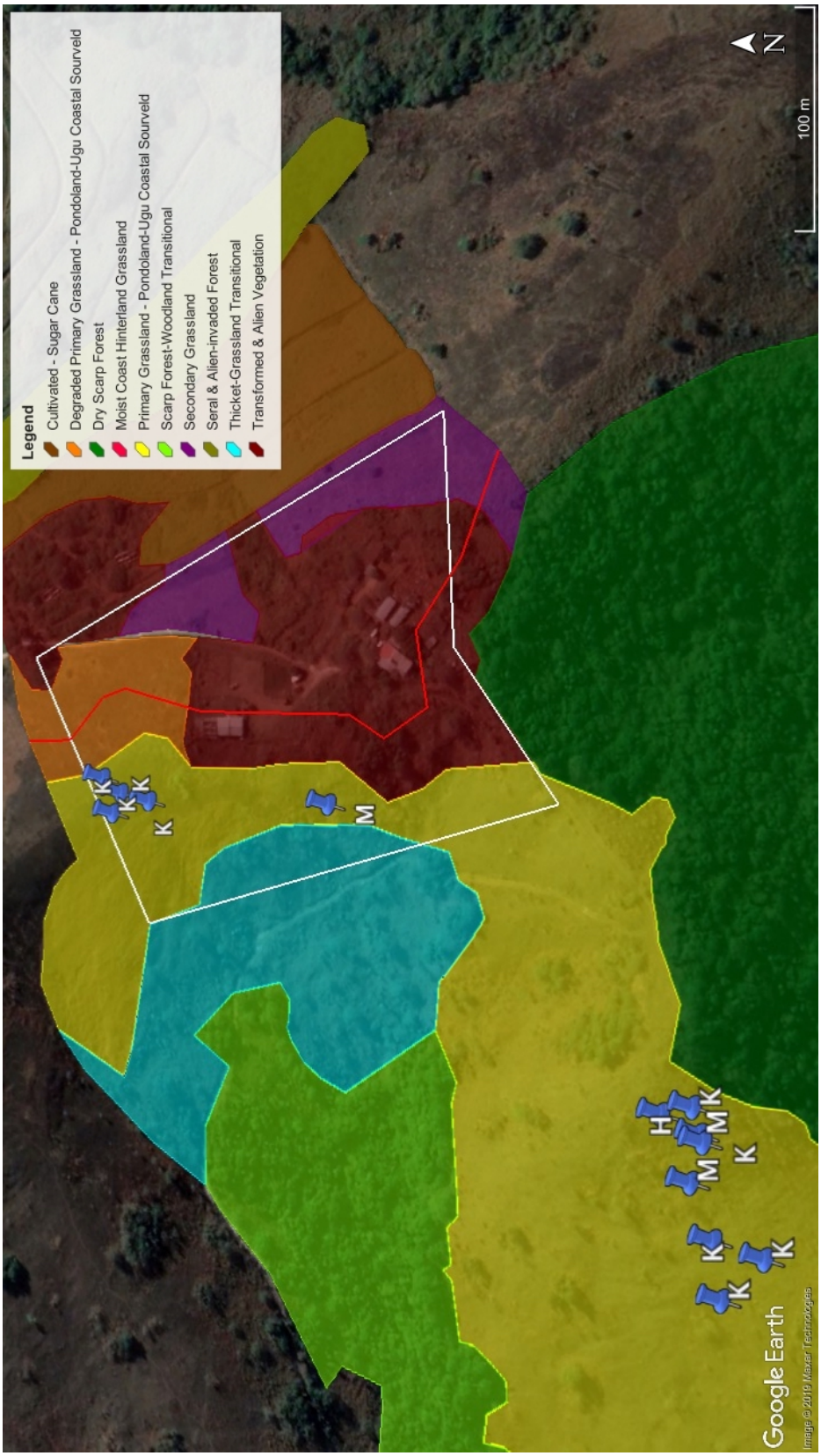
Appendix 2.2: Protected Plants – Closer view of preferred area

KEY: A = *Albuca setosa*, **Af** = *Aloe ferox* (many more than mapped), **Am** = *Aloe maculata*, **B** = *Boophone disticha*, **D** = *Dierama igneum*, **E** – *Eulophia* spp. (*parviflora* & *ovalis*), **K** = *Kniphofia coddiana*, **M** = *Merwilla plumbea*, **W =** *Watsonia* sp. cf. *densiflora*, **Wm** = *Sideroxylon inerme* (White Milkwood). Red line indicates 30 metre buffering of forest and primary grassland.



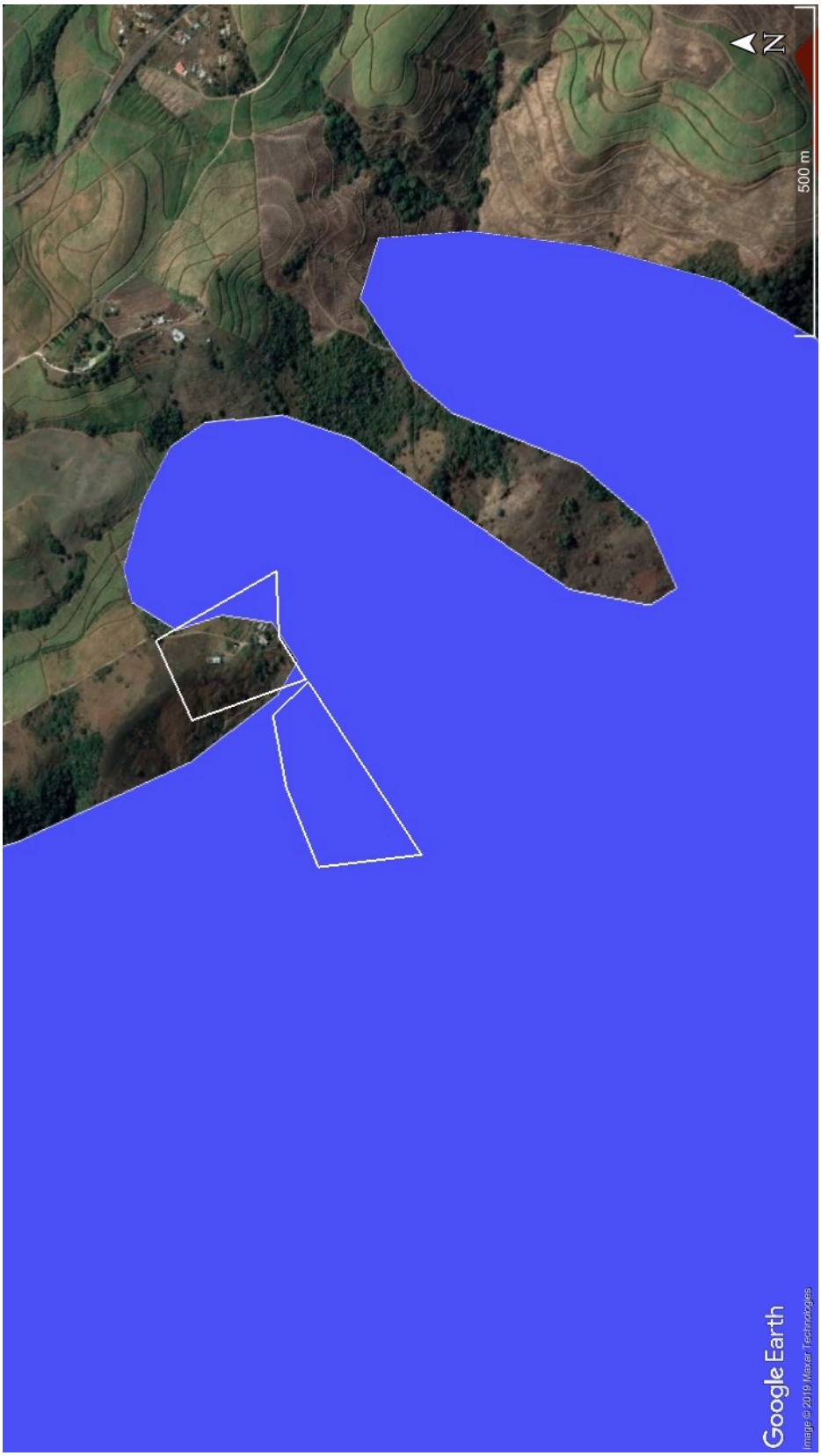
Appendix 3. Red listed plants

KEY: H = *Helichrysum pannosum* (Endangered), **K** = *Kniphofia coddiana* (Near Threatened), **M =** *Merwilla plumbea* sp. (Near Threatened)



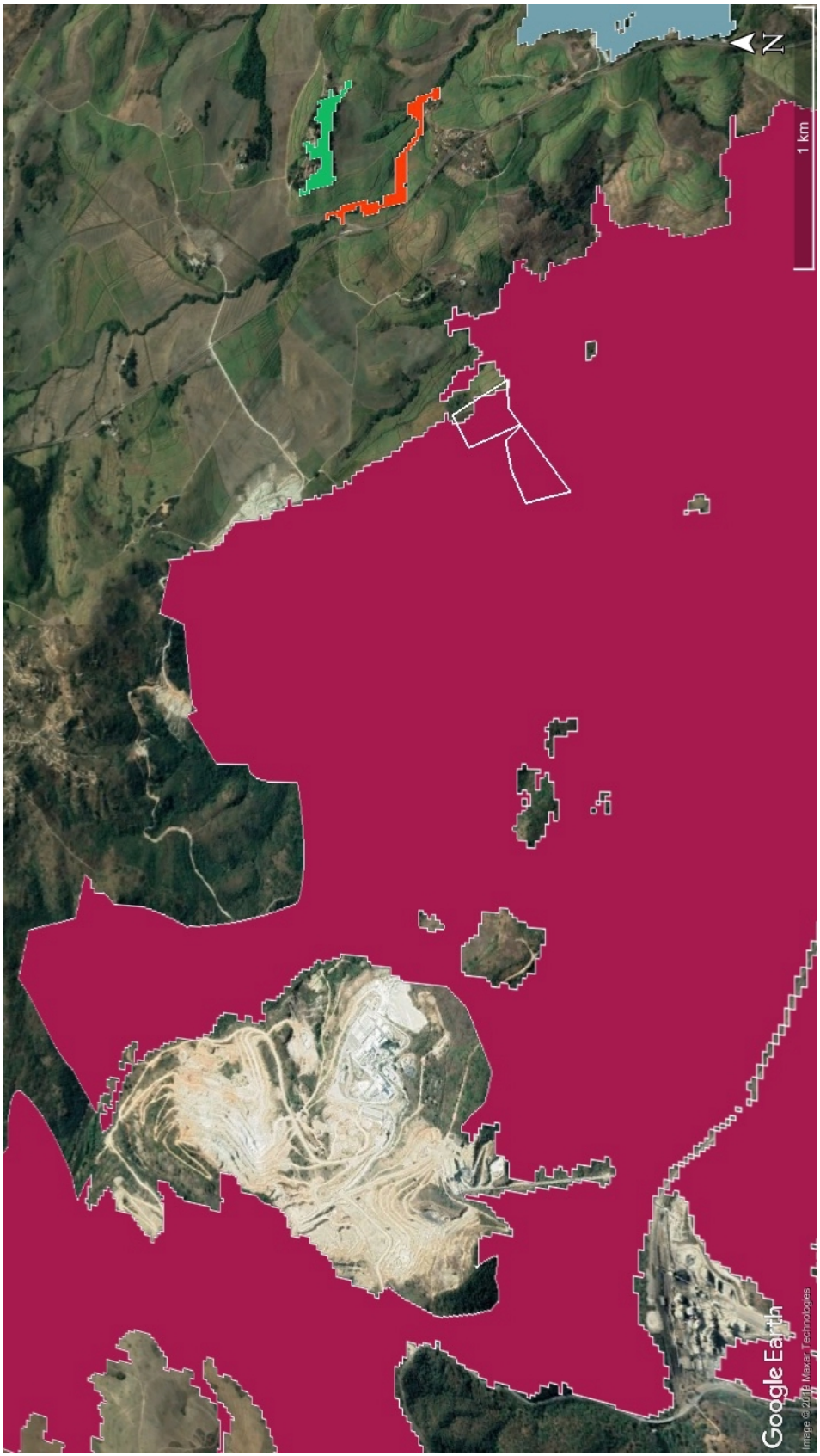
Appendix 4. National Vegetation Mapping

Blue shading indicates KwaZulu-Natal Coastal Belt Thornveld, unshaded parts of the upper site comprises KwaZulu-Natal Coastal Belt Grassland



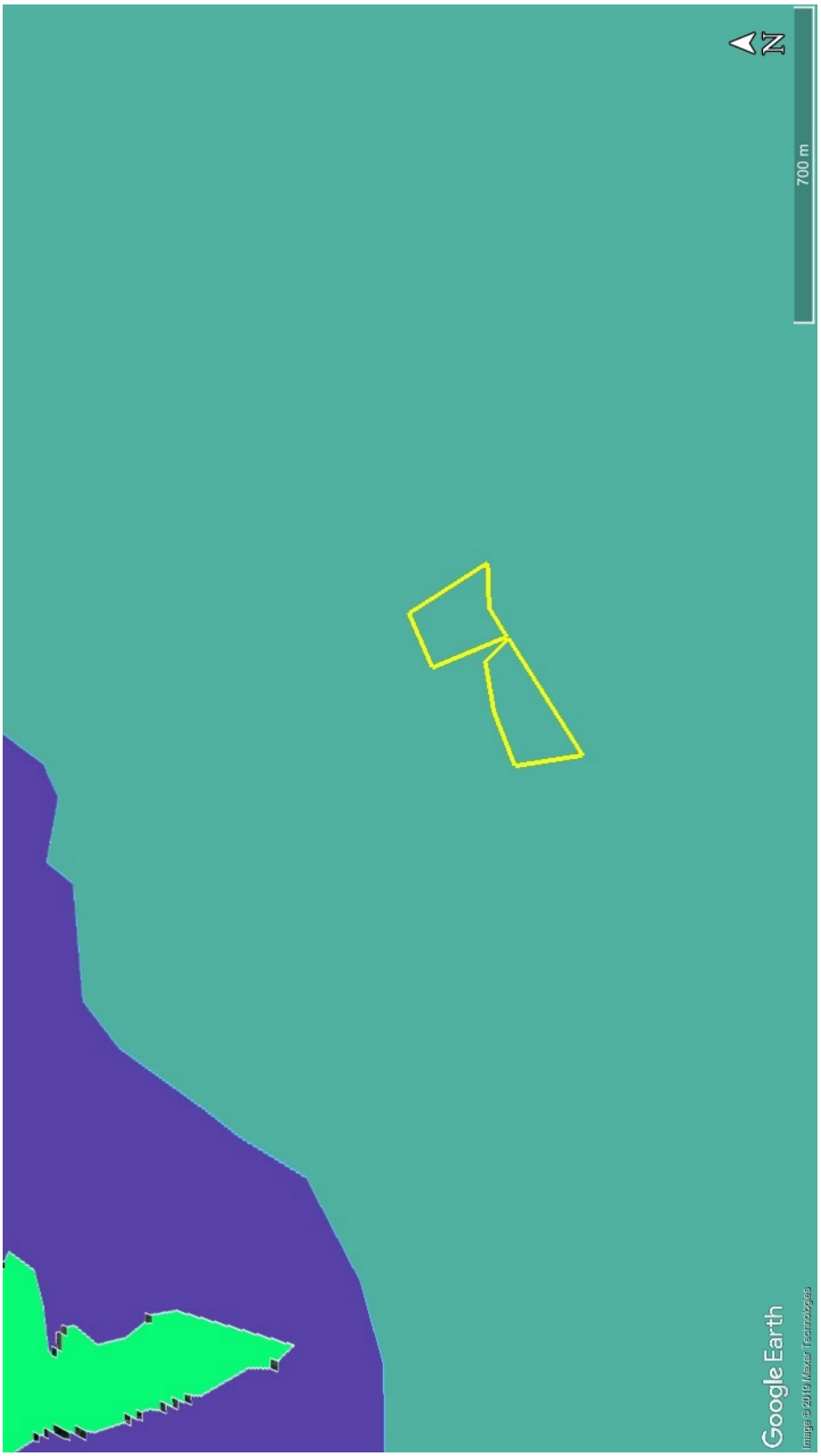
Appendix 5. Ezemvelo Critical Biodiversity Areas - Irreplaceable

Coloured polygons represent Irreplaceable Critical Biodiversity Areas



Appendix 6: National listed threatened ecosystem status

(Blue area indicates Interior South Coast Grasslands, Critically Endangered), yellow outlines showing considered mining sites with the easternmost preferred.



Appendix 7. Impact Assessment Methodology

Each impact identified must be assessed in terms of probability (likelihood of occurring), scale (spatial scale), magnitude (severity) and duration (temporal scale). To enable a scientific approach to the determination of the environmental significance (importance), a numerical value is linked to each rating scale.

The following criteria must be applied:

Occurrence

- Probability of occurrence (how likely is it that the impact may occur?); and
- Duration of occurrence (how long the impact may last).

Severity

- Magnitude (severity) of impact (will the impact be of high, moderate or low severity?); and
- Scale/extent of impact (will the impact affect the national, regional or local environment, or only that of the site?). The following ranking scales was used:

Probability: = P	*Duration: = D*
5 – Definite/Don't know	5 - Permanent
4 – Highly probable	4 – Long-term (ceases with operational life)
3 – Medium probability	3 – Medium-term (5-15 years)
2 – Low probability	2 – Short-term (0-5 years)
1 – improbable	1 – Immediate
0 – None	

Scale: = S	*Magnitude: = M*
5 – International 4 – National	10 - Very high/don't know
3 – Regional	8 – High
2 – Local	6 – Moderate
1 – Site only	4 – Low
0 – None	2 – Minor

Status of Impact
+ : Positive
– : Negative
N: Neutral

The following formula was applied to calculate the impact significance after the factors were ranked for each impact:

SP = (magnitude + duration + scale) x probability

The status of the impact is positive, negative or neutral (no impact):

Impact Significance Ratings

SIGNIFICANCE	ENVIRONMENTAL SIGNIFICANCE POINTS	COLOUR CODE
High (positive)	> 60	H
Medium (positive)	30 to 60	M
Low (positive)	< 30	L
Neutral	0	N
Low (negative)	> -30	L
Medium (negative)	– 30 to – 60	M
High (negative)	< – 60 (max = 100)	H

Appendix 8: Photographs

View from the edge of degraded natural vegetation on the preferred mining site, where after the quality of the grassland quickly improves.

Recently burned grassland (Pondoland-Ugu Coastal Sourveld) from the edge of the lower site (not preferred) onto the higher, preferred site. There is still only very limited grass and herbaceous grow through. Taller grass in the background is moribund.

Eulophia ovalis, one of the early-flowering species in the grassland, protected by the KwaZulu-Natal provincial conservation ordinance.

Top and middle: View of the edge of dry Scarp Forest on the southern edge of the sites. The deciduous trees are *Heteropyxis natalensis* (Lavender Tree).

Left: View into the forest interior.

Below right: A single example of *Sideroxylon inerme* (White Milkwood), protected by the National Forests Act, was found along this edge.

Top: View of burned *Watsonia* plants and *Protea caffra* on the edge of both sites.

Kniphofia coddiana, an early flowering species in primary grassland (Pondoland-Ugu Coastal Sourveld) on the lower site (not preferred).

Close-up of flowers, this time on the higher, preferred site.

Top: Degraded grassland on the edge of dwellings within the higher. Preferred site. Nearly all of the tree and woody plant growth in the background comprises alien invasive species.

Another view of dense alien invasive vegetation close to the dwellings, here comprised of very tall *Lantana camara* bushes and *Solanum mauritianum*. This vegetation is also mapped in Appendix 1.

Bottom: View of secondary or nearly secondary grassland mapped in Appendix 1, comprising species such as *Cymbopogon nardus* (indicative of underburning) and with little herbaceous diversity seen.

View of degraded, but still primary grassland (evidenced by still moderate species diversity) within the preferred mining area.

Appendix 9: Curriculum vitae

David Styles has for 12 years supplied a diverse range of vegetation-related consulting services on a full-time basis.

Professional qualifications

- MSc in Environmental Science from the University of KwaZulu-Natal, which was obtained with a first class pass. My thesis was a floristics and plot-based study of grassland of Cato Ridge, inland of Durban.

- Between 2003 and 2012, I edited the botanical journal *PlantLife*, during which time it was read around the world by botanists, horticulturalists, students, collectors and others interested in African botany. A copy of the journal during the period of my editorship can be accessed via the links www.plantlife.co.za or www.plantlife.co.za/download-contents/ respectively. Hard copies are available on request.

- I am an active botanical explorer in eastern South Africa, having collected approximately 5700 plant specimens from KwaZulu-Natal, the Eastern Cape and Mpumalanga Province, which have lodged at the KwaZulu-Natal Herbarium in Durban, the University of KwaZulu-Natal Herbarium in Pietermaritzburg and the National Herbarium in Pretoria. Confirmation of this extensive collecting and lodging can be obtained from KZN Herbarium curator Dr Yashica Singh or chief technician Mkhipheni Ngwenya on telephone 031 202 4095.

- Author of 36 botanical contributions or papers, apart from *PlantLife* published in: *Aloe* (journal of the Succulent Society of South Africa); *Asklepios* (journal of the International Asclepiad Society); *Bothalia* (journal of the South African National Biodiversity Institute); *Flowering Plants of Africa* (also published by South African National Biodiversity Institute); *South African Journal of Botany* (journal of the South African Association of Botanists). A list of these publications is provided at the end of this report and a synopsis of some of these can be viewed through the link: https://www.researchgate.net/scientific-contributions/2067949633_DGA_Styles

- Author or co-author of a number of plant species or taxa new to science, as follows: *Crassula smithii; Drimia flagellaris; Emplectanthus dalzellii; Gasteria croucheri* subsp*. pondoensis; Hypoxis nivea; Pseudoprospero firmifolium* subsp*. natalensis* and *Stellarioides littoralis.*

- Two plant species have been named after me, including the Pondoland endemic *Plectranthus stylesii* (Edwards 2005) and most recently the KwaZulu-Natal endemic tree *Combretum stylesii* (Maurin et al. 2011). The journal references are provided at the end of this CV.

Work experience and client list

I have supplied more than 200 specialist reports for environmental assessment processes and for other projects not linked to environmental assessment outcomes. Many of my clients are larger environmental consulting firms who employ me to assist in environmental assessment processes, particularly with in-the-field plant identification and vegetation assessments. One of my most important clients is the agro-forestry company Mondi (Pty) Ltd, for which I have worked for 7 years.

List of publications

I have authored or co-authored the following botanical publications:

1. Burns, S & Styles, D. 2007. *Thorncroftia*: a little-known genus in the Lamiaceae. *PlantLife* 36: 43-59.
2. Crouch, N.R. & Styles, D. 2002. A new locality for *Impatiens flanaganiae* (Balsaminaceae) in the Transkei. *PlantLife* 27: 10-11.
3. Crouch, N.R. & Styles, D.G.A. 2010. Rediscovery in South Africa of the neglected African vegetable *Plectranthus esculentus*. *Bothalia* 40(1): 65-67.
4. Crouch, N.R., Smith, G.F. & Styles, D.G.A. 2011. *Gasteria croucheri* subsp. *pondoensis*, a new cremnophyte from Pondoland, South Africa. *Bothalia* 41(1): 183-185.
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Meeting Minutes – Sakhela Consulting

Project Title: Limestone Quarry
Location: EnviroPro Office – 1a Leinster Place, Gillitts
Date: 22th July 2019

Attendees: **Peter Pretorius (Sakhela Consulting) - PP**
Stephanie Denison (EnviroPro) - SD
Rowan Buhrmann (EnviroPro) - RB

The following is a summary of points raised at the meeting to discuss the layout of the Limestone Quarry:

- PP – There are two major concerns that need to be addressed with the creation of the mine on the catchment; what is the quality of the water that will be washed into the drainage line/ catchment; and what quantity of water will be lost by creating the mine. Water quality can be maintained by creating a sump / initial bench at the western portion of the site, directly above the drainage line. This is a low point and will capture all contaminated runoff. As the mine is located on the ridgeline, there will only be a minimal lose in water entering the catchment.

- SD - Why is the initial bench/ sump located on the western portion of the site.
- PP - This was the lowest point within the mining footprint, and a sump would be required here to prevent any contaminated runoff entering the catchment/ drainage lines, thus safe guarding the frogs in the catchment.

- SD - Are there any alternatives and can mining initially start on the eastern back. Does the sump have to be constructed immediately?
- PP – The site can be divided into two phases. Phase one is mining the eastern bank up until the ridge line, with phase two continuing to mine the western bank. It is suggested that a sump be constructed immediately, even if phase one is initiated. This will prevent any contamination if there is a spill over the ridge, towards the Mzimkhulu river. The sump must be a minimum of 5m deep to prevent negative impacts from 'shallow blasting' of the rock. There are two alternatives for mining on the eastern bank/ phase 1: 1) Start benching vertically starting at the southern mining pillar and working up. 2) Bench horizontally, starting at the top or bottom. Benching can be optimized to maintain the structures at the top of the ridge.

- PP – Another concern with the site is the gradient on the western bank/ phase 2. The topography along this bank is very steep, with the sump falling within a 'dish' shape. This makes creating haulage roads exceptionally difficult as the gradient would be too large (possibly greater than 12 degrees). The use of a conveyer would work; however, the ore would need to be crushed within the pit and then transported up to the ridge. This is very expensive.

- SD – Would a sump need to be created for phase 1/ eastern bank?
- PP – As long as the mining pillar is kept in-tact, the initial box cut would create a natural sump.

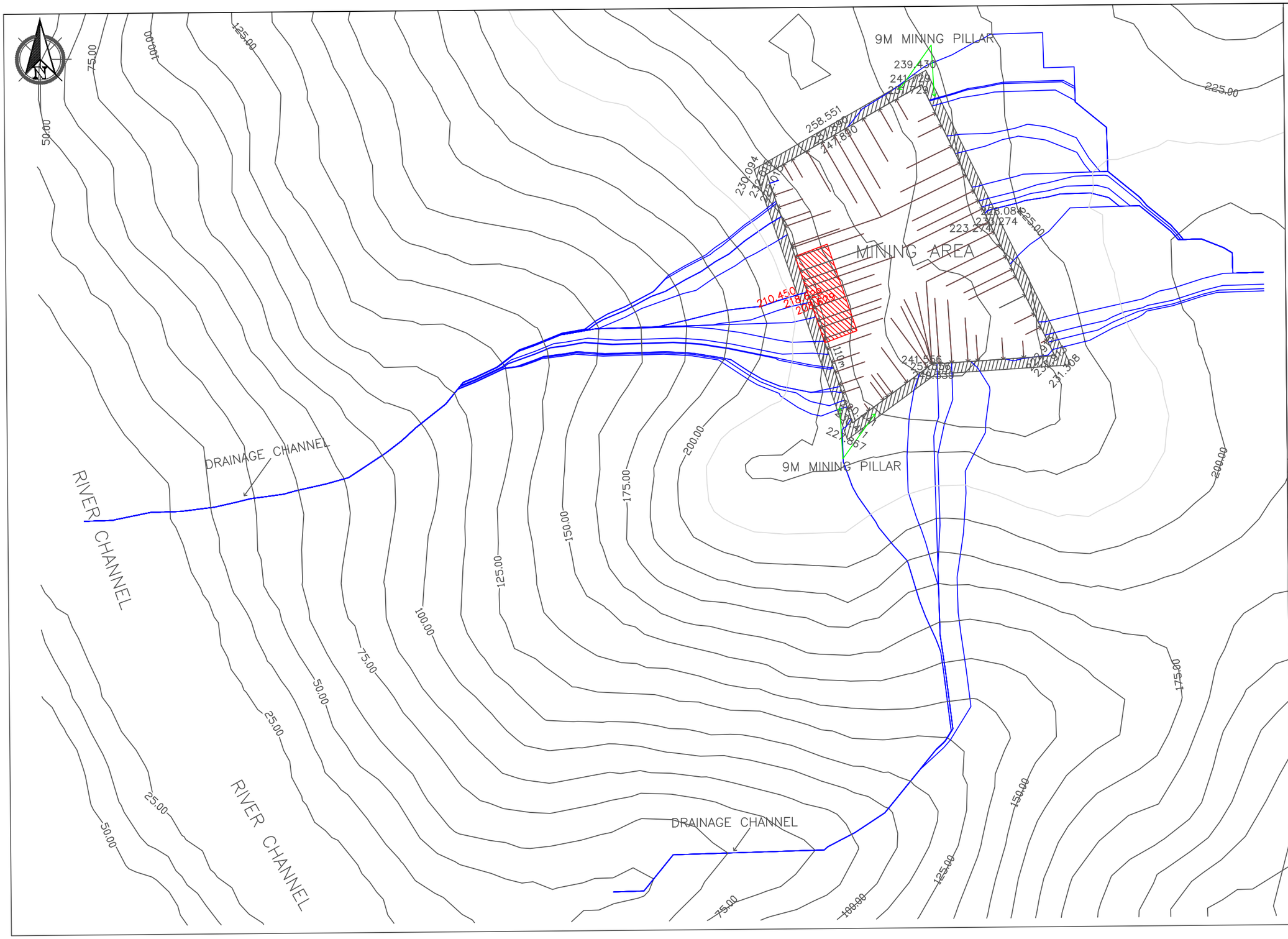
- SD – How long would mining take before phase 1/ the eastern bank is exhausted?

- PP – This all depends on the production of the mine. Approximately only 200 000 tons of material will be mined each year, and therefore phase 1 would take approximately 2 – 3 years to exhaust the site. This figure can be refined by determining the exact volume of ore the applicant is planning on mining each year.

The meeting was closed.

_____

EnviroPro – Rowan Buhrmann



NOTES

SURFACE WATER RUNOFF

SURFACE WATER RUNOFF FROM GRADED MINING SURFACE 10m LOWER THAN OGL

MAJOR CONTOURS @ 25m INTERVALS

MINOR CONTOURS @ 5m INTERVALS

THE FIRST MINING BENCH (HATCHED IN RED) MUST BE ESTABLISHED AT THE LOWEST POINT ON THE SOUTH WESTERN SIDE OF THE MINING AREA WHICH IS ADJACENT TO THE RIVER (SPOT HEIGHTS INDICATED IN RED).

THE MINING BENCH IS TO EXTEND 80m TO ACT AS A CUTOFF CHANNEL AND WILL ACT AS A SUMP TO PREVENT MINING AREA SURFACE WATER RUNOFF. THIS BENCH WILL HAVE TO BE STEPPED TO MAINTAIN A LEVEL FLOOR AND A HIGHWALL HEIGHT OF 10m.

NO ACTIVITY IS TO TAKE PLACE IN THE SOUTH WESTERN MINING PILLAR. THIS INCLUDES THE ESTABLISHMENT OF A HAUL ROAD IN THE MINING PILLAR

REV:	DESCRIPTION:	BY:	DATE:
STATUS:			

SAKHELA CONSULTING
8 PADLEY PLACE
PINETOWN
3610

0824410622

CLIENT: AFRICAN LIME (PTY) LTD

ARCHITECT:

SITE: ST FAITHS SITE
UGU DISTRICT (ET)

TITLE: SURFACE WATER RUNOFF GRADED MINING AREA

SCALE:	DATE:	DRAWN:	CHECKED:
N T S	JUL 2019	PLP	PLP
PROJECT NO:	DRAWING NO: AL 3		REVISION:

Wetland Baseline & Impact Assessment for the proposed Limestone Quarry

Ray Nkonyeni Local Municipality, KwaZulu-Natal

September 2019

CLIENT

IN ASSOCIATION WITH INKANYEZI YETHU

Prepared for:

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Report Name	**Wetland Baseline & Impact Assessment for the proposed Limestone Quarry**	
Submitted to	**EnviroPro Environmental Consulting (Pty) Ltd**	
Report Writer & Reviewer	**Andrew Husted (Pr Sci Nat 400213/11)**	
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.	
Report Writer & Fieldwork	**Wayne Jackson**	

Declaration

The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Ecological Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

Photograph from the proposed quarry area towards the Mzimkhulu River (May 2019)

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Declaration

I, Andrew Husted declare that:

- I act as an 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 relevant Acts, 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 48 of the EIA Regulations, 2014 (as amended).

Andrew Husted

Wetland Ecologist

The Biodiversity Company

5 September 2019

1 Introduction

The Biodiversity Company was commissioned to conduct a specialist wetland assessment for the proposed limestone quarry in the Cabhane area, KwaZulu-Natal.

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

A single site visit was conducted on the 7th of May 2019, which would constitute a dry season survey. The survey was undertaken in order to delineate the extent of, and also the determine the current state any wetland systems considered to be at risk due to the project.

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP), enabling informed decision making as to the ecological viability of the proposed project and to provide an opinion on the whether any environmental authorisation process or licensing is required for the proposed activities.

1.1 Objectives

The aim of the assessment is to provide information to guide the proposed quarry project with respect to the current state of the associated water resources in the area of study. This was achieved through the following:

- The delineation and assessment of wetlands within 500 m of the project area;
- A risk assessment for the proposed bridge maintenance; and
- The prescription of mitigation measures and recommendations for identified risks.

2 Key Legislative Requirements

2.1 National Water Act (Act No. 36 of 1998)

The Department of Water & Sanitation (DWS) is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (NWA) (Act No. 36 of 1998) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem, and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS.

For the purposes of this project, a wetland area is defined according to the NWA (Act No. 36 of 1998): “Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil”.

Wetlands have one or more of the following attributes to meet the NWA wetland definition (DWAF, 2005):

- A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil;
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils; and
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

2.2 National Environmental Management Act (Act No. 107 of 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

3 Project Area

The proposed project area is located in the Ray Nkonyeni Local Municipality. The project area comprises the 500m regulation area and is located approximately 10km north-west of Port Shepstone on the south coast of KwaZulu-Natal (Figure 1). The Mzimkhulu River is located approximately 700m west (and downslope) of the proposed quarry area.

The project area is located in the T52M quaternary catchment of the Phongola to Mtumvuna Water Management Area (WMA 4). The Phongola to Mtumvuna WMA is situated along the eastern coast of South Africa, mainly within the province of KwaZulu-Natal, and borders on Lesotho to the west and eSwatini in the north. The Phongola to Mtumvuna WMA is comprised of the rivers flowing eastwards into the Indian ocean.

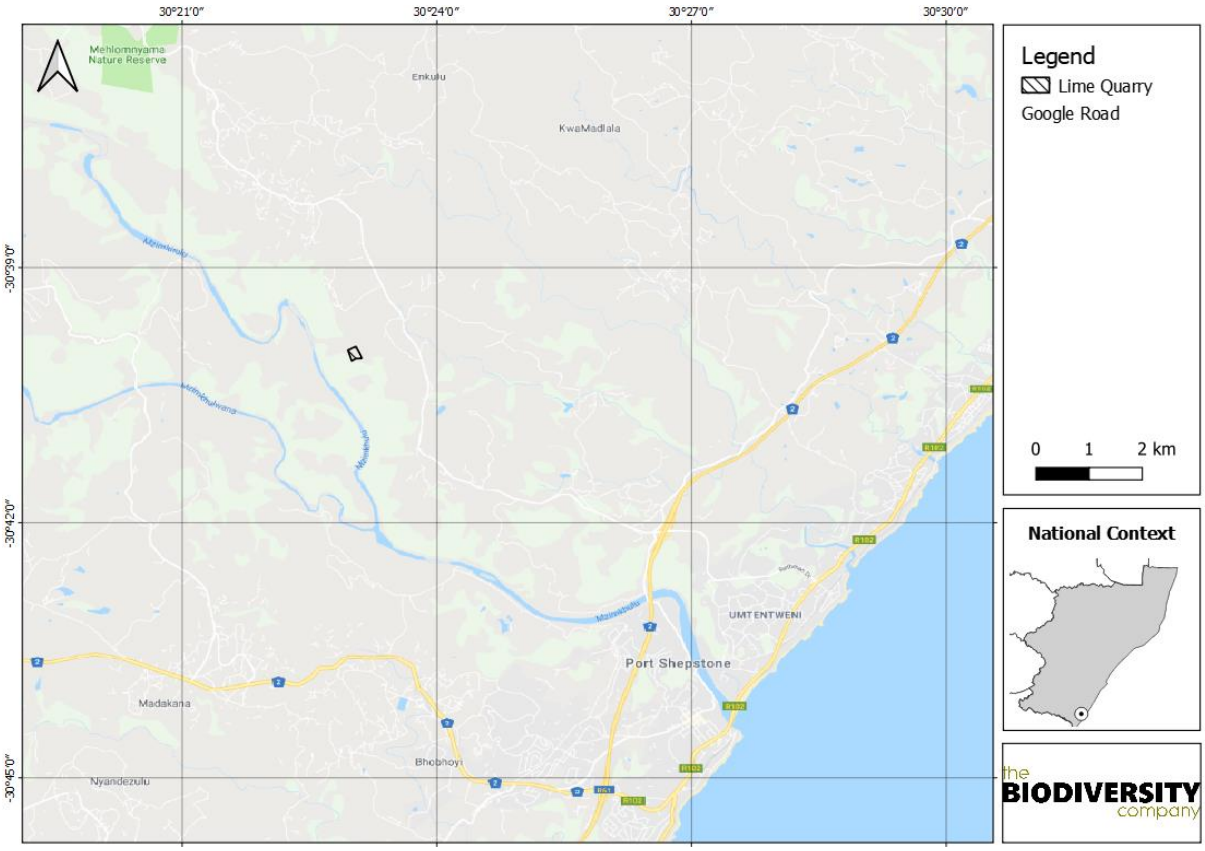

Figure 1: The regional layout of the project area

4 Limitations

The following aspects were considered as limitations;

- The assessment was based on the results of a single survey only, and information provided should be interpreted accordingly.
- Only wetlands that were likely to be impacted by proposed project were assessed in the field. Wetlands located within a 500 m radius of the project area but not in a position within the landscape to be measurably affected by the project were not considered as part of this assessment.
- Field assessments were completed to assess as much of the project area as possible with focus on the proposed directly impacted and downstream areas;
- The GPS used for delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side; and
- The information regarding the activities to be completed on the site, only allowed for the completion of a general assessment on the impacts and the buffer requirement. The risk assessment only considered the proposed quarry and not associated infrastructure such as new access routes and crossings. It has also been assumed that the quarry will not be back filled and rehabilitated.

5 Methodology

5.1 Desktop Assessment

The following information sources were considered for the desktop assessment;

- Aerial imagery (Google Earth Pro);
- Land Type Data (Land Type Survey Staff, 1972 - 2006);
- Topographical river line data;
- The National Freshwater Ecosystem Priority Areas (Nel *et al*., 2011); and
- Contour data (5 m).

5.2 Wetland Assessment

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and also then includes structural features at the lower levels of classification (Ollis *et al.,* 2013).

5.2.1 Delineation

The wetland areas are delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 2. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;

- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
    - The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

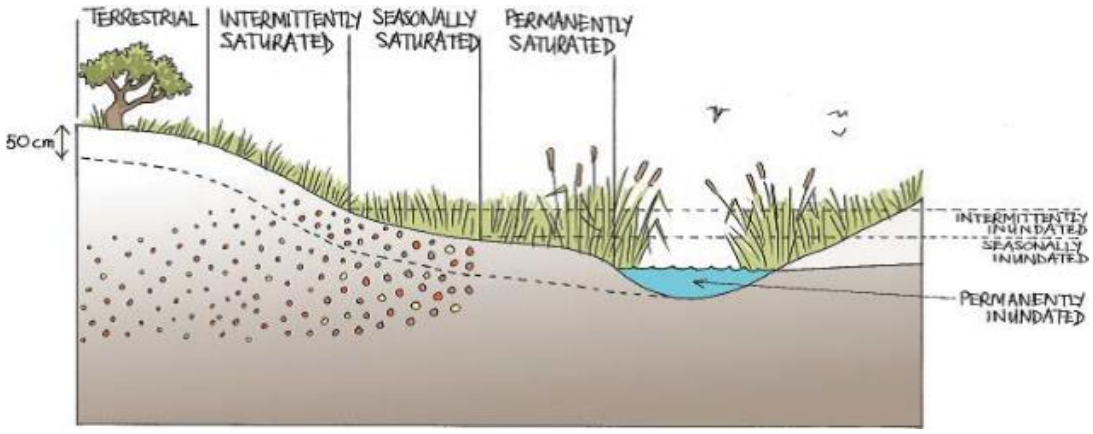

Figure 2: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al., 2013)

5.2.2 Present Ecological Status

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 1.

Table 1: The PES categories (Macfarlane, et al., 2009)

Impact Category	Description	Impact Score Range	Present State Category
None	**Unmodified, natural**	**0 to 0.9**	**A**
Small	**Largely Natural** with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	**1.0 to 1.9**	**B**
Moderate	**Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	**2.0 to 3.9**	**C**
Large	**Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred.	**4.0 to 5.9**	**D**
Serious	**Seriously Modified.** The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	**6.0 to 7.9**	**E**
Critical	**Critical Modification.** The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	**8.0 to 10**	**F**

5.2.3 Ecosystem Services

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze *et al*., 2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 2).

Table 2: Classes for determining the likely extent to which a benefit is being supplied (Kotze et al., 2009)

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

5.2.4 Ecological Importance and Sensitivity

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

Table 3: Description of EIS categories.

EIS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	**A**
High	2.1 to 3.0	**B**
Moderate	1.1 to 2.0	**C**
Low Marginal	< 1.0	**D**

5.3 Buffer Determination

The “Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries” (Macfarlane, *et al.,* 2014) was used to determine the appropriate buffer zone for the proposed activity.

5.4 Risk Assessment

The risk assessment will be completed in accordance with the requirements of the DWS General Authorisation (GA) in terms of Section 39 of the NWA for water uses as defined in Section 21(c) or Section 21(i) (GN 509 of 2016). The significance of the impact is calculated according to Table 4.

Table 4: Significance ratings 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. Wetlands are excluded.
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.

6 Desktop Assessment

6.1 Climate

This region is generally characterised by summer rainfall, even though rainfall in the winter months are not uncommon. This region is frost-free and has high humidity. The mean maximum temperatures for this region is 32.6°C whereas the mean minimum temperatures for this region is 5.7 °C in January and July respectively, see Figure 3 (Mucina & Rutherford, 2006).

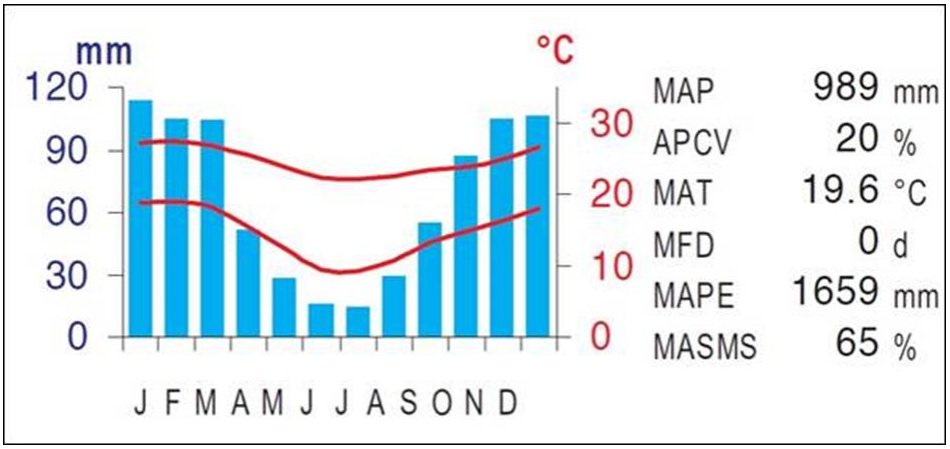

Figure 3: The climate summary for local area

6.2 Vegetation Types

The project area falls within the KwaZulu-Natal Coastal Belt Grassland (CB3), and the Indian Ocean Coastal Belt (CB6) vegetation units (Mucina & Rutherford, 2006) (Figure 4).

CB3 – KwaZulu-Natal Coastal Belt Grassland

KwaZulu-Natal Coastal Belt Grassland is a broad coastal strip along the KwaZulu-Natal coast, from near Mtunzini in the north, via Durban to Margate and just short of Port Edward in the south. Highly dissected undulating coastal plains which presumably used to be covered to a great extent with various types of subtropical coastal forest. Some primary grassland dominated by *Themeda triandra* still occurs in hilly, high-rainfall areas where pressure from natural fire and grazing regimes prevailed. At present the KwaZulu-Natal Coastal Belt Grassland is affected by an intricate mosaic of very extensive sugarcane fields, timber plantations and coastal holiday resorts, with interspersed secondary *Aristida* grasslands, thickets and patches of coastal thornveld (Mucina & Rutherford, 2006).

According to Mucina & Rutherford (2006), this vegetation type is classified as Endangered. The national target for conservation protection for this vegetation type is 25%, but only very small part statutorily conserved in Ngoye, Mbumbazi and Vernon Crookes Nature Reserves. About 50% is transformed for cultivation, by urban sprawl and for road-building. Alien species found in this vegetation type includes *Chromolaena odorata, Lantana camara, Melia azedarach* and *Solanum mauritianum*.

CB6 – Indian Ocean Coastal Belt

The vegetation unit stretches from near Mandini in the north to Oribi Gorge in the south. Altitude 30-500 m. It is characterized by steep valley sides and hilly landscape mainly associated with drier larger river valleys in the rain shadow of the rain bearing frontal weather systems from the east coast. Bushed grassland, bushland and bushland thicket and open woodland. This vegetation unit grades into the SVs 6 Eastern Valley Bushveld and SVs 3 KwaZulu-Natal Hinterland Thornveld in the larger river valleys.

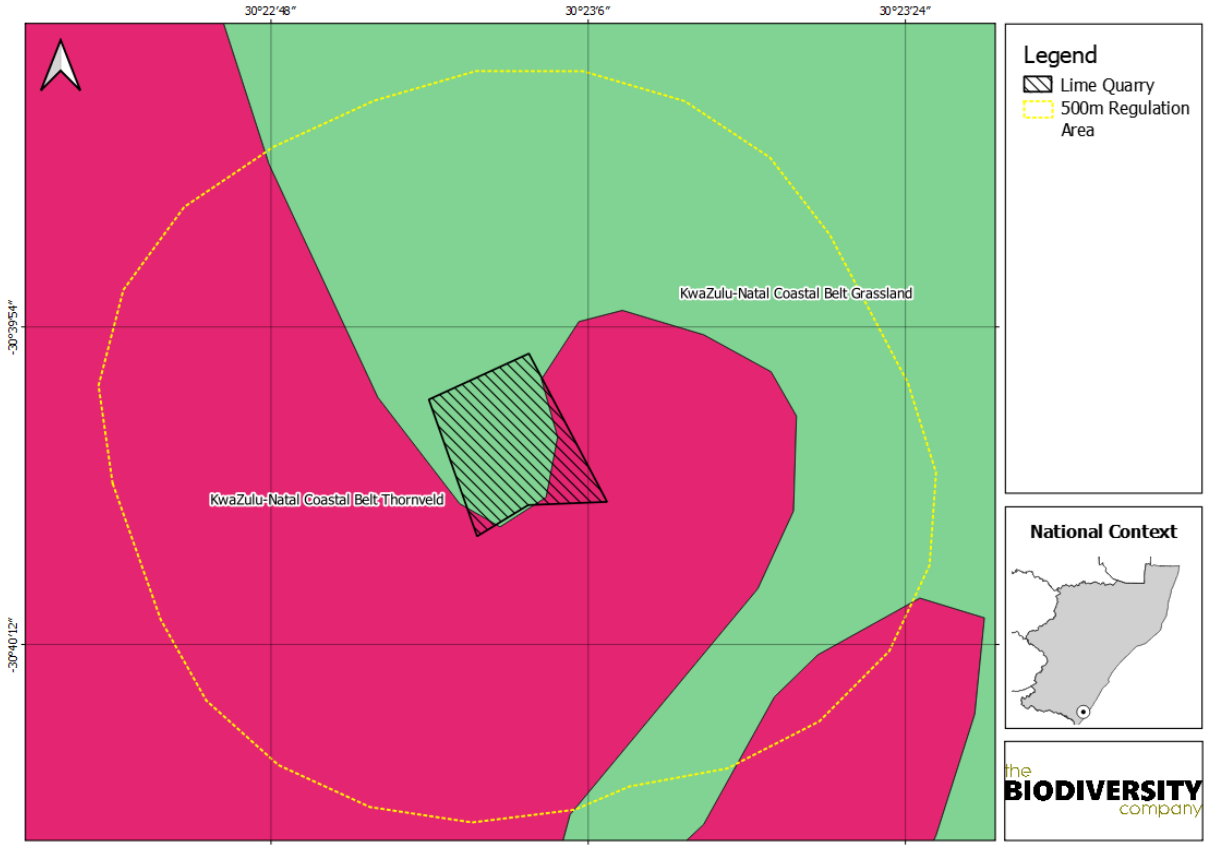

Figure 4: The vegetation units associated with the project area

6.3 Desktop Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006) the project falls within the Fa600 and Fb469 land types. The geology associated with the FA600 land type is generally mainly granite with small areas of alluvium, amphibolite and marble. The geology associated with the FB469 land type is mainly marble, with small areas of granite and alluvium.

6.4 NFEPA Wetlands

There are no NFEPA wetlands within the 500m regulation area.

6.5 Topographical river line data

The data was considered for the quarter degree square 3030 and indicates the presence of a series of non-perennial systems within the regulation area. It is apparent from this data that the flows for these non-perennial systems are all towards the Mzimkhulu River system (Figure 5).

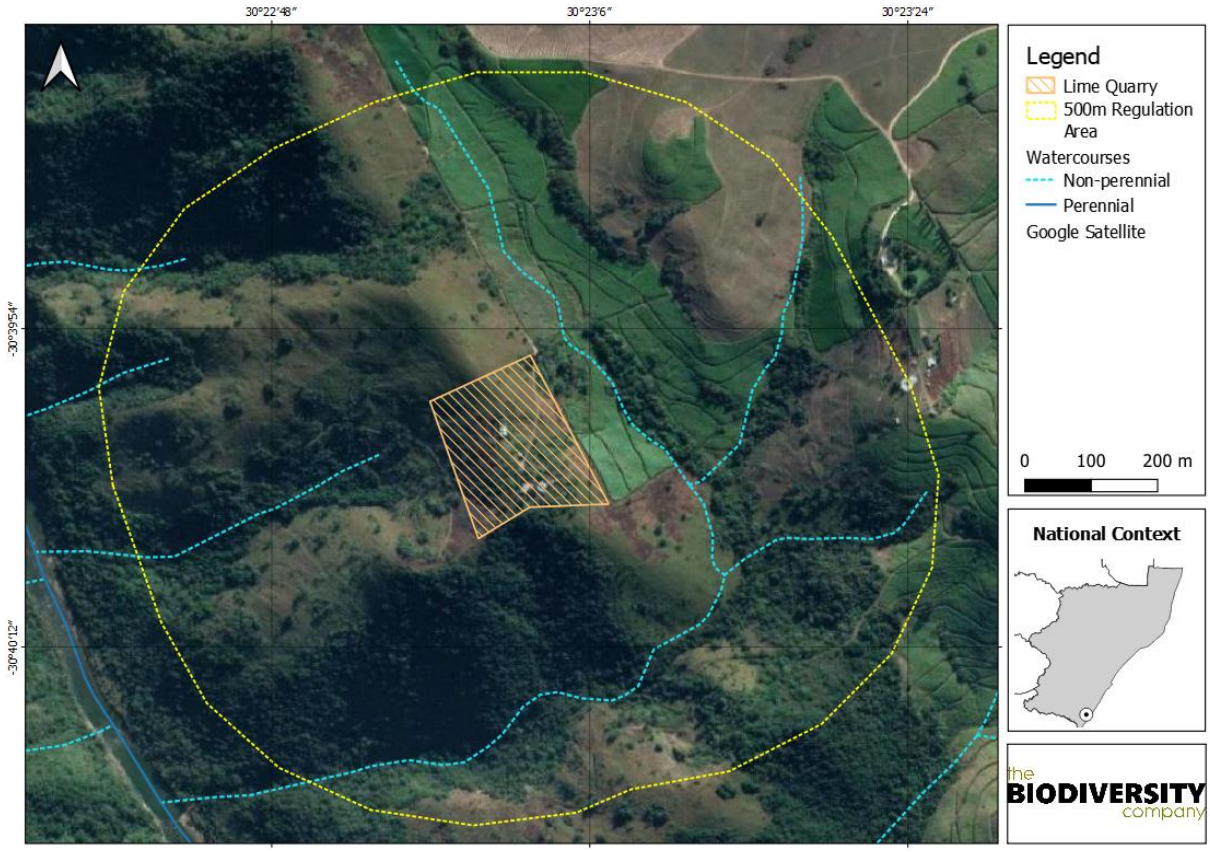

Figure 5: The river line data for the project area

7 Results and Discussion

7.1 Wetland Assessment

The wetland area was delineated in accordance with the DWAF (2005) guidelines (see Figure 7). A total of one (1) hydro-geomorphic (HGM) wetland type was identified and delineated for this assessment. The HGM type was a channelled valley bottom wetland located to the east of the proposed quarry (Figure 6).

The wetland classification as per SANBI guidelines (Ollis *et al.* 2013) is presented in Table 5. The wetland type delineated and assessed for the study includes a channelled valley bottom wetland. The quarry spans two ecoregions, namely the North Eastern Coastal Belt and the South Eastern Uplands.

Table 5: Wetland classification as per SANBI guideline (Ollis et al., 2013)

Wetland Name	Level 1	Level 2		Level 3	Level 4		
	System	DWS Ecoregion/s	NFEPA Wet Veg Group/s	Landscape Unit	4A (HGM)	4B	4C
HGM 1	Inland	North Eastern Coastal Belt South Eastern Uplands	Indian Ocean Coastal Belt Grp 2	Valley Floor	Channelled Valley Bottom	N/A	N/A

Figure 6: Photographs of the delineated systems for the project. A & B: Channelled valley bottom wetland. C & D: Drainage lines

Figure 7: The delineated watercourse within 500 m of the project area

Vegetation plays a considerable role in identifying, classifying and accurately delineating wetlands, (DWAF, 2005). The wetland vegetation that could be identified was a *Schoenoplectus spp., Phragmites australis, Cyperus spp.,* and *Typha capensis*. The dominant soil forms identified for the wetland system include the Dundee, Katspruit and Oakleaf forms (Figure 10).

The Dundee soil form consists of an Orthic A-horizon on top of a stratified alluvium horizon (SASA, 1999). The soil family group identified for the Dundee soil form on-site has been classified as the Mtamvuna (1210) soil family due to the non-calcareous nature, the fact that signs of wetness is present and the lack of red colours. This diagnostic soil type is formed alluvial or colluvial processes. This soil type is stratified and closely resembles the parent material of this soil type. Stratified alluvium generally is fertile and is often therefore used for cultivation purposes.

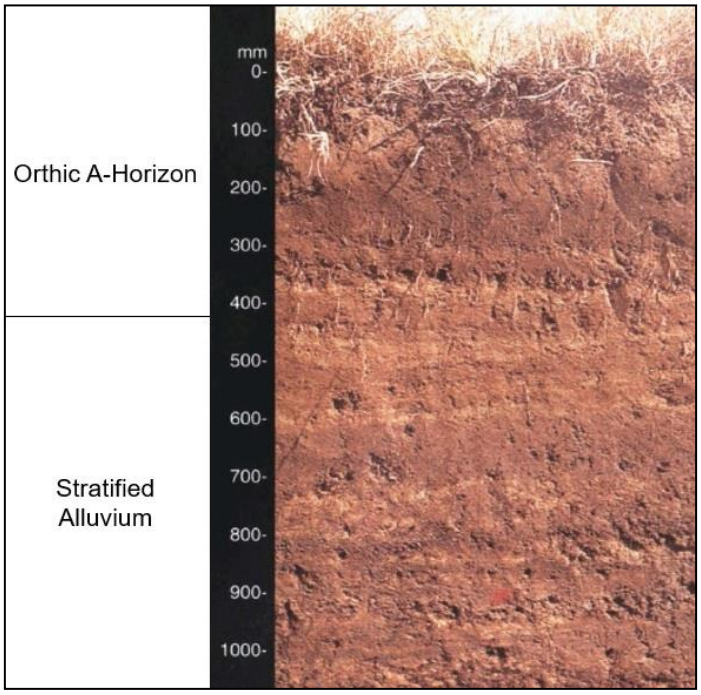

Figure 8: Example of a Dundee soil form (SASA, 1999).

The Katspruit soil form consists of an Orthic A-horizon on top of a G-horizon. The soil family group identified for the Katspruit soil form on-site has been classified as the Lammersmoor (1000) soil family due to the non-calcareous nature of the G-horizon (SASA, 1999). Gleying occurs within the G-horizon with the reduction of ferri-oxides. This soil horizon could have clay illuviation, especially in the upper parts of the soil horizon. In cases where a G-horizon is located directly beneath an Orthic A-horizon, low chroma colours can be expected, which is typical of hydromorphic soils (soils that have been saturated for medium to long periods).

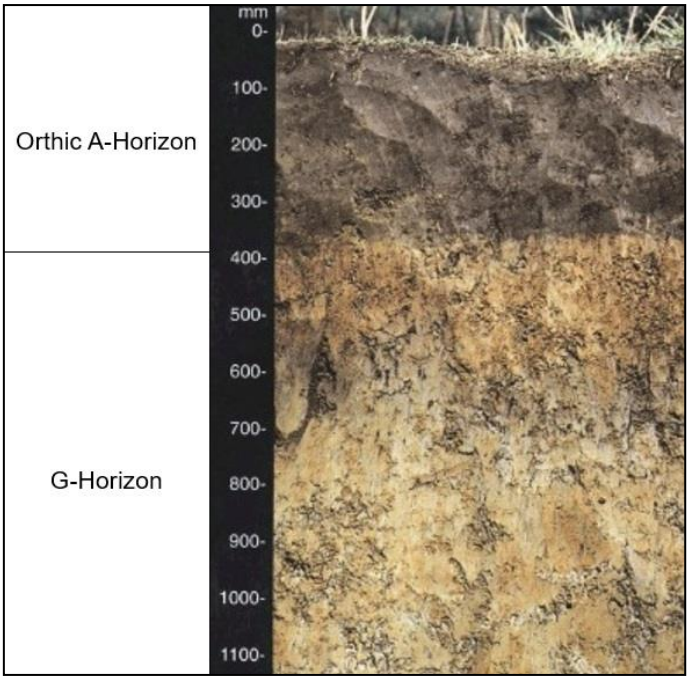

Figure 9: Example of a Katspruit soil form, (SASA, 1999).

The Oakleaf soil form consists of an Orthic A-horizon on top of a Neocutanic B-horizon, which in turn is underlain by an unspecified material without signs of wetness. The soil family group identified for the soil form on-site has been classified as the Ritchie (1110) soil family due to the fact that the A-horizon is not leached, the red colour of the sub-soil and the fact that no signs of luvic processes has been identified for this soil form.

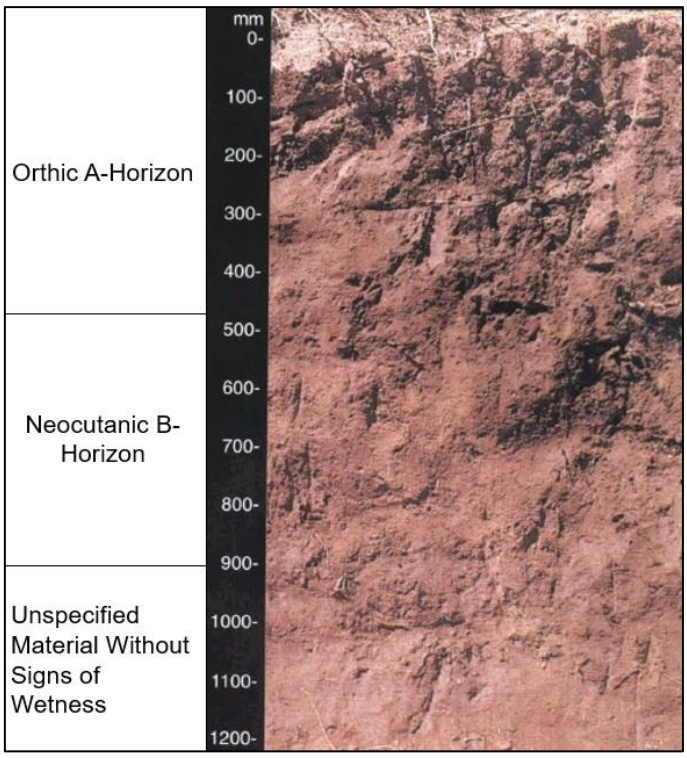

Figure 10: Example of an Oakleaf soil form, (SASA, 1999).

7.1.1 Wetland Unit Setting

HGM 1 is located on the “valley floor” landscape unit. Channelled valley-bottom wetlands are typically found on valley-floors with a clearly defined, finite stream channel and lacks floodplain features, referring specifically to meanders. Channelled valley-bottom wetlands are known to undergo loss of sediment in cases where the wetlands’ slope is high and the deposition thereof in cases of low relief. Figure 11 presents a diagram of HGM 1, showing the dominant movement of water into, through and out of the system.

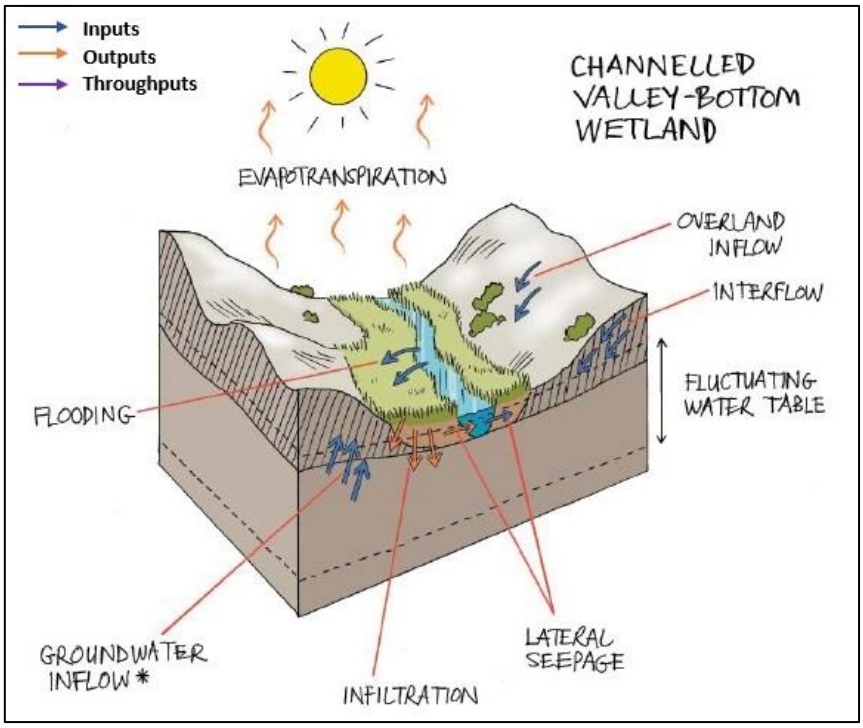

Figure 11: Amalgamated diagram of HGM 1, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

7.1.2 Present Ecological State

The PES for the assessed HGM unit is presented in Table 6. The overall wetland health for HGM 1 was determined to be that of a Moderately Modified (class C) system.

Table 6: Summary of the scores for the wetland PES: HGM 1

Component	PES Score	PES Rating	Description
Hydrology	4.0	D	**Largely Modified**: The hydrology of the system has been altered due to the local agricultural land use. Aspects which have contributed to modifications include; i) encroachment of sugar cane farming into the system, reducing surface roughness of the catchment, ii) informal access routes traversing the system and dominant flow paths. There are no dams nor large developments within the catchment area.
Geomorphology	2.1	C	**Moderately Modified**: Due to the extent and the encroachment of sugar cane into the periphery of the wetland, and within the actual system in some reaches, the structure of the system is largely modified. The system has been narrowed as a result of the agricultural activities.
Vegetation	5.0	D	**Largely Modified:** The local land uses have resulted in the following; i) removal of plant / vegetation cover to accommodate agriculture, ii) establishment of alien vegetation due to local disturbances.
Overall	**3.7**	**C**	**Moderately Modified**. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.

7.1.3 Ecosystem Services Assessment

The Ecosystem services provided by the HGM unit present at the site were assessed and rated using the WET-EcoServices method (Kotze, *et al*. 2009). The summarised results for the HGM unit are shown in Table 7

HGM 1 had an overall Intermediate level of service. The greatest benefits associated with the system are indirect services, particularly the trapping of sediment and erosion control. The maintenance of biodiversity and the remaining direct services provide no services of notable benefit.

Table 7: The EcoServices being provided by the wetland

Wetland Unit					HGM 1
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation		1.9
			Streamflow regulation		1.5
			Water Quality enhancement benefits	Sediment trapping	2.5
				Phosphate assimilation	2.0
				Nitrate assimilation	2.1
				Toxicant assimilation	1.9
				Erosion control	2.1
			Carbon storage		1.7
	Direct Benefits	Biodiversity maintenance			1.1
		Provision benefits	Provisioning of water for human use		1.3
			Provisioning of harvestable resources		0.8
			Provisioning of cultivated foods		0.4
		Cultural benefits	Cultural heritage		0.0
			Tourism and recreation		0.1
			Education and research		1.0
Overall					20.3
Average					1.4

7.1.4 Ecological Importance & Sensitivity

The EIS assessment was applied to the HGM unit described in the previous section in order to assess the levels of sensitivity and ecological importance of the wetlands. The results of the assessment are shown in Table 8.

The EIS for the HGM unit was calculated to have a High (class B) level of importance. The following findings were considered for the EIS classification:

- No NFEPA wetlands are located within the 500 m regulated area;
- The project area is located in an EN vegetation type;
- NFEPA wetlands beyond the 500m regulated area are classified as the Indian Ocean Coastal Belt Group 2, with a critical (CR) ecosystem threat status;
- According Brousse-James & Associates (2019) to there are numerous rocky streams in the area that provide critical habitat for the endangered Kloof Frog (*Natalobatrachus bonebergi*);

- The local area is dominated by sugar cane farming. However, areas associated with the Mzimkhulu River system are deemed sensitive and important refuge areas for biodiversity.

The Hydrological Functionality of the wetland was determined to have a Moderate (class C) level of importance. The Direct Human Benefits were calculated to have a Low (class D) level of importance.

Table 8: The EIS results for the delineated wetland

Wetland Importance and Sensitivity	
	HGM 1
Ecological Importance & Sensitivity	**2.2**
Hydrological/Functional Importance	**1.9**
Direct Human Benefits	**0.5**

7.1.5 Buffer Zones

The wetland buffer zone tool was used to calculate the appropriate buffer required for the project. The model shows that the largest risk (Very High) posed by the project during the construction phase is that of “Increased sediment inputs and turbidity”. This level of risk is expected due to the nature of the project, which will result in the removal of vegetation, exposure of soil and also alter surface flow characteristics. These risks are calculated with no prescribed mitigation and the calculated buffer requirement is presented in Table 9.

Table 9: Pre-mitigation buffer requirement

Required Buffer before mitigation measures have been applied	
Construction Phase	**56 m**
Operational Phase	**33 m**

According to the buffer guideline (Macfarlane, *et al.* 2014) a high-risk activity would require a buffer that is 95% effective to reduce the risk of the impact to a low-level threat.

Some mitigation measures can be implemented to decrease the size of the construction phase buffer requirement. Table 10 indicates the size of buffers required if these mitigation measures are successfully implemented. The above-mentioned mitigation measures are described in Table 11.

Table 10: Post-mitigation buffer requirement

Required Buffer after mitigation measures have been applied	
Construction Phase	**33 m**
Operational Phase	**25 m**

A conservative buffer zone was suggested of 33 m for the construction and operation phases respectively, this buffer is calculated assuming mitigation measures are applied.

Table 11: The risk results from the wetland buffer model for the proposed project

Threat Posed by the proposed land use / activity		Specialist Threat Rating	Threat Rating after Mitigation	Recommended Mitigation
Construction Phase	1. Alteration to flow volumes	Very Low	Very Low	
	2. Alteration of patterns of flows (increased flood peaks)	Low	Low	
	3. Increase in sediment inputs & turbidity	Very High	High	Minimise the extent of vegetation clearing. Make use of the existing access road to the north of the quarry area. No new watercourse crossings are recommended, the existing crossing may be upgraded. Create a stormwater berm on the edge of the project area to intercept run-off from the site. Design and implement a stormwater management plan. The areas adjacent to the quarry area must be vegetated with grass / ground cover and managed accordingly.
	4. Increased nutrient inputs	Very Low	Very Low	
	5. Inputs of toxic organic contaminants	Very Low	Very Low	
	6. Inputs of toxic heavy metal contaminants	Low	Low	
	7. Alteration of acidity (pH)	Very Low	Very Low	
	8. Increased inputs of salts (salinization)	Very Low	Very Low	
	9. Change (elevation) of water temperature	Very Low	Very Low	
	10. Pathogen inputs (i.e. disease-causing organisms)	Very Low	Very Low	
Operational Phase	1. Alteration to flow volumes	Low	Low	The proposed development is to avoid wetland areas. The following are mitigation measures to aid in the reduction of impacts: • Stormwater management plan; • Signage to discourage littering and pollution; • Adequate refuse points and refuse removal; • No activities to rake place within wetland and buffer zones • Rehabilitation of vegetation in disturbed areas; • Water velocity (dissipaters) management and plants at stormwater discharge points
	2. Alteration of patterns of flows (increased flood peaks)	High	Medium	
	3. Increase in sediment inputs & turbidity	High	Medium	
	4. Increased nutrient inputs	Low	Low	
	5. Inputs of toxic organic contaminants	Low	Low	
	6. Inputs of toxic heavy metal contaminants	Medium	Low	
	7. Alteration of acidity (pH)	Low	Very Low	
	8. Increased inputs of salts (salinization)	Low	Very Low	
	9. Change (elevation) of water temperature	Low	Very Low	
	10. Pathogen inputs (i.e. disease-causing organisms)	Very Low	Low	

8 Risk Assessment

The proposed project is located approximately 95m west of the delineated wetland system. The Mzimkhulu River is also located in excess of 600m west of the project area. It is apparent from this assessment that there will be no direct risks posed by the project on the wetland and river systems, but indirect risks remain a possibility. The focus for this risk assessment is the wetland systems east of the project area, within the 500m regulation area. The wetland is downslope of the proposed quarry, which may result in contaminants stemming from the quarry reporting to the wetland, having an impact on the ecological status and functioning of the system. The proposed quarry is also likely to have an impact on the hydrology of the wetland, due to the loss in catchment area and the altered hydrology of the area, which includes a loss of surface run-off. Due to the nature of the project, secondary impacts such as waste generation and alien vegetation establishment may also result due to the on-site disturbances.

The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) will be considered for this component of the study (Figure 12). In accordance with the mitigation hierarchy, the preferred mitigatory measure is to avoid impacts by considering options in project location, sitting, scale, layout, technology and phasing to avoid impacts. Whilst direct impacts to the wetland system will be avoided, the indirect risks have been assessed and mitigation measures prescribed. Findings from the DWS aspect and impact register / risk assessment are provided in the table below.

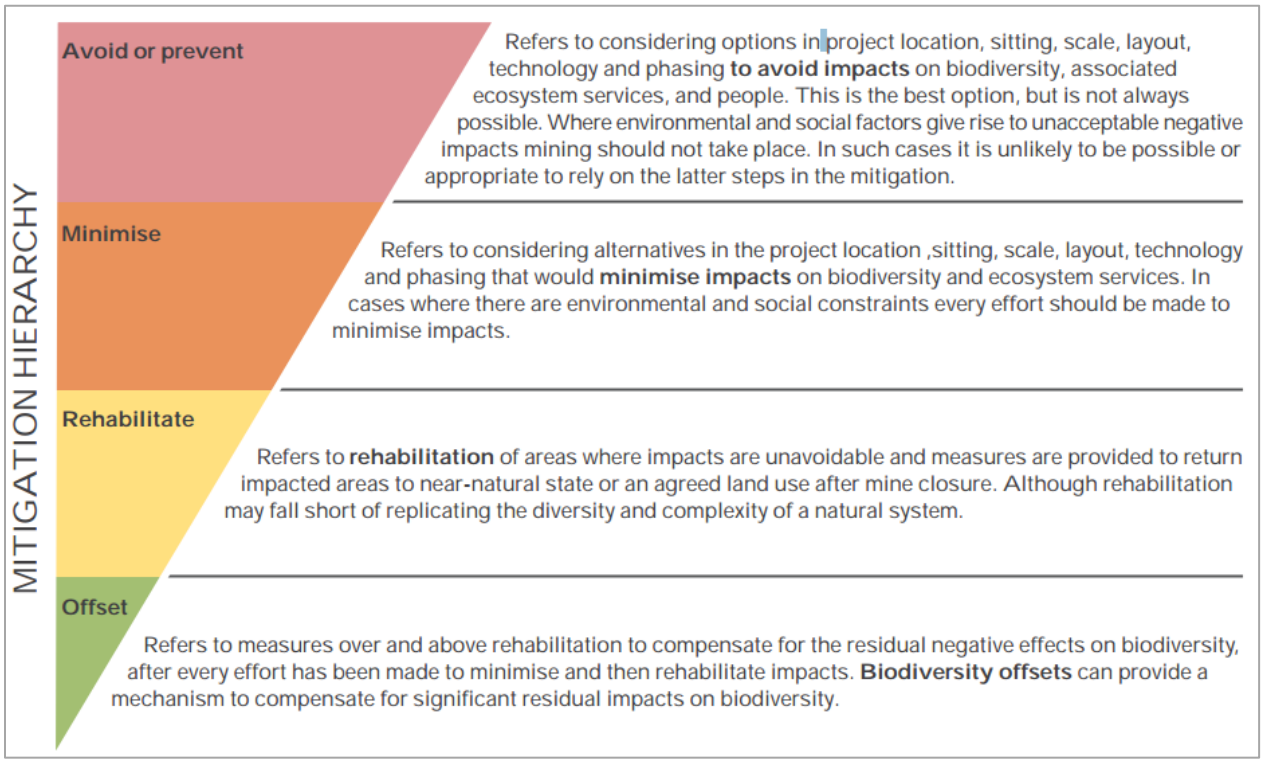

Figure 12: The mitigation hierarchy as described by the DEA (2013)

8.1 Potential Impacts

The construction and operation of the quarry poses a variety of Moderate pre-mitigation risks for a variety of aspects associated with the expected impacts. The notable impacts include altered hydrology, impaired water quality, erosion and sedimentation of the system and also alien vegetation establishment. Some of the notable aspects which pose a pre-mitigation Moderate risk include vegetation clearing, soil stripping, altered drainage and also landscape, waste management and also the operation of machinery and vehicles. Taking into account the distance between the quarry and the wetland, the level of risk associated with the majority of the aspects can be reduced to a Low level of risk, with the exception of changes to catchment drainage and the altered topography. The proposed quarry will result in the permanent changes to the drainage and altered topography, which is likely to result in the subsequent permanent impacts on the hydrology and overall functioning of the wetland system. Impacts to water quality stemming form the quarry area are also expected for the closure phase of the project, with drainage areas from the quarry area being conduits for impaired water quality towards the Mzimkhulu River. The following aspects pertaining to the buffer area were also considered for the mitigation of risks:

- According to Macfarlane et al. (2009) a maximum buffer range of between 10m to 61m is required for the removal of silt. Taking into account the distance of the wetland from the quarry area (approximately 95m) and the buffer area of 33m, this total distance of 95m is considered efficient for the removal of sediment;

- A maximum range of between 7m to 260m, with the majority of the buffer widths being below 85m is required for the efficient removal of nutrients (Macfarlane et al., 2009). In the event that blasting will be undertaken for the quarry, a buffer range of between 9.1m and 260m is provided, with the majority of the buffer widths being below 90m. The distance between the quarry and the wetland is greater than both majority widths provided above; and

- A maximum buffer range of between 3.8m to 50m is required for the efficient removal of toxicants (Macfarlane et al., 2009). The buffer area of 33m, and the larger total area of 95m between the quarry and the wetland do allow for this.

Table 12: Potential impacts associated with the project

Andrew Husted (Pr Sci Nat 400213/11)		
Construction & Operational Phase		
Activity	**Impact**	**Aspect**
Establishment and Operation of Pit	Altered hydrological regime	Clearing of vegetation
		Stripping and stockpiling of topsoil
		Changes to catchment drainage characteristics
		Altered topographical features
		Access road construction
	Impaired water quality	Operation of vehicles and machinery
		Leaks and spillages from machinery, equipment & vehicles
		Mining area and operation
		Human sanitation& ablutions
		Re-fuelling of machinery and vehicles
	Erosion & sedimentation	Clearing of vegetation
		Stripping and stockpiling of topsoil
		Changes to catchment drainage characteristics
		Altered topographical features
		Increased run-off velocity
		Bare areas after clearing
		Stormwater management during construction
	Alien vegetation	Clearing of vegetation
		Stripping and stockpiling of topsoil
		Operation of vehicles and machinery
		Vehicles access from other areas
		Waste (food & solid) disposal
Decommissioning Phase		
Activity	**Impact**	**Aspect**
Decommissioning of Pit	Closure (likely positive impacts from the operational phase)	Backfill of material
		Re-shaping & contouring

		Changes to catchment drainage characteristics
		Altered topographical features
		Access road rehabilitation
		Operation of vehicles and machinery
		Leaks and spillages from machinery, equipment & vehicles
		Solid waste disposal
		Human sanitation& ablutions
		Mining area and closure
		Stormwater management

Table 13: DWS Risk Impact Matrix for the proposed project

Severity									
Impact	**Aspect**	**Flow Regime**	**Water Quality**	**Habitat**	**Biota**	**Severity**	**Spatial scale**	**Duration**	**Consequence**
Construction & Operation Phase									
Altered hydrological regime	Clearing of vegetation	3	3	3	2	2.75	**2**	**4**	8.75
	Stripping and stockpiling of topsoil	3	3	3	2	2.75	**2**	**3**	7.75
	Changes to catchment drainage characteristics	3	2	2	2	2.25	**2**	**4**	8.25
	Altered topographical features	2	3	2	2	2.25	**2**	**4**	8.25
	Access road construction	2	2	2	2	2	**2**	**2**	6
Impaired water quality	Operation of vehicles and machinery	1	3	2	2	2	**2**	**4**	8
	Leaks and spillages from machinery, equipment & vehicles	1	3	2	2	2	**1**	**4**	7
	Mining area and operation	1	3	2	2	2	**3**	**4**	9
	Human sanitation& ablutions	1	3	2	2	2	**1**	**4**	7
	Re-fuelling of machinery and vehicles	1	3	1	1	1.5	**1**	**3**	5.5
Erosion & sedimentation	Clearing of vegetation	3	3	2	2	2.5	**2**	**4**	8.5
	Stripping and stockpiling of topsoil	3	3	2	2	2.5	**2**	**3**	7.5
	Changes to catchment drainage characteristics	2	2	2	2	2	**2**	**4**	8
	Altered topographical features	3	2	2	2	2.25	**2**	**4**	8.25
	Increased run-off velocity	3	2	2	2	2.25	**2**	**3**	7.25

	Bare areas after clearing	2	2	3	2		**2**	**3**	5
	Stormwater management during construction	2	2	2	2	2	**2**	**4**	8
Alien vegetation	Clearing of vegetation	3	2	2	2	2.25	**2**	**4**	8.25
	Stripping and stockpiling of topsoil	3	2	2	2	2.25	**2**	**3**	7.25
	Operation of vehicles and machinery	2	2	1	2	1.75	**1**	**4**	6.75
	Vehicles access from other areas	1	2	2	2	1.75	**1**	**3**	5.75
	Waste (food & solid) disposal	1	2	2	2	1.75	**2**	**4**	7.75
Decommissioning Phase									
Closure	Backfill of material	3	1	4	4	3	**2**	**4**	9
	Re-shaping & contouring	3	3	2	2	2.5	**2**	**3**	7.5
	Changes to catchment drainage characteristics	2	2	2	2	2	**2**	**4**	8
	Altered topographical features	3	2	2	2	2.25	**2**	**4**	8.25
	Access road rehabilitation	2	2	2	2	2	**2**	**2**	6
	Operation of vehicles and machinery	1	2	1	2	1.5	**2**	**4**	7.5
	Leaks and spillages from machinery, equipment & vehicles	1	2	1	2	1.5	**1**	**4**	6.5
	Solid waste disposal	1	2	2	2	1.75	**2**	**4**	7.75
	Human sanitation& ablutions	1	2	2	2	1.75	**1**	**4**	6.75
	Mining area and closure	1	2	1	1	1.5	**3**	**4**	8.5
	Stormwater management	2	3	2	2	2.25	**2**	**4**	8.25

Table 14: DWS Risk Impact Matrix for the proposed project continued

Impact	Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction & Operation Phase									
Altered hydrological regime	Clearing of vegetation	3	2	**1**	2	8	70	**Moderate***	**Low**
	Stripping and stockpiling of topsoil	3	2	1	2	8	62	**Moderate***	**Low**
	Changes to catchment drainage characteristics	3	1	1	3	8	66	**Moderate**	**Moderate**
	Altered topographical features	3	1	1	3	8	66	**Moderate**	**Moderate**
	Access road construction	2	2	1	2	7	42	**Low**	**Low**
Impaired water quality	Operation of vehicles and machinery	3	2	1	2	8	64	**Moderate***	**Low**
	Leaks and spillages from machinery, equipment & vehicles	3	2	**1**	2	8	56	**Moderate***	**Low**
	Mining area and operation	3	3	1	3	10	80	**Moderate***	**Low**
	Human sanitation& ablutions	2	1	1	1	5	35	**Low**	**Low**
	Re-fuelling of machinery and vehicles	2	1	1	1	5	27.5	**Low**	**Low**
Erosion & sedimentation	Clearing of vegetation	3	2	1	2	8	68	**Moderate***	**Low**
	Stripping and stockpiling of topsoil	3	2	1	2	8	60	**Moderate***	**Low**
	Changes to catchment drainage characteristics	3	1	1	3	8	64	**Moderate***	**Low**
	Altered topographical features	2	1	1	3	7	57.75	**Moderate***	**Low**
	Increased run-off velocity	3	1	1	3	8	58	**Moderate***	**Low**
	Bare areas after clearing	3	1	1	3	8	40	**Low**	**Low**
	Stormwater management during construction	3	2	1	2	8	64	**Moderate***	**Low**
Alien vegetation	Clearing of vegetation	3	2	1	2	8	66	**Moderate***	**Low**
	Stripping and stockpiling of topsoil	3	2	1	2	8	58	**Moderate***	**Low**
	Operation of vehicles and machinery	3	1	1	1	6	40.5	**Low**	**Low**
	Vehicles access from other areas	3	1	1	1	6	34.5	**Low**	**Low**
	Waste (food & solid) disposal	2	2	1	1	6	46.5	**Low**	**Low**
Decommissioning Phase									
Closure	Backfill of material	2	2	**1**	2	7	63	**Moderate***	**Low**
	Re-shaping & contouring	3	2	1	2	8	60	**Moderate***	**Low**
	Changes to catchment drainage characteristics	3	3	1	3	10	80	**Moderate**	**Moderate**

	Altered topographical features	3	3	1	3	10	82.5	**Moderate**	**Moderate**
	Access road rehabilitation	2	2	1	2	7	42	**Low**	**Low**
	Operation of vehicles and machinery	3	2	1	2	8	60	**Moderate***	**Low**
	Leaks and spillages from machinery, equipment & vehicles	2	2	**1**	2	7	45.5	**Low**	**Low**
	Solid waste disposal	2	2	1	1	6	46.5	**Low**	**Low**
	Human sanitation& ablutions	2	1	1	1	5	33.75	**Low**	**Low**
	Mining area and closure	2	2	1	3	8	68	**Moderate**	**Moderate**
	Stormwater management	3	2	1	**2**	8	66	**Moderate***	**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.”

8.2 Mitigation Measures

The prescribed mitigation measures for the project include the following:

- The wetland area and associated buffer must be avoided;
- The areas between the project area and the surrounding water resources, particularly downslope of the quarry must remain vegetated. These areas must also be avoided and managed to ensure sufficient ground / grass cover between the quarry and local water resources;
- Construction of a berm around the west, east and south project border for the trapping of run-off. These berms must be maintained during the operational phase of the project, which includes the removal of debris and waste;
- Access to the project area must be via the existing route, gaining entry from the northern corner of the project area;
- Clearing of vegetation and stripping of topsoil must be on a need basis only, minimising the extent of clearing only as the project progresses. Stripped topsoil must be allocated for rehabilitation, but can also be used for the construction of the berms;
- The contractors used for the project must have spill kits to ensure that any fuel, oil or hazardous substance spills are cleaned-up and discarded correctly;
- All project infrastructure, laydown areas and facilities must be located within the project area and moved into the excavated area as the project progresses. All potential sources of contamination must be located within the quarry area for containment purposes;
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems;
- All waste generated on-site must be adequately managed and disposed of;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”; and
- Adequate sanitary facilities and ablutions must be provided for all personnel. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation).

8.3 Recommendations

The following recommendations are pertinent:

- A stormwater management plan must be compiled and implemented for the project. All clean water must be diverted back into the wetland system;

- An alien vegetation control and eradication plan must be initiated from the onset of the project, and must be continued for one-year post closure;
- Measures to trap and treat impaired water quality stemming from the quarry area, particularly within the drainage channels must be implemented. This may include the construction of a passive water treatment system; and
- It is recommended that water quality monitoring be conducted on a quarterly basis for the duration of the project, and for one-year post closure. Monitoring sites should include the wetland system, the associated drainage line and also an upstream and downstream site on the Mzimkhulu River.

9 Conclusion

Wetlands

A total of one (1) hydro-geomorphic (HGM) wetland type was identified and delineated for this assessment. The HGM type was a channelled valley bottom wetland located to the east of the proposed quarry. The integrity of the system is moderately modified (class C). The Ecological Importance & Sensitivity of the system was determined to have a High (class B) level of importance. An overall intermediate level of ecosystem service benefit is provided by the system. A conservative buffer zone of 33 m (Post-mitigation) was suggested for the project.

Risk Assessment

The proposed project is located approximately 95m west of the delineated wetland system. It is apparent from this assessment that there will be no direct risks posed by the project on the wetland system, but indirect risks remain a possibility. The wetland is downslope of the proposed quarry, which may result in contaminants stemming from the quarry reporting to the wetland, having an impact on the ecological status and functioning of the system. The proposed quarry is also likely to have an impact on the hydrology of the wetland, due to the loss in catchment area and the altered hydrology of the area, which includes a loss of surface run-off. Due to the nature of the project, secondary impacts such as waste generation and alien vegetation establishment may also result due to the on-site disturbances.

The construction and operation of the quarry poses a variety of Moderate pre-mitigation risks for a variety of aspects associated with the expected impacts. The notable impacts include altered hydrology, impaired water quality, erosion and sedimentation of the system and also alien vegetation establishment. Taking into account the distance between the quarry and the wetland, the level of risk associated with the majority of the aspects can be reduced to a Low level of risk, with the exception of changes to catchment drainage and the altered topography. The proposed quarry will result in the permanent changes to the drainage and altered topography, which is likely to result in the subsequent permanent impacts on the hydrology and overall functioning of the wetland system. Impacts to water quality stemming form the quarry area are also expected for the closure phase of the project, with drainage areas from the quarry area being conduits for impaired water quality towards the Mzimkhulu River.

Professional Opinion

It is the specialist's opinion that no fatal flaws were identified for the proposed quarry, and that the project may proceed. All mitigation measures prescribed herein must be implemented as

a minimum requirement. The provided recommendations must be seriously considered by the issuing authority. Due to the Moderate level of risk posed by the project on the associated wetland system, a Water Use Licence will be required.

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