AN AGRICULTURAL POTENTIAL AND IMPACT ASSESSMENT, MITIGATION MEASURES AND REHABILITATION RECOMMENDATIONS ARISING FROM THE PROPOSED CHANGE OF LAND USE FROM VACANT RANGELAND TO THE ESTABLISHMENTOF OF AN OPENCAST MINING OPERATION ON THE LAND PARCEL KNOWN AS THE CAPE LIME MASKAM MINING RIGHT AREA AND DESCRIBED AS PORTION 4 OF THE REMAINDER OF THE FARM WELVERDIEND N0 511, ASSOCIATED ACCESS ROADS AND ADDITIONAL SURFACE WORKING AREAS, SITUATED IN THE MATZIKAMA LOCAL MUNICIPALITY, WEST COAST DISTRICT MUNICIPALITY, WESTERN CAPE MAGISTERIAL/ADMINISTRATIVE DISTRICT OF VAN RHYNSDORP, 50 HA AND 10 KM IN EXTENT.

AGRICULTURAL IMPACT ASSESSMENT STUDY

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1 INTRODUCTION AND BACKGROUND

1.1 The Objective

The objective behind this assessment has been to determine whether the agronomic or agribusiness potential of this land parcel precludes or permits a change of land use from low sensitivity agricultural land to opencast mining and associated infrastructure.

There are three components to the assessment

1. The opencast mining material extraction area and adjoining surface working area (The Maskam Mining Site). The Mining Rights Application (MRA) has already been approved

2. The service road linking the Maskam Mining Site to the existing Vredendal Mining Site, 10 km away. Both these proposed operations will take place on vacant arid rangeland with a nominal Agricultural Theme Sensitivity of 1 to 2 on a scale of 1 to 15

3. The commissioning of two additional kilns at the Vredendal Processing Site. The proposed kilns will be located within the existing Vrededendal Processing Site which is already a fully transformed industrial site as illustrated in Picture Gallery PG 10.4

The commissioning of a new mining site has been prompted by two considerations

A. An ever expanding demand for products derived from the mining operation. These include:

   i. Concrete stone ranging from 10 mm to 37 mm for building, rail ballast and road making purposes

   ii. Dolomitic and calcitic fines for amelioration of agricultural soil acidity and replenishment of magnesium deficiency in agricultural soils

   iii. Industrial lime for building and plastering purposes

B. The existing ore bodies at the Vredendal mining site have a forward life expectancy of approximately two years. It is uncertain whether additional ore bodies in the existing mining area can produce the volumes and quality required for the forward sustainability of the present Cape Lime mining operation

The planting and harvesting of 1 600 ha of hemp (*cannabis sativa ssp sativa*) is being actively investigated as a carbon offset. Areas along the valley bottoms of the Wiedouw and Trotroer Rivers are being are being assessed. The crop will be irrigated by seepage water from the existing Vredendal mining operation

1.2 The Locality

The target site lies southeast of the N7 National Highway at a point 16 km northeast of the town of Klawer and 9 km southwest of the town of Vanrhynsdorp in the far north-western corner of the Western Cape Province.

A Google Earth Pro image reflecting this locality appears as Appendix 11.1 hereto.

1.3 The Proposed Change of Land Use

It is proposed that an opencast mining operation and a related product surface working area be established at the target site. This site represents 50 ha out of the 470 ha land parcel which is currently arid open rangeland, surrounded by further arid rangeland

A Google Earth Pro image reflecting the mining site appears as Appendix 11.2 hereto

1.4 The Regulatory Framework

From an agricultural perspective the most important pieces of legislation effecting land use management are:

- Subdivision of Agricultural Land Act 70 of 1970 (SALA);
- Conservation of Agricultural Resources Act 43 of 1983 (CARA);
- National Environmental Management Act 107 of 1998 (NEMA) - (It should be noted that Government Notice 320 of 20 March 2020 introduces new tables on a scale of 1-15 for Land Classification purposes).

The specialist study covering the site under consideration was guided by the need to:

- Establish the agricultural potential of the site that is to be utilised from the existing farms;
- Estimate the potential and existing arability and carrying capacity of the study area;
- Establish the availability and condition of the existing agricultural resources and agricultural infrastructure;
- Describe past and current agricultural practices/activities on the site as part of identifying and describing the existing agricultural environment;
- Identify indications of possible constraints;
- Consider and evaluate possible impacts on the existing agricultural resources and activities;
- Identify and describe the risks and possible impacts of the proposed project on the agricultural environment;
- Assess the severity of the possible impacts;
- Assess possible impacts on the agricultural activities of the surrounding agricultural properties, particularly during the two key phases of construction and operation;

- Consider alternatives to avoid the impacts; and
- Identify and describe mitigation measures to avoid or reduce the impacts of the project on the existing agricultural environment.

1.5 Summary of Findings

1.5.1 Maskam Mining Area

With the exception of one small area of a few hundred m2, the entire site is covered by shallow, non arable stony soils of the Mispah Soil Form. Topsoil depth ranged from a nominal 50 mm to 250 mm. Rehabilitation of similar soils has been successfully carried out in other parts of the Karroo, the closest being at nearby Nieuwoudtville.

Annotated photographs illustrating the Mispah Soil Form as present at the site appears in Picture Galleries under Appendix 11.14. A table providing the physical properties of each profile examined constitutes Appendix 11.7 hereto.

There is no agronomic or agribusiness reason why the mining operation should not be approved.

1.5.2 The Proposed Link Road to the Maskam Mining Area

Again, the soils constitute shallow, non-arable land, the major difference being that the new portion of road traverses steeper slopes. The river floodplains are covered by waterborne coarse sand and dense stands of Sweethorn (Acacia karoo ssp. karroo).

There is a narrow strip of arable alluvium along the upper floodplain and lower footslopes which is being assessed for hemp production.

A table providing the physical properties of each profile examined constitutes Appendix 11.8 hereto.

There is no agronomic or agribusiness reason why the construction of the link road should not be approved.

1.5.3 The Proposed two Kilns

These will be commissioned on lad within the existing Vredendal processing area. As illustrated in Appendix 11.14, the locality is within an industrial site that is already a fully transformed industrial undertaking and therefore is outside of the terms of reference of this study.

2 METHODOLOGY: DESKTOP STUDY

2.1 Soils Data

2.1.1 Soil parent materials

The standard reference for soil parent materials are maps provided by the Council for GeoScience, in this instance, GeoScience Geological Survey Map No. 3118, Calvinia as reflected in Appendix 11.3 hereto.

Although these maps are on a scale of 1:250 00 they do provide useful indicators of the quality of soils that are likely to be encountered within the study site. The soils presently found at the site are geologically young, having weathered down from igneous rock accumulations of the Karroo Group formed between 50 million and 30 million years ago that generated a stratum of quartz porphyry that overlaid the older Vanrhynsdorp Group (550 million years old). These are all part of the 1 500 million year old Bushmanland Group which was caused by huge continental tectonic plates that moved and forced what is now the western seaboard and hinterland of RSA below the then sea level.

2.1.2 Present Day Soil Families

Most of the ecosystem under scrutiny is covered by soils derived from quartz porphyry referred to above, although in places there are intrusions of rock from the Vanrhynsdorp Group through the surface or are close to it.

Approximately half the ecosystem area is covered by red and /or yellow coloured Soil Families that have a topsoil depth of less than 300 mm, thus rendering them unsuitable for arable crop cultivation (Land Type Af).

Nearly all the rest of the area is made up mainly of Glenrosa and Mispah Soil Families which are characteristically shallow and / or rocky and are often steep. These soils have lime throughout and are therefore most likely to be the soils found at the site (Land Type Fc)

These physical properties have been confirmed either way during the course of the site assessment

The following standard soil classification texts have been used in order to determine site specific Soil Forms and thus obtain data on the physical properties of the Soil Forms encountered and the management thereof:

Soil Classification: A Taxonomic System for South Africa: McVicar et al, ISCW (Blue book)

Soils of South Africa: Martin Fey, Cambridge

2.2 Other Ecosystem Services

Although this exercise is fundamentally a soils potential survey there are other important ecosystem services that need to be taken into account, the more important among which are climate and vegetation

2.2.1 Climate

Although there is no officially recognised standard for defining climate, the table below developed by Scotney et al (UKZN 1987) is extremely useful and has been widely adopted

Table 1: Description of Climate Capability Classes

Climate Capability Class	Limitation Rating	Description
C1	None to slight	Local climate is favourable for good yields for a wide range of adapted crops throughout the year.
C2	Slight	Local climate is favourable for a wide range of adapted crops and a year round growing season. Moisture stress and lower temperatures increase risk and decrease yields relative to C1.
C3	Slight to Moderate	Slightly restricted growing season due to the occurrence of low Temperatures and frost. Good yield potential for a moderate range of adapted crops.
C4	Moderate	Moderately restricted growing season due to low temperatures and severe frost.
C5	Moderate to Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops at risk of some yield loss.
C6	Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops which frequently experience yield loss.
C7	Severe to Very Severe	Severely restricted choice of crops due to heat, cold and/or moisture stress
C8	Very Severe	Very severely restricted choice of crops due to heat, cold and/or moisture stress. Suitable crops at high risk of yield losses.

Table 2: Climatic Data for the Study Area: VanRhynsdorp Gannabosveld

Climate Item	Incidence and Impact
Mean Annual Rainfall, precipitated mainly from May to August. Winter rainfall area	163 mm. This is insufficient to sustain temperate vegetative growth which requires 600 mm to 800 mm rainfall per annum
Annual Precipitation Coefficient of Variation	38%. Rainfall can vary from 100 mm per annum to 225 mm per annum
Mean Annual Temperature	18.2 Deg C. Temperatures ranges from 5 Deg C monthly mean to 30 Deg C
Mean Frost Days per annum	3
Mean Annual Potential Evaporation	2 604 mm. In temperate areas this figure is typically around 1 800mm
Mean Annual Soil Moisture Stress. Evaporative demand is more than double soil moisture supply	80%

The target area falls into Climate Capability Class C8

2.2.2 Vegetation

The standard reference for vegetative habitat is the Mucina and Rutherford publication *The Vegetation of South Africa Swaziland and Lesotho* published by Sanbi

In addition to narrative extracted from the Mucina and Rutherford Report, the document provides large scale maps of the various regions. The applicable map in this instance is Vegmap no.766 which is reproduced herein as Appendix 11.4

The arrow indicates the locality of the study site coded SKk 5, Vanrhynsdorp Gannabosveld of the Knersvlakte Bioregion of the Succulent Karoo Biome

Appendix 11.5 illustrates the locality of the Knersvlakte Region within the Succulent Karoo Biome (A3)

The Vanrhynsdorp Gannabosveld ecosystem lies between Vredendal and Vanrhynsdorp. It is mainly flat or gently undulating landscape supporting succulent shrub land dominated by species such as *Salsola, Drosanthemum* and *Ruschia,* commonly referred to as “Vygies”

If there are good winter rains there is a short lived and rich flush of *Osteospermum pinnatum, Caulipson rapaceum and Faveolina dichotomata* which throw a rich carpet of pink, white and yellow flowers that attracts tens of thousands of seasonal visitors both from within SA and from overseas.

This is not a threatened habitat.

2.3 Terms of Reference

Terms of reference, proposed future use of land, land portion details, land ownership details, site relevant site maps and similar data was provided by the client.

2.4 Experience of Similar Arid Ecosystems

John Phipson has successfully concluded impact assessments on 300 ha to 500 ha sites for solar panel installations at Cradock and Victoria West, both in the Karoo as well as an assessment of ecosystem resources in the South Kalagadi District of Botswana, the ZF Mgcawu and John Taolo Gaetsewe District Municipalities of the Northern Cape for the IUCN. The above are all also arid rangeland habitats

3 SITE VERIFICATION

3.1 Methodology

The site verification exercise was carried out on the 13th and 14th of August 2020. Conditions were cool and calm. Due to rain earlier in the week soil profiles were damp but showed no symptoms of permanent wetness.

3.1.1 The Proposed Mining Area

For an observation area of 20 ha to 50 ha, the Survey Standards, Version 2, May 2015 require a survey intensity of 25-35 profiles for spatial assessments. There are no standards profile intensity for linear assessments. This is left to the type of terrain and the judgement of the specialist

The tool for profile observations was a Dutch Auger. Slope was measured using an Abne Level.

Where profiles were physically exposed, representative profiles were photographed. A cross-section of annotated photographs appears in the Picture Gallery accompanying this report.

Soil texture was estimated using the ball and sausage method. In order to judge the possibility of the mining operation impacting on the surrounding area a few profiles were examined to the south and southeast of the mining area (Profiles CL 10 to CL15, Appendix 11.7). The terrain to the north and northwest of the mining area that lies in the direction of the N7 was assessed on a drive through reconnaissance basis as by this stage of the assessment it was abundantly apparent that soils were visibly uniform across the entire impact potential area

A total of 35 profiles were examined and the outcome for each profile recorded in Appendix 11. 7 hereto.

3.1.2 The Proposed Link Road

The link road can be addressed in three phases:

The first phase is a minor straightening and upgrade of an existing gravel road across level terrain for a distance of 3.6 km west from the N7.

The second phase is the construction of a new road that first turns southwards over the hill and then runs westwards across a steep midslope to the north of the two rivers before again turning south to cross the Wiedouw and Troetroer Rivers, a distance of the 3.7 km.

The final phase is across the lower slope to the south of the rivers in a westerly direction towards the present mining site, a distance of 2.7 km, giving a total upgrade and new road a length of 10 km.

Access from this point is to the Vrededorp processing plant is along the existing mine to processing plant road which is in daily use and will require no alterations or upgrades. This road traverses 9 km of similar arid rangeland, giving a total haulage distance of 19 km.

3.2 Soils Data

Table 4 below provides a descriptive summary of the main features of the only Soil Form encountered at the site in layman’s language. Corresponding technical details constitute Appendix 11.10 hereto:

Table 3: Description of Site Soil Families

Mispah	Highly erodible, exceptionally good surface water management is required. Topsoil depth is often less than 200 mm, covering a stratum of densely bedded shale or solid rock. Often found in proximity are Glenrosa soils. Mispah soils also carry a high erosion hazard.

The physical properties of these soil families were summarized from “Identification and Management of the Soils of the South African Sugar Industry” published by the SA Sugar Research Institute. (Sugar book)

This is an extremely useful publication as it details physical and chemical characteristics as well as soil management guidelines for all 48 of the Soil Forms that occur within the RSA

Sugar Industry. This data is further refined at the Soil Series level for some 400 Soil Series that occur within the 48 Soil Forms.

3.3 Land Capability Class Determination

Once the relevant soil profile and topographic data had been recorded, the next step was to compile and record the Land Capability Class for each soil profile assessed.

This is the fundamental step in assessing all the individual components that determine the physical capability and crop yield potential of a particular soil at a particular site.

Examination and assessment of the individual components of the determination can also give valuable insights into the management practices that will be required during the construction and rehabilitation phases of a proposed development process.

The following determinants are then applied to a Land Capability Class determination flowsheet (Appendix 11.6):

- Soil texture (clay content)
- Slope % of surrounding area
- Effective rooting depth
- Moisture intake rate
- Soil permeability
- Soil wetness
- Rockiness and crusting potential are sometimes a consideration. Aspect and location on the slope (terrain units) can sometimes also provide insight.

Table 4 overleaf defines the qualities of each of the eight nationally recognised Land Capability Classes.

The values attached to each determinant of an LCC also provide useful management guide e.g. Texture, rooting depth, permeability etc.

Only soils complying with Land Capability Classes I to III (LCCI to LCCIII) are readily acceptable for arable crop cultivation. LCC IV soils may be cultivated under certain stringent and well managed conditions.

LCC V usually refers to wetlands and LCC VI to non arable land that can be used only for long term crops due to steepness, soil depth and so forth

LCC VII and VIII soils are limited to domestic livestock and wild game.
Most of the profiles studied fell into LCC VII.

Table 4: Description of Land Capability Classes

Class	Concepts
I	Land in Class I has few limitations that restrict its use; it may be used safely and profitably for cultivated crops; the soils are nearly level and deep; they hold water well and are generally well drained; they are easily worked, and are either fairly well supplied with plant nutrients or are highly responsive to inputs of fertilizer; when used for crops, the soils need ordinary management practices to maintain productivity; the climate is favourable for growing many of the common field crops.
II	Land in Class II has some limitations that reduce the choice of plants or require moderate conservation practices; it may be used for cultivated crops, but with less latitude in the choice of crops or management practices than Class I; the limitations are few and the practices are easy to apply.
III	Land in Class III has severe limitations that reduce the choice of plants or require special conservation practices, or both; it may be used for cultivated crops, but has more restrictions than Class II; when used for cultivated crops, the conservation practices are usually more difficult to apply and to maintain; the number of practical alternatives for average farmers is less than that for soils in Class II.
IV	Land in Class IV has very severe limitations that restrict the choice of plants, require very careful management, or both; it may be used for cultivated crops, but more careful management is required than for Class III and conservation practices are more difficult to apply and maintain; restrictions to land use are greater than those in Class III and the choice of plants is more limited.
V	Land in Class V has little or no erosion hazard but has other limitations which are impractical to remove that limit its use largely to pasture, range, woodland or wildlife food and cover. These limitations restrict the kind of plants that can be grown and prevent normal tillage of cultivated crops; it is nearly level; some occurrences are wet or frequently flooded; others are stony, have climatic limitations, or have some combination of these limitations.
VI	Land in Class VI has severe limitations that make it generally unsuited to cultivation and limit its use largely to pasture and range, woodland or wildlife food and cover; continuing limitations that cannot be corrected include steep slope, severe erosion hazard, effects of past erosion, stoniness, shallow rooting zone, excessive wetness or flooding, low water-holding capacity; salinity or sodicity and severe climate.
VII	Land in Class VII has very severe limitations that make it unsuited to cultivation and that restrict its use largely to grazing, woodland or wildlife; restrictions are more severe than those for Class VI because of one or more continuing limitations that cannot be corrected, such as very steep slopes, erosion, shallow soil, stones, wet soil, salts or sodicity and unfavourable climate.
VIII	Land in Class VIII has limitations that preclude its use for commercial plant production and restrict its use to recreation, wildlife, water supply or aesthetic purposes; limitations that cannot be corrected may result from the effects of one or more of erosion or erosion hazard, severe climate, wet soil, stones, low water-holding capacity, salinity or sodicity.

In order to facilitate flow and avoid clutter, the flowsheets reflecting the key components of LCC determination are relegated to Appendix 11.6 hereto.

3.4 Agricultural Theme Sensitivity

It is unfortunate that the Sensitivity Rating Definitions as detailed in GN 320 do not contain the clarity of definition and the empirical data base requirements that are inherent in Land Capability Class Definitions. The latter give clear guidelines and distinctly define the physical components that place a particular soil profile within a specific Land Capability Class

3.5 Soil Properties

For the technically minded, physical and chemical properties of the soil encountered at the site are detailed in Appendix 11.10 hereto.

Agricultural Theme Sensitivity

Due to the long period that has expired between March 2020 and the first time that specialists are now able to go into the field GN 320 the practical interpretation of the sensitivities and the reporting thereon is only now being empirically tested in the field.

It would appear that some of the Sensitivity Rating Definitions as detailed in GN 320 do not contain the clarity of definition and the empirical data base requirements that are inherent in Land Capability Class Definitions. The latter give clear guidelines and distinctly define the physical components that place a particular soil profile within a specific Land Capability Class.

This particular assessment does not present any undue challenges as the findings of the specialist are broadly in line with GN 320 agricultural sensitivity guidelines.

3.6 Use and Ownership of Land

All the land under review is vacant rangeland with a Land Capability Class Value of LCC VII and LCC VIII, which equate to a Low Sensitivity Rating in terms of GN 320. The land has a carrying capacity of one 60 kg Dorper hamel per 8 to twelve ha. This equates to one Large Stock Unit (LSU), an ox of 450 kg, per 60 ha to 90 ha of grazing veld. Good quality grazing veld supports one LSU per 2 to 2.5 ha.

Apart from the three km west of the N7 all the properties are owned by Afrimat (Pty) Ltd., Alberton, Gauteng. The contact person is Ms. Ntsanko Ndlovu: 016 366 0321 / 082 728 8975. Email ntsanko.ndlovu@afrimat.co.za.

4 ACCESS, INFRASTRUCTURE AND SERVICES

Access to the Maskam mining site is from the N7 National Highway at 31˚40’20.8”S, 18˚42’14.0”E southwards onto a macadamised road. Access to the link road is from the same point, but northwest onto a gravel road.

Apart from the macadamised access road there is no infrastructure at or near the mining site except for a few farm tracks. The same applies to the proposed new section of link road.

There are currently no services such as Eskom power and municipal water at the proposed mine site or the proposed new road.

5 ECOSYSTEM SERVICES

The paucity of ecosystem services in terms of rainfall, climate and soil quality is commensurate with arid rangeland.

6 IMPACT ASSESSMENT AND MITIGATION MEASURES

6.1 Maskam Mining Site

It is inevitable that the proposed material extraction process will permanently impact on the site, not only during the life of the mine, but also after the closure of the mine as extracted material is removed from the site for processing. Due to extremely shallow nature of the topsoil there is surplus material available for topdressing mined areas. This is an inherent component of any opencast mining operation, particularly in areas without readily available topsoil.

The social offset in this instance is not only the creation of employment at the site but also downstream employment in transport, kilns, administration and marketing. The economic offset is a contribution to Gross Domestic Product (GDP) from land that previously contributed nothing.

Ecological damage to the Surface Working Area (SWA) of the site in the form of offices, accommodation, roads and material storage can be repaired once the life of mine has expired.

Apart from nuisance dust, the material extraction process and activities in the SWA will have no impact, either positive or negative on the remainder of the Maskam property or the adjoining land parcels.

6.2 The Link Road

As illustrated in Appendix 11.12 the impact of the new sections of link road will be minimal within the extent of the of the haulage distance of 19 km. After expiry of life of mine the new sections of the route can be rehabilitated to vacant rangeland or kept as part of the local road infrastructure

The design of stormwater runoff control on the moderate to steep section of the new portions of the link road are at a civil engineering level, not an agricultural level

6.3 The Two New Kilns

As these will be in a fully developed and transformed industrial area they do not fall within the terms of reference of an agricultural impact assessment

The numerical values used in the table below are derived from the following formula:

Table 5: Impact Assessment Table: Mining Material Extraction Site and Surface Working Area.

Occurrence	Duration:	Probability:
	5 – Permanent	5 – Definite/don't know

	4 - Long-term (ceases with the operational life)	4 – Highly probable
	3 - Medium-term (5-15 years)	3 – Medium probability
	2 - Short-term (0-5 years)	2 – Low probability
	1 – Immediate	1 – Improbable
		0 – None
Severity	Extent/scale:	Magnitude:
	5 – International	10 - Very high/uncertain
	4 – National	8 – High
	3 – Regional	6 – Moderate
	2 – Local	4 – Low
	1 – Site only	2 – Minor

The significance of each impact is calculated using the following formula:

The environmental significance of each identified potential impact is then be rated as follows:

Significance Rating	Score
High	>60–100
Moderate	30–60
Low	<30-0

Table 6: Impact on extraction site

The Nature of the Impact		
Impact on the material extraction site will be long term, irreversible and severe. The impact on the surface working area will also be long term, but reversible and moderate. For the purpose of the table below, values derived from the material extraction site are used. The entire operation takes place within the context of presently vacant, unutilized arid rangeland that employs nobody. The long term economic and social benefits are positive in that food security will be provide for a number of families in the form of permanent employment.		
Defining the Impact	**Without Mitigation**	**With Mitigation**
Extent	1	1
Duration	5	5
Magnitude	10	10

Probability	5	5
Significance	90: High	90: High
Status	Positive	Positive
Reversibility	Extraction site: No Surface Working Area:Yes	Extraction site: No Surface Working Area: Yes
Irreplaceable Loss of Resources?	Yes	Yes
Can Impacts be Mitigated?	No	Yes
Mitigation: The only offsite mitigation that is required is control of nuisance dust, which is controlled by keeping unhardened surface working areas damp. Blasting dust will have dissipated before it reaches the only other activity in the area, the N7 National Highway which is approximately 1.5 km away.		
Residual Impacts: The material extraction area can never be fully rehabilitated as the extracted material is removed from the site for processing elsewhere and therefore cannot be used as backfill. Areas where vegetation has been removed or damaged should be lightly ripped with a vlegploeg or similar implement in order to release buried seed and organic material. Locally collected seeds may be added. Re-colonisation will occur rapidly after the first rain Other residual impacts are civil engineering and safety concerns etc. that will be addressed by others.		

Table 7: Cumulative Impact Assessment Table: Mining Material Extraction Site and Surface Working Area

The Nature of the Cumulative Impact Impact on the material extraction site is within the context of arid rangeland and even more arid mountains that extend from horizon to horizon. Apart from the existing N7 National Highway which passes by approximately 1.5 km away, there is no other development within 10 km of the site. For the purpose of the table below, values derived from the material extraction site are used		
Defining the Impact	**Overall Impact of the**	**Cumulative Impact of the**

	Proposed Project Considered in Isolation	Project and Other Projects in the Area
Extent	1	1
Duration	5	1
Magnitude	10	0
Probability	5	1
Significance	90:High	1:Very Low, insignificant
Status	Positive	Neutral
Reversibility	Extraction site: No Surface Working Area: Yes	N/A
Irreplaceable Loss of Resources?	Yes	No
Can Impacts be Mitigated?	No	N/A
Mitigation: As there are no impacts on the surrounding area, there is nothing to mitigate		
Residual Impacts: There are no residual impacts on the surrounding area		

Table 8: Impact: Link Road, Maskam Mining Site to Vredendal Mining Area

The Nature of the Impact The Impact of the link road will be long term, irreversible and of inconsequential magnitude. In part it involves minor straightening and upgrade of an existing road which passes through shallow, level and arid rangeland. In order to avoid dust and noise nuisance to an existing farmstead a new road is planned to bypass the said homestead by building a new road that is out of sight. On expiry of the Maskam mine life the new section of road can either be kept in good order as part of the local road infrastructure or allowed to revert to arid rangeland.		
Defining the Impact	**Without Mitigation**	**With Mitigation**

Extent	1	1
Duration	5	5
Magnitude	1	1
Probability	5	5
Significance	25	25
Status	Positive	Positive
Reversibility	No	No
Irreplaceable Loss of Resources?	Yes	Yes
Can Impacts be Mitigated?	No	Yes
Mitigation: The only offsite mitigation that is required is control of nuisance dust, which is controlled by keeping unhardened surface working areas damp.		
Residual Impacts: If the new portion of the road is decommissioned at the termination of the life of the mine, the hardened surface should be broken up and removed. The surface should then be lightly ripped with a vlegploeg or similar implement in order to release buried seed and organic material. Locally collected seeds may be added. Re-colonisation will occur rapidly after the first rain. Nature will then restore itself		

Table 9: Cumulative Impact Assessment Table: Link Road, Maskam Mining Site to Vredendal Mining Area

Defining the Impact	Overall Impact of the Proposed Project Considered in Isolation	Cumulative Impact of the Project and Other Projects in the Area
Extent	1	1
Duration	5	1
Magnitude	0	0
Probability	5	0

Significance	25	1
Status	Positive	Neutral
Reversibility	Yes	N/A
Irreplaceable Loss of Resources?	Yes	No
Can Impacts be Mitigated?	No	N/A
Mitigation: As there are no impacts on the surrounding area, there is nothing to mitigate		
Residual Impacts: There are no residual impacts on the surrounding area		

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Synopsis of Impacts

Synopsis of the impact on ecosystem services of the proposed development at the target site and the agricultural implications thereof

Issue	Nature of Impact	Extent of Impact (local / 500m radius)	No-go areas
Soils	The soils are shallow sandy gravel and stone chips over solid rock, which precludes them from being used as arable land. The proposed development will have no effect on the physical or chemical properties of the soils. The soils at the site have a relative agricultural theme sensitivity of 1 to 2	Limited to the target site only.	Nil
Climate	The climate is harsh with winter rainfall, the implication being that most arable crops can only be grown during the winter months. The proposed development will not impact on climate related agricultural effects	Limited to the target site only	Nil
Crops	The only crops that will grow on these soils are locally habituated grasses and shrubs that have a very shallow	Limited to the target site only	Nil

	root concentration and woody vegetation that has strong rooting systems that will spread and look for water.		
Description of expected significance of impact Although the proposed development will permanently transform the site, the significance is minimal as it is currently vacant and unused land with no arable crop potential.			
Gaps in knowledge & recommendations for further study There is no gap in knowledge regarding the soils on this site There are no further recommendations			

8 Conclusion

There are no apparent agronomic or agribusiness reasons for refusing the proposed change of land use.

This assessment concurs with the Agricultural Theme Sensitivity Map provided by the DEA website. This map reflects the proposed mining site and link road as falling into a low sensitivity area, numerically defined as land having a score of between 1 and 5. The empirical evidence gathered at site suggests that the appropriate numerical sensitivity rating for the study is between 1 and 2.

9 Recommendation

It is therefore recommended that approval for the proposed mining operation and associated infrastructure be approved.

10 REFERENCE PUBLICATIONS

i. The following reference material was utilized during the assessment and verification process:

ii. *Development and Application of a Land Capability Classification System for South Africa:* J L Schoeman et al, ARC-ISCW, 2002

iii. *Geological Journeys:* Norman and Whitfield: Struik

iv. *Karoo Veld, Management and Ecology:* Esler et al. Briza

v. *Natural Resources and/or Agricultural Survey Specifications, Version 2 May 2015:* KZN DARD Natural Resources Directorate, Cedara

vi. *Soil Classification: A Taxonomic System for South Africa:* CN MacVicar et Al, ICSW

vii. *Soils of South Africa:* Martin Fey, Cambridge University Press

viii. *The Story of Earth and Life*: McCarthy and Rubridge: Struik

ix. *The Vegetation of South Africa, Lesotho and Swaziland:* Mucina and Rutherford: Sanbi

x. *Wild Flowers of South Africa:* John Manning: Struik

11 APPENDICES

11.1 Appendix 11.1 Locality

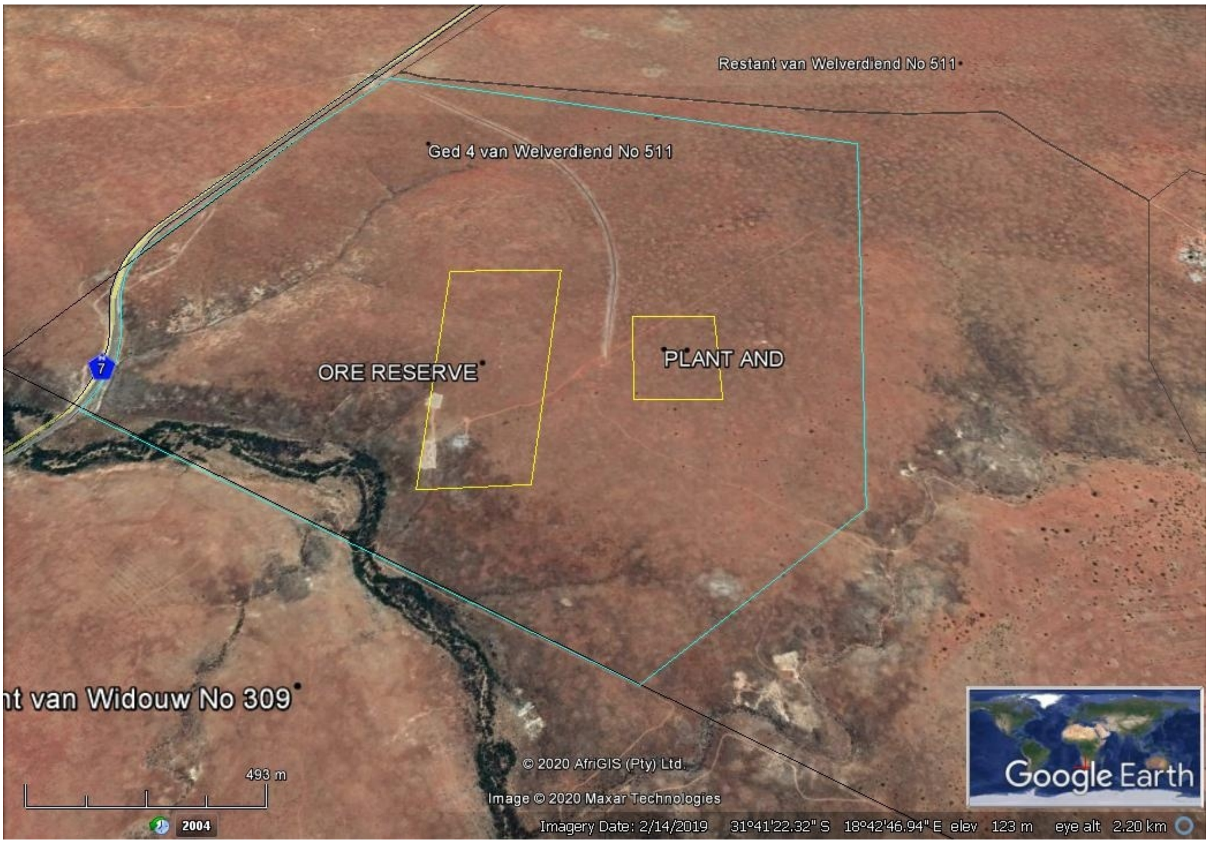
The N7 National Highway running from Klawer to Vanrhynsdorp is clearly visible at centre right as is the proposed mining site to the right of the N7

The town of Vredendal, the location of the existing mining operation, is visible in the upper left section of the map

The irrigated fields along the Olifants River illustrate how irrigation water together with deep alluvium in valley bottoms and footslopes can transform an arid rangeland into a high value, high yield arable crop production area

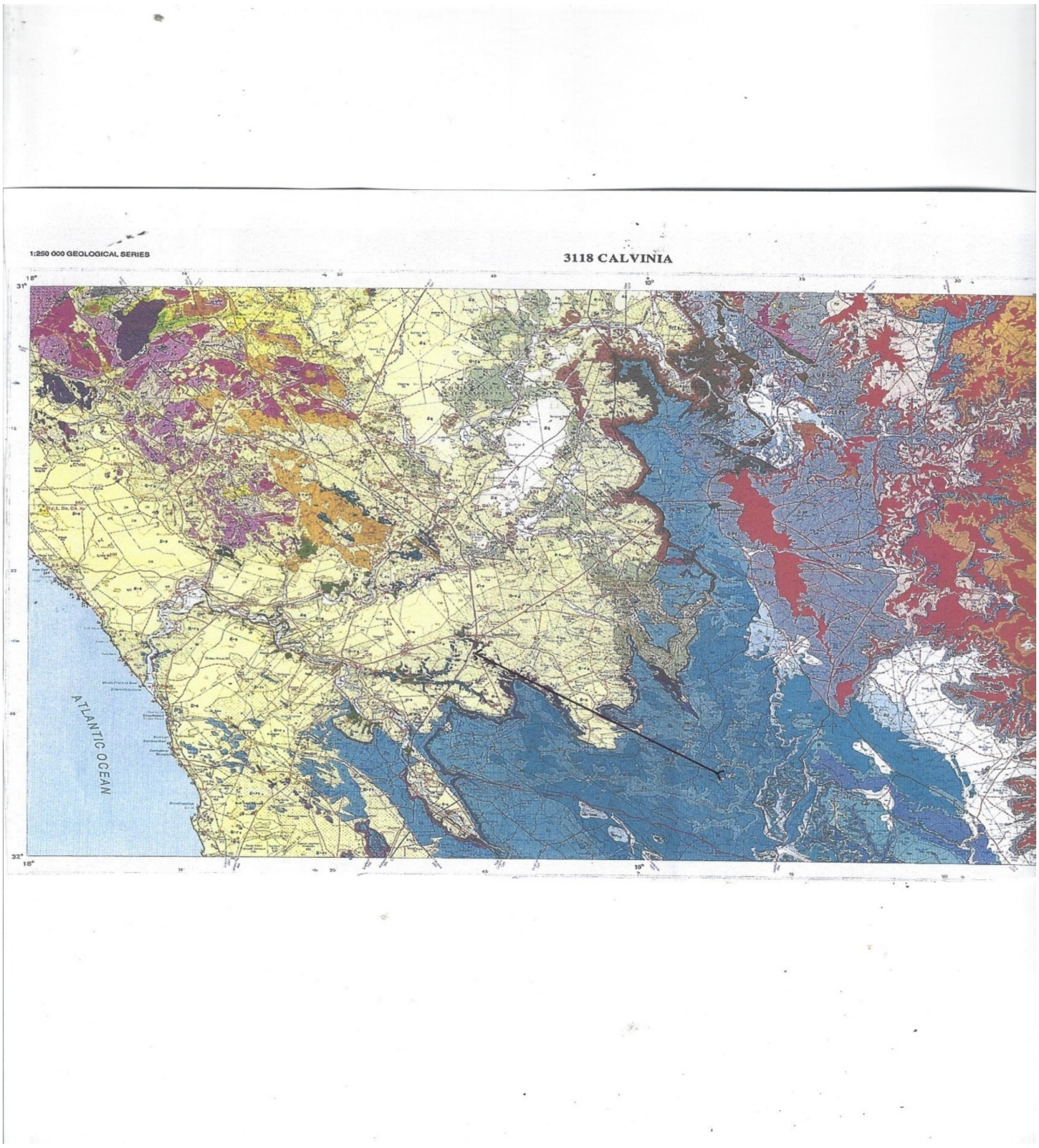
11.2 Appendix 11.2 The Mining Site

Access from N 7 is at 31°40’23°2”S and 18°42’11°9”E which is also the point from which the proposed link road to the mining works outside of Vredendal commences



11.3 Appendix 11.3 Soil Parent Materials

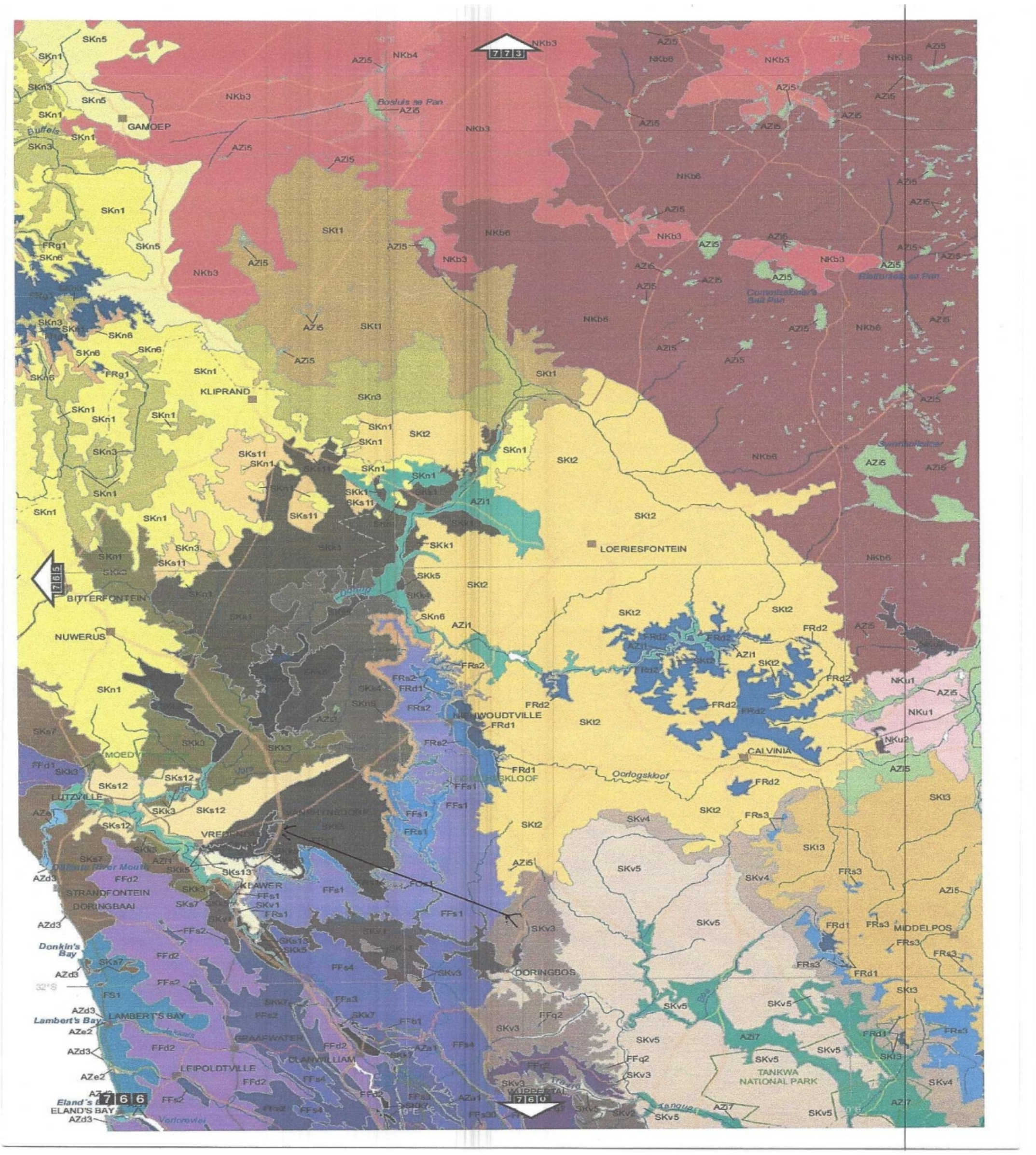
The arrow indicates the locality of the proposed mining site at which the soil parent material is quartz porphyry



11.4 Appendix 11.4 Mucina and Rutherford Vegmap

Again, the arrow indicates the locality of the proposed mining site

The dark colouring indicates the Knersvlakte Bioregion within whick which the Vanrhynsdorp Gaannabos ecosystem exists (Code SKk 5)



11.5 Appendix 11.5 Map Depicting the Succulent Karoo Biome

Code A 3 reflects the locality of the Knersvlakte Bioregion within the Succulent Karroo Biome

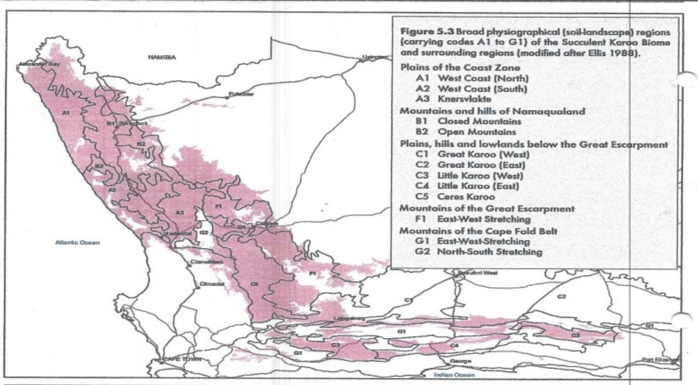


Figure 5.3 Broad physiographical (soil-landscape) regions (carrying codes A1 to G1) of the Succulent Karoo Biome and surrounding regions (modified after Ellis 1988).

Plains of the Coast Zone
- A1 West Coast (North)
- A2 West Coast (South)
- A3 Knersvlakte

Mountains and hills of Namaqualand
- B1 Closed Mountains
- B2 Open Mountains

Plains, hills and lowlands below the Great Escarpment
- C1 Great Karoo (West)
- C2 Great Karoo (East)
- C3 Little Karoo (West)
- C4 Little Karoo (East)
- C5 Ceres Karoo

Mountains of the Great Escarpment
- F1 East-West Stretching

Mountains of the Cape Fold Belt
- G1 East-West-Stretching
- G2 North-South Stretching

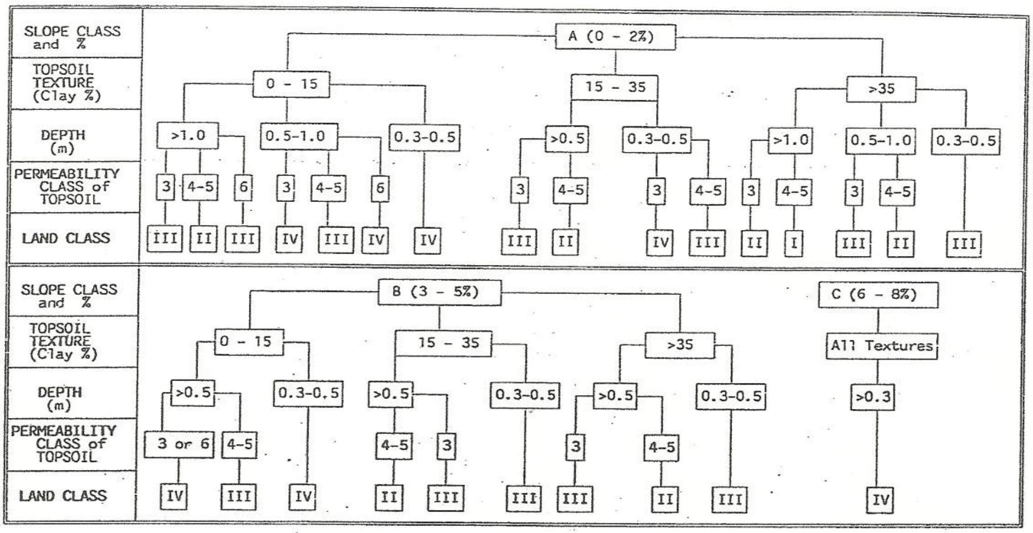
Succulent Karoo Biome 225

11.6 Appendix 11.6: Definition and Determination of Land Capability Classes

The flowsheets below and overleaf detail the procedures used to determine Land Class Capability. This capability is closely allied to soil yield potential.

CAPABILITY CLASS DETERMINATION GUIDELINE for BRGs:
Dry Zululand Thornveld (20), Valley Bushveld (21), Lowveld (22), Sandy Bushveld (23) (Average annual rainfall 587-830 mm)

Use the following flow chart to determine the land capability classes for land to be cropped in the above Bioresource Groups.



PERMEABILITY CLASS DESCRIPTION*			
Class	Rate (seconds)	Description	Texture
7	<1	Extremely rapid	Gravel and Coarse Sand. 0 to 10 % clay.
6	1-3	Rapid	5% to 10% clay.
5	4-8	Good	> 10% clay.
4	9-20	Slightly restricted	
3	21-40	Restricted	Strong structure, grey colours, mottles. > 35% clay.
2	41-60	Severely restricted	Strong structure, weathered rock. > 35% clay.
1	>60	Impermeable	Rock and very strong structure. > 35% clay.

* If roots can penetrate the subsoil, test permeability of upper subsoil.
If roots cannot penetrate the subsoil, test the permeability of the mid-topsoil.
Dark structured clay topsoil (vertic & melanic) with a Class 2 permeability should be assessed in the chart as if it has a Class 3 permeability. If permeability is Class 7, downgrade to Land Class IV.

Now refer to the opposite page to make adjustments for wetness, rockiness, crusting or permeability.

USE THE FOLLOWING LAND CHARACTERISTICS TO MODIFY THE LAND CLASS OBTAINED OPPOSITE, IF NECESSARY: The land capability class determined using the "flowchart" cannot be upgraded through consideration of wetness, rockiness, surface crusting or permeability classes given below, but it may be downgraded as indicated.

WETNESS		
Class	Definition	Land Class
W0	Well drained - no grey colour with mottling within 1.5 m of the surface. Grey colour without mottling is acceptable.	No change
W1	There is no evidence of wetness within the top 0.5 m. Occasionally wet - grey colours and mottling begin between 0.5 m and 1.5 m from the surface.	Downgrade Class I to Class II, otherwise no change
W2	Temporarily wet during the wet season. No mottling in the top 0.2 m but grey colours and mottling occur between 0.2 m and 0.5 m from the surface. Included are: soils with G horizons (highly gleyed and often clayey) at depths deeper than 0.5 m; soils with an E horizon overlying a B horizon with a strong structure; soils with an E horizon over G horizons where the depth to the G horizon is more than 0.5 m.	Downgrade to Class IV
W3	Periodically wet. Mottling occurs in the top 0.2 m, and includes soils with a heavily gleyed or G horizon at a depth of less than 0.5 m. Found in bottomlands.	Downgrade to Class Va
W4	Semi-permanently / permanently wet at or above soil surface throughout the wet season. Usually an organic topsoil or an undrained vlei. Found in bottomlands.	Downgrade to Class Vb

PERMEABILITY	
Permeability Class	Adjustment to be made
1 - 2	If in sub-soil, rooting is likely to be limited: Use the permeability of the topsoil in the flow chart. If this is the permeability of the topsoil, then the topsoil is probably a dark structured clay, in which case a permeability Class 3 can be used in the flow chart.
3 - 5	Classify as indicated in the flow chart.
6	Topsoil should have < 15% clay - use the flow chart.
7	Downgrade Land Classes I to III to Land Class IV.

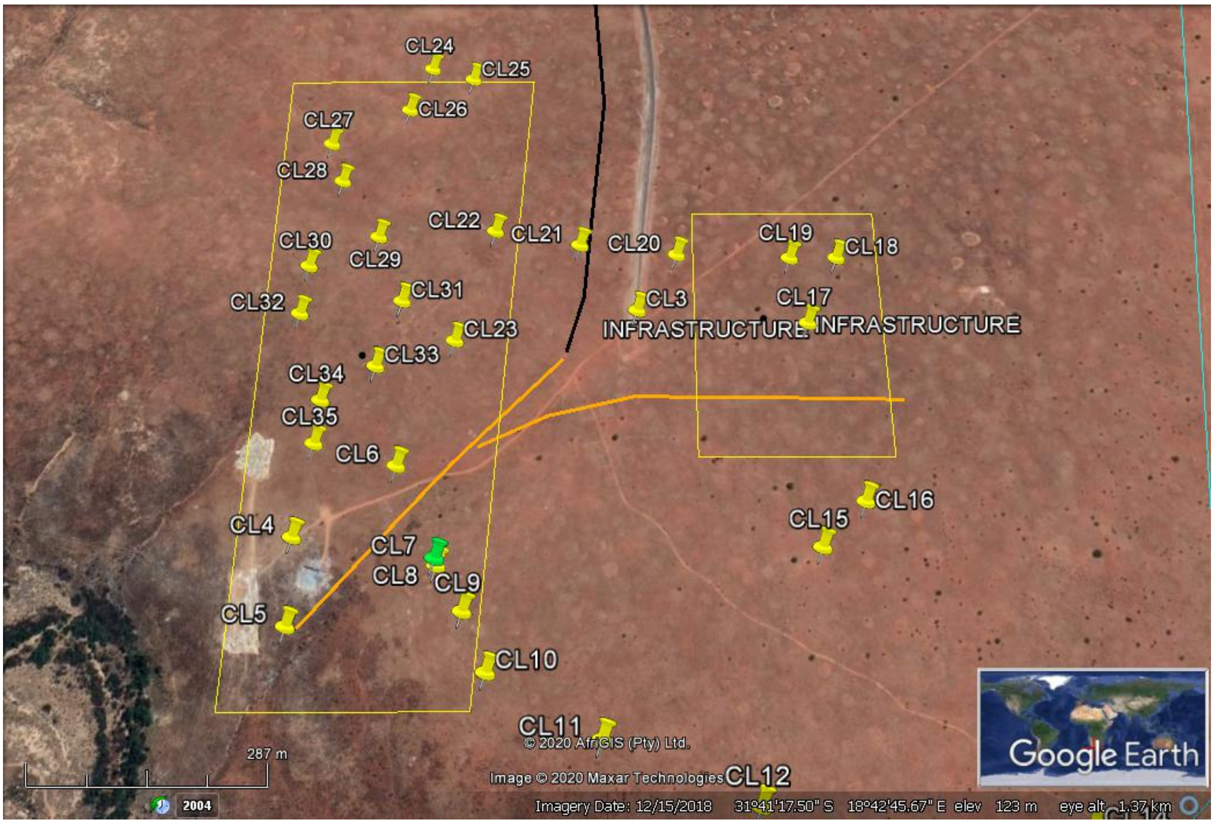
ROCKINESS		
Class	Definition	Land Class
R0	No rockiness	No change
R1	2 - 10% rockiness	Downgrade Classes I to II, otherwise no change
R2	10 - 20% rockiness	Downgrade Classes I to II, otherwise no change
R3	20 - 30% rockiness	Downgrade to Class IV
R4	> 30% rockiness	Downgrade Classes I, II, III & IV to Class VI

SOIL SURFACE CRUSTING		
Class	Definition	Land Class
t0	No surface crusting when dry	No change
t1	Slight surface crusting when dry	Downgrade Class I to Class II, otherwise no change
t2	Unfavourable surface crusting when dry	Downgrade Classes I & II to Class III, otherwise no change

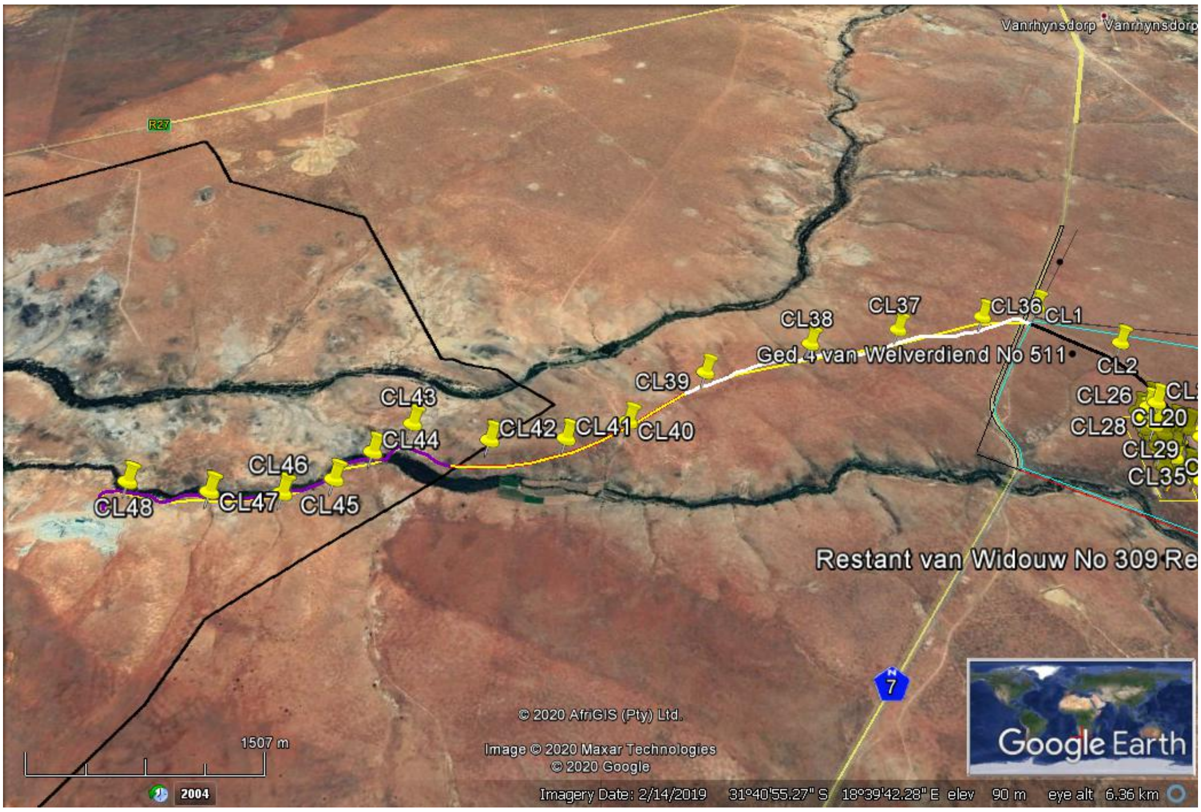
NB **Any land not meeting the minimum requirements shown is considered non-arable (Class V, VI, VII or VIII).**
Non-arable land in BRGs 2, 4, 6, 9, 12, 14, 15, 16, 17, 18 & 19 includes:
* all land with W3, W4 or R4,
* all land with slope exceeding 20%,
* land with slope 13-20%, if clay < 15% or depth < 0.4m,
* land with slope 8-12% and clay > 15%, if depth < 0.25m,
* land with slope 8-12% and clay < 15%, if depth < 0.5m, and
* land with slope 0-7%, if depth < 0.25m.

20 March 1996

11.7 Appendix 11.7 Spatial representation of Land Capability Classes: Maskam Mining Site



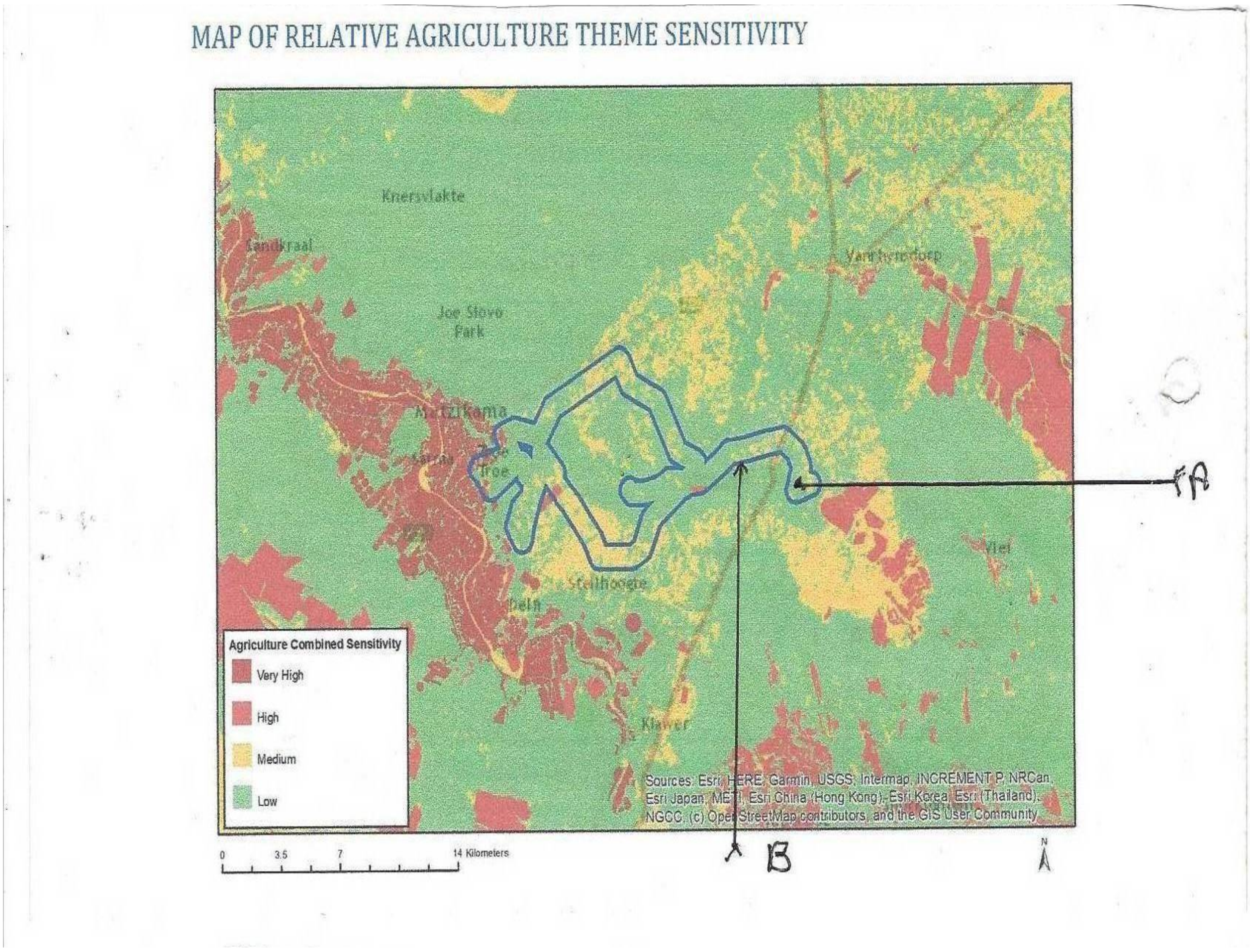
11.8 Appendix 11.8 Spatial representation of Land Capability Classes: Link Road



11.9 Appendix 11.9: Site Sensitivity Theme

Figure A represents the Maskam Mining Area

Figure B represents the Link Road



11.10 Appendix 11.10: Physical properties, Tillage constraint codes & Chemical properties

Physical Properties

Soil Form / Family	Clay % of Topsoil	Water Holding Capacity (mm/m)	Water Intake Rate	Drainage Capacity	Erosion Hazard	Tillage Constraints
Mispah	6 to 35	< 80	Medium	Moderate	Moderate to high	Cr, co, mw, sh

Tillage Constraint Codes

Code	Restraint
Cl	Cloddy consistency, slippery when wet, hard and cloddy when dry
Co	Compaction, puddling and smearing when wet
Cr	Crusting, soft when wet, cemented and brittle when dry
Mw	Machine wear, abrasion in sharp sandy soils
Sh	Subsurface hindrance, shallow soils on rock or hard plinthite

Chemical Properties

Soil Form / Family	Base Status	Organic matter Content	N&S Mineralisation Capacity	K Reserves	Zn Reserves	Salinity/ Sodicity Hazard
Mispah	Low to moderate	Low to moderate	Low	Low	Low	Low to moderate

11.11 Appendix 11.11: Land Capability Classes: Soil Profiles at the proposed Maskam Mine

Ref	Co-ordinates	Soil Form	Slope %	Clay %	Depth (mm)	Permeability	Wetness	LCC	Aspect/ Terrain Unit
CL 1	31˚40'20.8"S 18˚42'14.0"E	Mispah	0-2	20-30	50	1	W0	VII	Plain
CL 2	31˚40'37.0"S 18˚42'36.7"E	Mispah	0-2	20-30	50	1	W0	VII	Plain
CL 3	31˚41'12.7"S 18˚42'47.0"E	Mispah	3-5	20-30	100	1	W0	VII	SW US
CL 4	31˚41'23.4"S 18˚42'30.6"E	Mispah	3-5	20-30	50	1	W0	VII	SE MS
CL 5	31˚41'2.7"S 18˚42'47.0"E	Mispah	3-5	20-30	50	1	W0	VII	S LS
CL 6	31˚41'20.5"S 18˚42'35.3"E	Mispah	0-2	20-30	150	1	W0	VII	SE US
CL 7	31˚41'24.3"S 18˚42'37.4"E	Mispah	0-2	20-30	600	5	W0	III	SW MS
CL 8	31˚41'24.6"S 18˚42'37.5"E	Mispah	0-2	20-30	50	1	W0	VII	S MS

CL 9	31˚41’26.4”S 18˚42’38.8”E	Mispah	6-10	20-30	50	1	W0	VII	S MS
CL 10	31˚41’25.7”S 18˚42’40.0”E	Mispah	0-2	20-30	100	1	W0	VII	S FS
CL 11	31˚41’31.1”S 18˚42’45.2”E	Mispah	0-2	20-30	50	1	W0	VII	S FS
CL 12	31˚41’33.4”S 18˚42’52.0”E	Mispah	0-2	20-30	200	1	W0	VII	S FS
CL 13	31˚41’37.6”S 18˚43’0.7”E	Mispah	0-2	20-30	300	1	W0	VII	SW FS
CL 14	31˚41’34.2”S 18˚43’0.7”E	Mispah	0-2	20-30	100	1	W0	VII	W MS
CL 15	31˚41’23.9”S 18˚43’12.7”E	Mispah	0-2	20-30	50	1	W0	VII	NW LS
CL 16	31˚41’15.6”S 18˚42’57.6”E	Mispah	0-2	20-30	150	1	W0	VII	VB
CL 17	31˚41’14.2”S 18˚42’55.5”E	Mispah	0-2	20-3O	100	1	W0	VII	VB
CL 18	31˚41’11.O”S	Mispah	0-2	20-30	150	1	W0	VII	VB

	18˚42’57.2”E								
CL 19	31˚41’11.1”S 18˚42’54.8”E	Mispah	0-2	20-30	200	1	W0	VII	VB
CL 20	31˚41’1O.9”S 18˚42’49.0”E	Mispah	0-2	20-30	100	1	W0	VII	NW LS
CL 21	31˚41’10.4”S 18˚42’44.0”E	Mispah	0-2	20-30	50	1	W0	VII	S MS
CL 22	31˚41’9.7”S 18˚42’39.6”E	Mispah	0-2	20-30	50	1	W0	VII	S MS
CL 23	31˚41’15.0”S 18˚42’37.8”E	Mispah	0-2	20-30	100	1	W0	VII	S FS
CL 24	31˚41’0.9”S 18˚42’35.7”E	Mispah	0-2	20-30	50	1	W0	VII	S FS
CL 25	31˚41’01.5”S 18˚42’38.0”E	Mispah	0-2	20-30	200	1	W0	VII	S FS
CL 26	31˚41’03.2”S 18˚42’34.6”E	Mispah	0-2	20-30	300	1	W0	VII	SW FS

CL 27	31˚41’05.0”S 18˚42’30.5”E	Mispah	0-2	20-30	100	1	W0	VII	W MS
CL 28	31˚41’07.0”S 18˚43’32.3”E	Mispah	0-2	20-30	150	1	W0	VII	NW LS
CL 29	31˚41’09.9”S 18˚42’33.5”E	Mispah	0-2	20-30	50	1	W0	VII	VB
CL 30	31˚41’11.3”S 18˚42’30.0”E	Mispah	0-2	20-3O	200	1	W0	VII	VB
CL 31	31˚41’13.1”S 18˚42’35.0”E	Mispah	0-2	20-30	150	1	W0	VII	VB
CL 32	31˚41’13.6”S 18˚42’29.8”E	Mispah	0-2	20-30	100	1	W0	VII	VB
CL 33	31˚41’16.1”S 18˚42’33.9”E	Mispah	0-2	20-30	50	1	W0	VII	NW LS
CL 34	31˚41’17.6”S 18˚42’31.3”E	Mispah	0-2	20-30	50	1	W0	VII	S MS
CL 35	31˚41’19.6”S 18˚42’31.2”E	Mispah	0-2	20-30	150	1	W0	VII	S MS

Colour Coding

Colour	Comment
(green)	LCC Column: Marginal arable land
(yellow)	LCC Column: Non arable land

Terrain Unit Key

Abbreviation	Explanation
CREST	Crest
US	Upper Slope
MS	Mid Slope
FS	Foot Slope

Aspect Key

Abbreviation	Explanation
N	North
NE	North East
E	East
SE	South East
S	South
SW	South West
W	West
NW	North West

11.12 Appendix 11.12: Land Capability Class Determinations per Soil Profile.

Description of Profiles	**Number of Profiles**	**Land Capability Class**	**Observations**
Total	35		
Arable	1	LCCIII : Agricultural Theme Sensitivity: 6 to 7	The only profile that reflected arable land. This has probably been brought about by a depression that filled with waterborne or windborne soil particles and organic matter. Twenty to thirty meters away the pattern of shallow soils resumed itself
Non arable	34	LCCVII: Agricultural Theme Sensitivity: 1 to 2	Reference material perused during the desktop study strongly suggested this outcome. However available desktop data is usually on such a coarse scale that onsite verification is required

11.13 Appendix 11.13: Land Capability Classes: Soil Profiles: Proposed Link Road

Ref	Co-ordinates	Soil Form	Slope %	Clay %	Depth (mm)	Permea-bility	Wet-ness	LCC	Aspect/ Terrain unit
CL 36	31˚40’25.3”S 18˚41’53.6”E	Mispah	0-2	20-30	50	1	W0	VII	Crest
CL 37	31˚40’31.0”S 18˚41’22.9”E	Mispah	0-2	20-30	50	1	W0	VII	Crest
CL 38	31˚40’37.2”S 18˚40’51.7”E	Mispah	0-2	20-30	50	1	W0	VII	Crest
CL 39	31˚40’49.3”S 18˚40’15.2”E	Mispah	0-2	20-3O	50	1	W0	VII	Crest
CL 40	31˚41’08.4”S 18˚39’49.4”E	Mispah	0-2	20-30	150	1	W0	VII	
CL 41	31˚41’14.4”S 18˚39’30.0”E	Mispah	3-6	20-30	100	1	W0	VII	
CL 42	31˚41’14.7”S 18˚39’06.4”E	Mispah		20-30	50	1	W0	VII	
CL 43	31˚41’08.2”S 18˚38’41.5”E	Mispah	0-2	20-30	200	1	W0	VII	VB
CL 44	31˚41’18.3”S 18˚38.30.8”E	Mispah	0-2	20-30	150	1	W0	VII	N FS
CL 45	31˚41’27.6”S 18˚38’20.9”E	Mispah	3-5	20-30	100	1	W0	VII	NW LS
CL 46	31˚41’32.0”S 18˚38’06.5”E	Mispah	3-5	20-30	50	1	W0	VII	NW LS
CL 47	31˚41’31.4”S 18˚37’44.7”E	Mispah	3-5	20-30	50	1	W0	VII	N LS

CL 48	31˚41’28.0”S 18˚37’19.2”E	Mispah	3-5	20-30	100	1	W0	VII	N LS

11.14 Appendix 11.14: Picture Gallery

Mispah Soil Profile

Amongst the diagnostic features of the Mispah Soil Form is shallow topsoil over layered shale over solid rock or shallow topsoil directly over solid rock

These features are both clearly illustrated in the photograph below taken at an exploratory pit at the proposed Maskam mining site

Typical Soil Surface, Proposed Maskam Mining Site

The photograph below illustrates a typical soil surface in the proposed mining area and along the proposed new link road

Arid rangeland is characterized by shallow soils and sparse soil cover and tough, hardy plants. Mole runs play an important role in assisting permeability of rainwater and maintaining O2 levels in the soil

Termite activity is important for the storage of plant seeds underground that cane released at later dates, especially in areas that have a short flowering and seeding season

Terrain and Topography

Another diagnostic feature of the Mispah Soil Family is a high erosion hazard, especially in the Soil Systems that comprise of light topsoils.

The photograph below illustrates that most of the Maskam Mining Area occurs within level or gently sloping soils, thus minimising the risk of erosion through stormwater runoff.

The grey shrubs are gannabossies, the diagnostic species for the VanRhynsdorpgannabosveld.

One of the drive through reconnaissance diagnostics of shallow soils is the absence of antbear, porcupine and meerkat burrows

Woody vegetation in the form of large shrubs or trees is often absent or only widely scattered in arid rangeland areas.

The small trees in the background are the *Prosopis* species, an alien invader from northern Mexico and the Southwest USA, which in parts of southern Botswana and the Northern Cape has become seriously aggressive.

Although the pods have a high livestock nutrient content, the cost of collection exceeds that of equivalent maize based products.

The Vredendal Processing Site

The lime bearing calcitic and dolomitic rock that will be extracted from the proposed Maskam mining site and delivered along the existing and proposed link road will be processed in two proposed kilns at the Vredendal processing plant depicted in the photograph below.

As the kilns will be located in the centre and foreground of the photograph below it is self evident that this is already fully transformed industrial land and therefore falls outside of the ambit of an agricultural impact assessment.

In conclusion it might be noted that the entire proposed new operation will create between 55 and 60 new employment opportunities, thus providing food security for the corresponding number of families in the form of permanent employment. At a mean of 5 individuals per family, this represents between 275 and 300 people, a very real benefit derived from vacant land that currently employs no one and does not carry even one unit of small livestock.

End of Report