DRAFT EIA REPORT FOR THE CLEARING OF VEGETATION ON PTN 18 (PTN OF PTN 15) OF THE FARM UITDRAAI NO.33 & ERF 1, PRIESKA

PREPARED FOR

UITDRAAI BOERDERY (PTY) LTD

JULY 2021

Reference: NC/EIA/03/PIX/SIY/PRI1/2021

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BACKGROUND

Digital Soils Africa (Pty) LTD (DSA) was tasked by Uitdraai Boerdery (Pty) Ltd to conduct environmental investigations and complete the Environmental Authorisation Application for the authorisation of clearing 163.82Ha of vegetation on Portion 18 (Ptn of Ptn 15) of the Farm Uitdraai No. 33, Prieska in the Northern Cape.

In terms of the National Environmental Management Act 107 of 1998 ("NEMA"), environmental authorisation must be obtained before any person can conduct activities that cause damage to the environment.

DSA was appointed by Uitdraai Boerdery (Pty) Ltd as the independent environmental assessment practitioner (EAP) to undertake the Environmental Authorisation Application for the commencement of a listed activity in terms of the Environmental Impact Assessment Regulations 2014, as amended in 2017.

Uitdraai Boerdery (Pty) Ltd would like to clear vegetation to establish a vineyard. Currently the site host intact vegetation with some evidence of overgrazing. Soil samples were taken and analysed to investigate if the soil is suitable for establishing a vineyard on a 174Ha area. The soil study indicated that about 145Ha were suitable for the cultivation of vineyards according to the norms and standards provided by the Northern Cape Department of Agriculture. Drainage is of most importance and would require deep ripping of the soft and hard carbonate. Since the 'pockets' of soil areas that are not suitable for cultivation are situated in between the suitable soils, it is recommended that additional soil upgrading as recommended in the soil report be implemented. Conditions of the soil report and comments from the Department of Agriculture were considered, and it was decided to exclude the area located on Erf 1. This area will therefore not be cleared from vegetation, but rather be used as a nursery for plants that will be transplanted from the areas to be cleared.

Also, from an environmental point of view, since the unsuitable soils for vineyard are located in between the suitable soils, it would be futile to exclude the unsuitable areas from the application area as a whole and to preserve it for conservation purposes since the isolation of the 'pockets' of areas will not serve any ecological connectivity. It is therefore proposed that the area situated on Farm Uitdraai No. 33 be regarded as the area to be cleared from vegetation. In total it amounts to about 111.22Ha.

A plow certificate was also be applied for at the Department of Agriculture to ensure all legal requirements for such a development are met. The ploughing certificate has not been issued yet and is still in process.

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The owner of the property (Uitdraai Boerdery (Pty) Ltd and the PA le Roux Trust) have existing water use rights for the property and therefore do not require additional applications for a Water Use Right. In the future, they might apply for an increase in usage, however, at this stage, it is not required.

A vegetation survey was completed by Dr. van Aardt and according to the vegetation report, the study site is not regarded as a site of ecological importance when studying the vegetation nor does the site have any high conservation value.

The proposed study area does not fall within any National Protected area, nor is close to any formal or informal protected area. The site does not fall within any of the focus areas of the Northern Cape Protected Area Expansion Strategy. According to the Northern Cape Biodiversity Conservation Plan, the site falls within both a Terrestrial CBA 1 area.

According to the Spatial Development Framework the R357 has been identified as a Tourism Corridor, which is considered a scenic route linking places attracting tourists with one another and therefore the Municipality supports the notion of focussing capital investments to favour the nodes where development will more likely be sustained in the future. Since the site is situated along the R357 and the establishment of a vineyard is proposed, it could very well fit in with the tourism corridor ideology of the Municipality from a scenic point of view.

From an environmental point of view, the Siyathemba Municipality has mapped the environmental sensitivity of the municipal area in the SDF. Unfortunately, the ecological sensitivity map of the SDF is a bit unclear, but it does seem to appear that the site falls within an environmental area that is rated as a low sensitivity.

Considering all the maps available and data presented, it must be concluded that the NPAES, the Northern Cape PAES, and the Siyathembe SDF all indicate that the proposed site does not fall within any biodiversity-sensitive area. On the other hand, the Northern Cape Biodiversity Conservation Plan (NCBCP) indicates that the site falls within a CBA 1 terrestrial area.

It is therefore very important that the classification is verified by onsite inspection to either confirm or reject the ecological sensitivity of the site. Onsite investigations confirmed that the study site is not regarded as a site of ecological importance when studying the vegetation nor does the site have any high conservation value, thus the SDF rating is applicable and the CBA 1 status of the NCBCP could not be fully aligned with onsite conditions.

PERSONAL PARTICULARS OF APPLICANT

Uitdraai Boerdery (Pty) Ltd (2020/618672/07)
P. O. Box 250
Prieska
8940
Tel: 053 004 0104
Cellphone: 073 754 5924
Email: davidlerouxmuller@gmail.com

LANDOWNER

The property is owned as a 50-50% ownership between:

Uitdraai Boerdery (Pty) Ltd (2020/618672/07)
Mr. David le Roux Muller
P. O. Box 250
Prieska
8940
Tel: 053 004 0104
Cellphone: 073 754 5924
Email: davidlerouxmuller@gmail.com

AND

PA Le Roux Trust (T196/1987)
Mr. A.O. Muller
Kusweg 166
Kleinmond
7195
Cellphone: 082 804 3598
Email: orffermuller@gmail.com

Responsible person:
Mr. David le Roux Muller from Uittdraai Boerdery (Pty) Ltd will be the responsible person for this application.

ENVIRONMENTAL CONSULTANT

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Attention: Natalie Sharp

DETAILS OF THE AUTHOR

Natalie Sharp is the project manager and senior Environmental Assessment Practitioner leading this project and is registered as an Environmental Assessment Practitioner (EAP) with the Certification Board for Environmental Assessment Practitioners of South Africa (EAPSA) (Registration Number: 2020/230) and as a Professional Natural Scientist (Pri.Sci.Nat) with the South African Council for Natural Scientific Professions (SACNASP) (Registration Number: 123443) (see Appendix A). Natalie Sharp has worked in the environmental industry for over seventeen years.

CURRICULUM VITAE

NATALIA SHARP

Personal Details	Date of birth: 12 August 1979 Nationality: South African Identity number: 790812 000 7080 Gender: Female Languages: English / Afrikaans
Qualifications:	BSc (2000) UFS – Zoology and Botany BSc Honors (2001) UFS - Limnology Masters in Environmental Management (2003) UFS - Evaluation of Phytoplankton as an indicator in a biomonitoring program, with special reference to the Modder River.

Experience (Seventeen years' experience in environmental law and environmental management)	During the 2 years associated with the Centre for Environmental Management intense training was provided for equipping Natalia Sharp with adequate knowledge in terms of biomonitoring water systems and scientific report writing for research done by her through the Centre. Various scientific contributions were made during these few years which included formal reports to Bloem Water and seminars providing management principles for polluted water bodies, thus providing her with additional regulatory and environmental skills. During the 5 years associated with the DME, now changed to the Department of Mineral Resources (DMR), vast knowledge was gained in terms mine environmental management, the development, rehabilitation and closure of mining and prospecting areas. Environmental Management Programmes, Environmental Performance Assessment Reports, and Closure Reports were scrutinized continually. Therefore, adequate expertise was gained to assist the applicants with relevant environmental and mining advice and providing her with adequate knowledge to evaluate environmental impacts relating to mining. During the 11 years associated with SES (Stellenryck Environmental Solutions), Natalia Sharp has obtained immense understanding in completing environmental impact assessments, not only associated with mining projects, but also for a wide variety of different developing projects such as Light Industrial developments, Road upgrade projects, bush clearing for agricultural developments, and applications for exemptions, and so forth. She has excellent experience in writing environmental reports, which ranges from Scoping Reports, Environmental Management Plans, Environmental Awareness Plans, Mining Work Programs, Closure Plans, Risk Assessments, Performance Evaluations on projects, and Plan of Study reports. She has also been involved in performing biomonitoring on river systems associated with some of the projects, completing it by obtaining all the data and writing the Biomonitoring Report for the relevant Department. This is mainly attributed to her Limnology background and she is competently able to add value to this field in her current position.
Previous Employment	Centre for Environmental Management University of the Free State: Lab Assistant [2001 – 2003] Mine Environmental Management [2003-2005] at the Department of Mineral Resources: Environmental Officer Mine Environmental Management [2005-2008] at the Department of Mineral Resources: Senior Environmental Officer Stellenryck Environmental Solutions: Senior Environmental Practitioner [2008-2019]
Current Employment	Digital Soils Africa Pty Ltd: Senior Environmental Practitioner [2020-currently]

Digital Soils Africa Pty Ltd (DSA) is an independent environmental consulting firm that is also soil specialists, focussing on all soil solutions in the agricultural and environmental fields. The specialists are SACNASP registered and recognized leaders in their fields of study.

The soil specialist services provided include soil surveys, soil erosion mitigation, fertilization management, soil and land capability studies, and wetland delineation amongst others, while the fields of specialization are hydropedology and digital soil mapping. Together the directors have 58 years of experience.

Prof. Pieter le Roux boasts more than 35 years of experience as a soil scientist. He is the initiator and main driving force behind hydropedology research in South Africa, which has earned him a C2 NRF research grading. As such, he has published more than 50 peer reviewed scientific publications, but also oversaw more than 40 consultancy projects. He is SACNASP registered and recently co-produced a webinar on hydropedology.

Prof. Johan van Tol is currently the national leading researcher on hydropedology. He is a Y1 NRF rated researcher, who boasts 34 peer reviewed scientific publications and has put his research to work in more than 30 consultancy reports. He is also a SACNASP registered scientist.

Dr. George van Zijl is Africa's foremost Digital Soil Mapper. For his PhD he developed a DSM protocol for use in southern Africa, and has subsequently improved the methodology to include machine learning such as shown in the mapping of Ntabelanga catchment and City of Joburg Hydropedological mapping. He has served on the scientific committee for international DSM conferences. George has conducted more than 60 consultancy projects and is a SACNASP registered scientist.

Dr. Darren Bouwer boasts 10 years' experience as a soil scientist. His PhD incorporated chemical measurements into hydropedological assessments, which improves flow path determination. He has also completed a post doctorate at Ghent University, Belgium, where he specifically worked on hydropedological modelling. Darren is a SACNASP registered scientist and has completed more than 45 consultancy reports.

TITLE DEED DESCRIPTION

Portion 18 (Portion of Portion 15) of Farm Uitdraai No. 33 & Erf 1, Prieska, Northern Cape

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REGIONAL SETTING

SITE LOCATION

The site is situated east of Prieska in the Northern Cape (29°41'11.33"S; 22°50'85"E) on Portion 18 (Portion of Portion 15) of the Farm Uitdraai No. 33, within the Siyathemba Local Municipal area. The farm can be reached by traveling along the R357 east from Prieska for about 10km until the farm road is reached.

FIGURE 1: SITE LOCATION, ALSO SEE APPENDIX B.

LAND DESCRIPTION / INFORMATION

SURROUNDING AREAS

- The site is bordered by vineyards and pivots with crops to the north and west of the site;
- To the south, is the R357, further south is natural veld that is used for grazing;
- An Eskom line is also running through the eastern section of the site with a servitude under the line;
- To the east is a natural veld that is used for grazing;

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- To the north is farmland and the Orange River.

PROJECT DESCRIPTION

In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), an Environmental Authorisation (EA) must be obtained from the relevant competent authority before commencing with any listed activity that may impact the environment. The Applicant would like to clear more than 20Ha of vegetation to establish a vineyard for agricultural purposes.

The Applicant already has a Water Use License, for the abstraction of water for irrigation and is in the process of obtaining a plowing certificate from the Department of Agriculture, Land Reform and Rural Development.

The area under application is not regarded as a site of ecological importance when studying the vegetation nor does the site have any high conservation value. The development is situated more than 100m from any watercourse on a fairly flat, undulated landscape.

Description of listed activities associated with the project

Act. No.	Listings	Coordinates of listed activities (centre point coordinates of the listed activity location)
15	GNR 325 – Clearance of an area of 20 hectares or more indigenous vegetation.	29°41'12.06"S 22°50'50.25"E
12 g.ii.	GNR 324 – Clearance of an area of 300m^2 or more indigenous vegetation in the Northern Cape within a critically biodiversity area identified in bioregional plans.	29°41'12.06"S 22°50'50.25"E

CONSTRUCTION PHASE

The clearance of vegetation will take place in phases over a 7-8 year period. About 30-40Ha block areas will be cleared once every 2 years, the soil will be prepared and the vine trees will be planted, until the entire area applied for has been cleared from vegetation and a vineyard established.

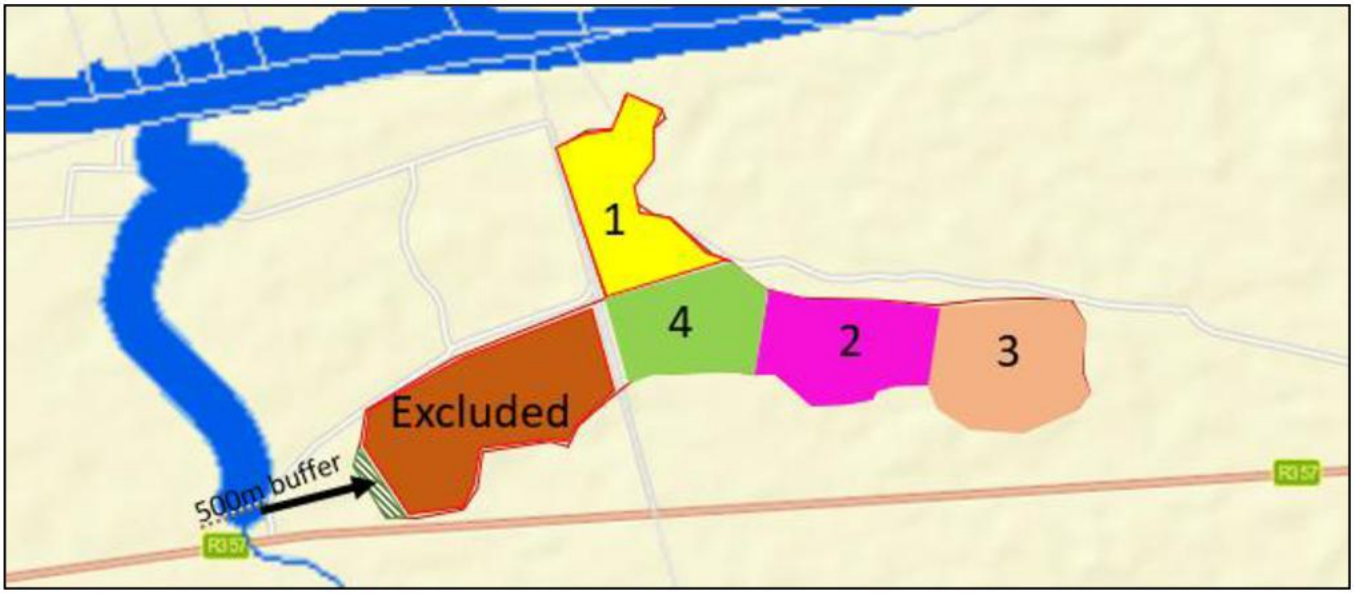

FIGURE 2: PHASE DEVELOPMENT OF THE VINEYARD. THE AREA ON ERF 1 WILL BE EXCLUDED FROM THE CLEARING OF VEGETATION AND THE AREA ON FARM UITDRAAI NO. 33 WILL BE DIVIDED INTO 4 PHASES.

Clearing of vegetation will commence in Phase 1 which is about 25Ha (see Figure 2), after which clearance will continue in Phase 2 which is about 32Ha, Phase 3 which is about 32 Ha, and Phase 4 which is about 23Ha. Each phase will be developed over 1-2 years. This total an area of about 111.22Ha of vegetation clearing.

Although the soil study indicated that the soil on Erf 1 could be cultivated considering the depth of topsoil, the Department of Agriculture indicated during the public participation that the soil on Erf 1 should be excluded from the application, due to the drainage issues foreseen. Erf 1 should rather be used as a natural nursery for the transplant of species that can be transplanted, as part of an environmental offset plan.

The soil report further indicated that the majority of the soil in Phases 1-3 is suitable for vine crop production, whereas in Phase 4 the mix of suitable and unsuitable soil is about a 50% ratio. Thus the reason for the 'haphazard' development and developing Phase 4 last.

After 8-10 years after the commencement of the project, Phases 1-4 should be cleared and the vineyard should be established. It will be managed and maintained by the farmer and will be a permanent establishment.

As with the construction phase, the workforce (upkeep of the vineyard and harvesting) will be sourced locally.

DECOMMISSIONING PHASE

This is a permanent change from grazing to crop production. Should the activity be authorized, it is highly unlikely that the proposed development will ever or at least within the next 20 years be decommissioned, and therefore a decommissioning Phase for the EMP is not included in the management plan.

However, should the Applicant elect to decommission the vineyard at any point in the future, the necessary authorization must be obtained and the correct decommissioning protocol must be followed. The relevant State Departments (those applicable at the time of decommissioning) should be consulted before decommissioning.

Following the decommissioning, the site should be rehabilitated back to a predetermined state, e.g. sufficient for grazing or near-natural state. A qualified botanical specialist should be contacted for more information on rehabilitation techniques.

LEGISLATION, POLICIES AND/OR GUIDELINES

Title of legislation, policy and/or guideline:	Administering authority:	Compliance
National Environmental Management Act (Act No 107 of 1998).	Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape	Application for GNR 325 (15) and GNR 324 (12) g.ii. was made and a Scoping Report, EIA and EMP was supplied to ensure management of such development and was subjected to Public Participation.

Environmental Impact Assessment Regulations: 324, 325, 326 & 327	Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape	Application for GNR 325 (15) and GNR 324 (12) g.ii. was made.
Northern Cape Nature Conservation (Act 09 of 2009)	Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape	A Soil, Flora and Heritage specialist study was completed, Scoping and EIA & EMP to ensure sustainability is improved in terms of balancing natural resource usage and protection or conservation thereof.
National Water Act (No. 36 of 1998).	DWS Kimberley	The Applicant has an existing water use right, DWS was however consulted during the public participation process.
National Environmental Management: Biodiversity Act	DEA	Application for GNR 324 (12) g.ii. was made and a Scoping Report, EIA and EMP were supplied to ensure management of such development and was subjected to Public Participation.
National Environmental Management: Protected Areas Act	DEA	A Flora study was completed to establish if any protected areas apply to this application.
National Environmental Management Waste Act, 2008 (Act 59 of 2008)	DEA and Provinces	Waste management was discussed in the EMP.
Conservation of Agricultural Resources Act (Act 43 of 1983):	Department of Agriculture, Environmental Affairs, Rural Development and	Application for a ploughing certificate was submitted to the Agriculture department

	Land Reform in the Northern Cape	(Mr. H. Roux) from the Northern Cape office.
The Provincial Spatial Development Framework for the Northern Cape	Office of the Premier of the Northern Cape	Application for GNR 325 (15) and GNR 324 (12) g.ii. was made and a Scoping Report, EIA, and EMP were supplied to ensure management of such development and was subjected to Public Participation.
National Heritage Resources Act (No 25 of 1999):	SAHRA	SAHRA was consulted and a Heritage Assessment Study was completed.
Alien and Invasive Species Regulations, 1 August 2014	DEA	A Flora study was completed to establish if any alien or invasive species occurred at the site. The EMP provides alien control mitigation measures.
List of Protected Tree Species under the National Forest Act, 1998 (Act No. 84 of 1998)	Department of Environment, Forestry and Fisheries	A Flora study was completed to establish if there are any protected tree species on site.
National Road Traffic Act, 1996 (Act 93 of 1996)	South African National Road Agency Limited	The Northern Cape Department of Roads and Transport was consulted during the Public Participation Phase.
Occupational Health & Safety Act, 1993 (Act No. 85 of 1993)	Department of Labour	Health and safety protocols for workers were prescribed in the EMP.

See Appendix D (EMP) for a full discussion on applicable Legislation

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ALTERNATIVES INVESTIGATED FOR THE PROPOSED DEVELOPMENT & MOTIVATION FOR THE PREFERED DEVELOPMENT FOOTPRINT

Alternative sites/land use/layout are chosen based on the outcome of the site investigation and proposed activities, which determine the social and environmental impacts. In the process, each environmental parameter and the possible impact of bush clearing is considered and investigated to determine any alternative location/land use/layout or method that could reduce the environmental and social impact and improve the sustainability of the project.

The investigation has led to no alternative sites being chosen for this particular project since no alternative land is available that belongs to the Applicant, which has water use rights for this portion of land.

In terms of alternative site layout, initially, 160ha was presented as a potential development area within the 32m area of drainage lines. However, the soil report indicated that a vineyard can be established on at least 145Ha of the site, however, the soil conditions are not viable for Erf 1 to establish a vineyard. Also, to protect the drainage lines it was requested to include buffer zones of 100m from the drainage lines. This reduced the area for development to 111.22Ha.

Therefore as an alternative site development layout, it is highly recommended (and the preferred site layout option), to **exclude Erf 1** from the development and use it as an offset plan to transplant vegetation that could be rescued from Farm Uitdraai no. 33.

Also, the vegetation report indicated that the site is not listed as an endangered or protected ecosystem and the area has limited connection to other environments with natural conditions that represent the Northern Upper Karoo. The risk of soil degradation on Erf 1 is too high and not recommended for the proposed development.

In terms of alternative land uses, instead of agriculture will not be considered, since it involves an application for change of land use and the landowner does not wish to change the land use of the property.

In light of this, it is recommended that 111.22Ha of this site be developed into a vineyard, with the benefit of socio-economic improvement and job creation opportunities, while remaining an agricultural unit and reducing the risk of soil degradation. Developing this site into a vineyard will be the best viable land-use option for the applicant who is also the landowner.

Therefore, it was concluded that the area recommended in the soil report applies to this application and there is no viable alternative site layout option other than the one proposed.

The full process in reaching these conclusions has been described in the Plan of Study to follow under the heading 'A Description of the Alternatives to be Considered' and will therefore not be repeated here.

In terms of the 'no-go' option; if the site is not developed there will be no change (good or bad) to the status of the site; it will remain as-is: an area that is not an endangered or protected ecosystem, with limited connection to other environments, but with natural conditions that represent the Northern Upper Karoo that is used for grazing. To the north, west and south are transformed land, to the east are natural veld.

From an economic and agricultural point of view, it is better to develop the area and improve the agricultural potential of the land. Therefore, no alternative site, no alternative land use, and the 'no-go' option will not be considered or evaluated. The alternative site layout is however applicable.

The EIA will assess the impacts of the 111.22Ha area only.

NEED AND DESIRABILITY OF THE PROJECT

The purpose of this Environmental Authorisation Application is for the Applicant to obtain permission from the Department to clear 111.22Ha (although 163.82Ha have been applied for) of vegetation to establish a vineyard for the production of dried vine fruit, i.e. raisin production.

In 2009, South Africa ranked 31st on the international gross domestic product (GDP) list, making South Africa the top producing country from the African continent (Quinn *et al*. 2011) and the agricultural sector is responsible for 8% of South Africa's total exports. According to Quinn *et al* (2011), the wine and fruit export consistently dominate as the major export products for South Africa.

According to Gale, 2020 the South African raisin industry is poised for a significant expansion in the next few years and this application will be in line with this projection. In 2019 the raisin production was a record 74 830 tonnes from a total planted area of 13 085Ha across the Northern and Western Capes. For 2020 the production is expected the have a second consecutive year of high production and South Africa ranks currently as the world's fifth-largest raisins producer (Gale, J. 2020).

The annual raisin production is around 70 000 dried tonnes and there are about 1 000 growers in total. A 2019 vine census showed that seedless sultanas account for an estimated 34% of total cultivars. Merbein seedless raisins are at 41%; Selma Pete 9% (which is known for being the most resistant to rainfall); Sugra 39 and currents at 4% each; and Flame seedless 3%. About 85% of all production is exported. In percentage

terms, the UK accounts for 7% of total export while the EU collectively imports 49%. Canada and the USA imports 12%, Russia 12%, Africa 9%, the Middle East 2% and the Far East 2%.

South Africa's strategy is based on the long-term sustainability of the South African raisin industry. Raisins can only be produced under certain climatic conditions and the Northern Cape benefits from plenty of sunlight and very warm weather which means that a premium quality raisin can be produced with minimal to zero traces of chemical residues. Raisins are known for being excellent quality products and the production of fresh grapes average 30-35t/Ha on new varieties, which reduces to 20-25t/Ha on old varieties.

In terms of the socio-economic benefit, it is no secret that South Africa has one of the world's highest unemployment rate, with the IDP of the Siyathemba Municipality indicating that in 2009 the unemployment rate was about 34.7%, which has steadily increased over the past decade. A small portion of workers (10.3%) can be classified as highly skilled, but more than 52% of workers can be regarded as semi- or unskilled workers.

Therefore, the raisin industry plays a key role to generate economic activity, create jobs, earn foreign currency and stimulate rural economies in general. According to Raisins SA, the production of raisins will:

- Produce a total GDP in the region of R 4.1 billion at constant 2019 prices;
- Resulting in total Capital utilisation of R5.1 billion;
- Sustain 30 110 job opportunities, of which just over 16 079 will be for unskilled workers; thereby significantly contributing to South Africa's job creation and poverty alleviation goals for unskilled workers;
- Generate just over R2 791 million in additional household income, of which over R 611 million will accrue to low-income households; thereby significantly contributing to poverty alleviation and;
- Generate additional Government Revenue of just over R1 122 million.

TABLE 1: EMERGING FARMERS ECONOMIC CONTRIBUTION TO THE GDP AND EMPLOYMENT IN THE RAISIN INDUSTRY (SOURCE RAISINS SA)

	Emerging Farmers	Total Industry	Percentage of Emerging Farmers
Impact on Gross Domestic Product (GDP) [R million]	456	3630	13%
Impact on employment [number of job opportunities]	4172	28392	15%

It is thus clear that a raisin production, as proposed by the Applicant, will contribute to economic growth within the Siyathemba Municipal area. This development will not only benefit the Applicant but will also create job opportunities for many low-income households that will assist in poverty alleviation.

NO DEVELOPMENT OF THE SITE

In terms of the 'no-go' option; if the site is not developed there will be no change (good or bad) to the status of the site; it will remain as-is: an area that is not an endangered or protected ecosystem, with limited connection to other environments, but with natural conditions that represent the Northern Upper Karoo that is used for grazing. To the north, west and south are transformed land, to the east are natural veld.

The development of the site into a vineyard will have a permanent impact on grazing capacity but will increase the yield production of the land and increase capital revenue for the farm, thus minor losses will occur in terms of loss of grazing capacity. Such losses will be offset against crop production and will increase job opportunities and the capital value of the property.

From an economical point of view, it would be preferable to transform the area into a vineyard.

Therefore, the 'no-go' option for this portion of land as an alternative is not recommended, since the site can be optimally utilized in an economic and environmentally sustainable manner, which in turn would generate jobs whilst it would result in optimal land use.

THE FOOTPRINT OF THE PROPOSED DEVELOPMENT WITHIN THE APPROVED SITE

ALTERNATIVE FOOTPRINT CONSIDERED

FIGURE 3: PLAN 1 IS THE ORIGINAL FOOTPRINT AND SITE LAYOUT BEFORE INVESTIGATIONS, WHILE PLAN 2 IS THE PREFERED SITE LAYOUT AND FOOTPRINT PROPOSAL AFTER INVESTIGATIONS

Initially, the entire site was considered for clearing vegetation and establishing a vineyard. The initial development would have been developed in 5 phases, of which Phase 3 would have been the development of Erf 1.

However, specialist studies conducted during the EIA phase, have indicated that an alternative layout plan or site development plan, should be considered to minimize the impacts on the physical, biological, and socio-economic aspects of the proposed development. It is proposed that Plan 2 (see Figure 3) be regarded as the preferred layout plan. The main reason is the potential increase to high ratings in impacts on the soil, fauna, flora, and sensitive sites if Erf 1 is included, see discussion below.

PUBLIC PARTICIPATION PROCESS

All the details of the public participation process undertaken, including copies of the supporting documents and inputs and the summary of the issues raised by Interested and affected parties can be viewed in Appendix C.

In conclusion, all stakeholders, abutting neighbours, and other authorities were directly consulted, and any potential I&AP was notified via a local newspaper advertisement in the Noordwester/Oewernuus/Messager and a notice board that was placed at the site entrance along the R357. During the public participation of the Scoping Phase, no comment was received from any I&AP, and no person registered as a result of the public notices.

Therefore no public input was provided to establish any alternative options. Therefore no issues were raised that required incorporation in the Draft EIA. Since public participation is underway for the Draft EIA, if any comments are received it will be considered and if needed it will be incorporated in the final EIA.

ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT

Since no alternative site location or land use has been considered, the environmental attributes associated with the proposed development footprint in the alternative layout included investigations into the topography of the site, the geology & paleontology, soil (properties, erosion risk, and pollution), land use (considering the current agricultural use and the proposed agricultural use), flora, fauna, sensitive sites, water, air quality (dust and pesticides), noise, waste, visual and aesthetic acceptability, transport impact, socio-economic impact, and the heritage and archaeological impact. All of these attributes are discussed in detail further in this document. In terms of the alternative layout, the following is applicable:

In terms of the topography, the impact was rated low without mitigation and very low with mitigation for the preferred layout (111.22Ha), considering the geographical, physical, socio-economic, and heritage aspects. This impact will increase slightly if Erf 1 (about 52.6Ha) is included since the footprint will increase.

In terms of geology and paleontology, there was no impact associated with this proposed development and will remain the same if Erf 1 is included in the application. The main reason is the proposed development will not transform the geology of the site. The findings of the paleontology report included the whole study area and not just the 111.22Ha and indicated that no fossils or potential fossil exposures were observed within superficial sediments or within rarely exposed and moderately significant Mbizane Formation deposits.

In terms of the soil, three attributes were considered (soil properties, soil erosion, and soil pollution). Considering the physical, biological, and socio-economic aspects, the findings were sufficiently conclusive to propose an alternative layout for this development.

In terms of the soil properties, the impact on the preferred layout was rated moderate-high without mitigation and reduced to low-moderate with mitigation. This is mainly due to the risk of soil degradation due to the drainage of the site and the risk of salinization. This impact will increase significantly if Erf 1 is included due to the soil properties of Erf 1. The main issue with Erf 1 is the drainage and higher risk of salination of abutting crop areas on the neighboring farm, compared to the rest of the site. Developing Erf 1 can potentially cause a significant negative economic impact on the abutting farmer. Furthermore,

salination of soil could change the physical and biological content of the soil which will ultimately impact the biodiversity of the area.

In terms of soil erosion, the impact on the preferred layout was rated low-moderate without mitigation and reduced to low with mitigation but is highly dependent on soil management. This impact will increase significantly if Erf 1 is included since the drainage issues on this portion of land increase the risk of erosion, and the footprint will increase, which will also increase the risk of erosion if poor soil management is carried out.

In terms of soil pollution, the impact on the preferred layout was rated moderate-high without mitigation and reduced to low-moderate with mitigation but is highly dependent on the application and management of applying pesticides. Similar to the impacts on soil properties, this impact will increase significantly if Erf 1 is included since the footprint will increase that would require the application of pesticides, and due to the soil properties could impact the neighboring crops. Incorrect application of pesticides could physically and biological change the soil composition which will ultimately impact the health of the area.

In terms of the land use, the impact was rated moderate-high without mitigation and significantly reduced to low with mitigation for the preferred layout (111.22Ha), considering the geographical, physical, biological, socio-economic, and heritage aspects. This impact will increase if Erf 1 is included since the footprint will increase and there is a high risk that vineyard production on Erf 1 might fail due to the soil properties.

In terms of the flora, the impact was rated moderate-high without mitigation and reduced to moderate with mitigation for the preferred layout (111.22Ha), considering the geographical, physical, biological, socio-economic, and heritage aspects. This impact will increase if Erf 1 is included since the footprint will increase and there is a high risk that Erf 1 would be more difficult to rehabilitate should the vineyard fail on this portion of land.

In terms of the fauna, the impact was rated moderate-high without mitigation and reduced to low-moderate with mitigation for the preferred layout (111.22Ha), considering the geographical, physical, biological, socio-economic, and heritage aspects. This impact will increase if Erf 1 is included since the footprint will increase and there is a high risk that Erf 1 would be more difficult to rehabilitate should the vineyard fail on this portion of land, which will hinder the habitation of animal life on this portion of land.

In terms of the environmental sensitivity of the site, the impact was rated moderate-high without mitigation and reduced to moderate with mitigation for the preferred layout, as this impact is closely related to the impact on both fauna and flora. Considering the geographical, physical, biological, socio-economic, and heritage aspects, this impact will increase if Erf 1 is included since the footprint will increase.

In terms of water, the impact was rated low-moderate without mitigation and reduced to low with mitigation for the preferred layout, considering the geographical, physical, biological, and socio-economic aspects. This impact will increase if Erf 1 is included since the footprint will increase and therefore the stormwater and drainage issues will increase.

In terms of the air quality, the impact of dust and pesticides were assessed. It was found that the impact was rated moderate-low without mitigation and reduced to low with mitigation with regards to dust for the preferred layout. The impact of pesticide application on air quality was rated moderate-high without mitigation and reduced to low-moderate with mitigation for the preferred layout. This impact will increase if Erf 1 is included since the footprint will increase, increasing the area of exposure to both dust generation and pesticide application. Thus from a physical, biological, and socio-economic, the preferred option is the better choice.

In terms of the noise, the impact was rated low without mitigation and reduced to very low with mitigation for the preferred layout, considering the geographical, and socio-economic aspects. This impact will increase slightly if Erf 1 is included since the footprint will increase, but considering the abutting land uses it will not be a cause of concern.

In terms of the waste generated by this development, the impact was rated very low without or without mitigation and will be applicable for the preferred layout and whether or not Erf 1 is included or excluded. The issue regarding waste management will mainly depend on site management and it could potentially have a negative biological, and socio-economic impact on abutting farmers.

In terms of the visual impact and aesthetic acceptability, the impact was rated low-moderate without mitigation and reduced to a neutral, very low impact with mitigation. This rating will be applicable for the preferred layout and whether or not Erf 1 is included or excluded, since the development of a vineyard on 111.22Ha or the entire area will have the same aesthetic impact.

In terms of the impact on transport, the impact was rated low without mitigation and reduced to a very low with mitigation and will be applicable for the preferred layout and whether or not Erf 1 is included or excluded. The issue regarding this impact will mainly depend on the management of contract transport of the product that could potentially have a negative socio-economic impact.

In terms of the socio-economic aspect, the impact was rated positive low without mitigation and increased to positive low-moderate with mitigation for the preferred layout, considering the geographical, physical, biological, socio-economic, and heritage aspects. This positive impact will however not increase if Erf 1 is included due to the high risk of vineyard failure on Erf 1.

In terms of the heritage and archaeological aspects, the impact was rated very low without mitigation and reduced to insignificant with mitigation and will be applicable for the preferred layout and whether or not Erf 1 is included or excluded. This is because the site is capped by variable clasts of bedrock-derived gravels, surface limestones / reworked calcretes, and well-developed Quaternary sand. No fossils or potential fossil exposures were observed within superficial sediments or within rarely exposed and moderately significant Mbizane Formation deposits. There was no evidence of *in situ* Stone Age archaeological material, either as capped assemblages or distributed as surface scatters on the landscape within the boundaries of the proposed development footprint. There are also no indications of rock art (engravings), stonewalled structures or historically significant buildings older than 60 years, or aboveground evidence of graves within the boundaries of the site.

CONCLUDING STATEMENT

From the above, it is concluded that the preferred site layout is considered for the development and that Erf 1 must be excluded from the development and rather used as part of the environmental offset plan.

Therefore, only the 111.22Ha area on Farm Uitdraai No. 33 (site layout of Plan 2 Figure 3) will be regarded as the area for environmental assessment. All the impacts and risks identified including the nature of the impacts, the significance, the consequence, the extent, duration, and probability of the impacts are discussed in full detail in the section below.

ENVIRONMENTAL IMPACT ASSESSMENT

METHODOLOGY OF IMPACT ASSESSMENT

The identification and assessment of environmental impacts is a multi-faceted process, which combines quantitative and qualitative analysis and evaluation. It involves the application of scientific measurements and professional judgment to determine the significance of environmental impacts associated with the proposed project.

The assessment of impacts will be based in accordance with Section 3: Assessment of Impacts, in DEAT Guideline 5, June 2006. This identification of potential impacts should include impacts that may occur during the different phases of the operation (construction, operational, and closure phases) and assessment of the impacts should include the direct, indirect, and cumulative impact.

The process of the identification and assessment of impacts must always include the conditions of the current environment so that an environmental baseline is determined from which impacts can be identified and measured. The process must also determine future changes to the environment that will occur if the activity proceeds and the consequences (environmental/social risks as well as the positive and negative consequences).

Different approaches can be adapted to the undertaking of the assessment of impacts, but they should always be based on a methodology that includes:

- A clear process for impact identification, prediction and evaluation;
- Criteria for evaluating the significance of impacts;
- Identifying and assessing the potential impacts associated with a proposed activity and its alternatives (if any) and defining types of impacts (direct, indirect or cumulative);
- Predicting the nature, magnitude, extent and duration of potentially significant impacts;
- The design of mitigation measures to address impacts;
- Evaluating the significance of residual impacts i.e. impacts that remain after taking mitigation measures into account; and
- Specifying uncertainties.

As per the DEAT Guideline, the following methodology is to be applied to the prediction and assessment of impacts. Potential impacts should be rated in terms of direct, indirect, and cumulative:

Direct impacts – are impacts that are caused directly by the activity and generally occur at the same time and the place of the activity.

Indirect impacts – are impacts caused as a result of the activity and normally do not manifest immediately when the activity is undertaken or could occur at a different place as a result of the activity.

Cumulative impacts – these are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present, or reasonably foreseeable future activities. Cumulative impacts can include both direct and indirect impacts and can occur from the coactive impacts of individual minor actions over a period of time.

Cumulative Scoring: None, Very Low, Low, Low-Medium, Medium, Medium-High, High, Very High.

Impacts will be assessed according to the criteria listed below:

TABLE 2: IMPACT ASSESSMENT TABLE

Criteria	Description	Rating	
Spatial Extent	Whether the impact will occur on a scale limited to the immediate site of the proposed activity, local area and immediate communities and settlements, sub-regional (municipal), regional (provincial), or national scale.	None/Insignificant Site Local Sub-Regional Regional	0 1 2 3 4
Duration	Whether the period of the impact will be short term (0-5 years), medium term (5-15 years), long term (> 15 years) or permanent where natural processes or mitigation processes cannot eliminate the impacts.	None Short Term Medium Term Long Term Permanent	0 1 2 3 4
Intensity	Whether the size of the impact is low, medium, high, or negligible.	None Very Low Low Low-Medium Medium Medium-High High Very High	0 1 2 3 4 5 6 7
Probability	The probability of the impact occurring as either unlikely, probable, likely or definite.	None Unlikely Probable Likely Definite	0 1 2 3 4
Significance	The total level of impact.	Insignificant Very Low Low Low-Moderate Moderate Moderate-High High Very High	0-6 7-15 16-22 23-31 32-40 41-47 48-55 >55

These criteria are evaluated in terms of

- *Significance (Insignificant-low-moderate-high)*
- *Status (positive-negative-neutral)*
- *Confidence (based on academic information, specialist knowledge, site evaluations, applicants approach)*

To determine/calculate the level of significance, the weight of the spatial extent, the duration, and intensity ratings are added and this total is multiplied by the probability rating.

*Example: If the spatial extent is site-specific (thus = **1**), the duration of the project is permanent (thus = **4**), and the intensity of the impact is high (thus = **6**) the total is (**1+4+6**) = **11**.*
*If the probability of that impact occurring is likely (thus = **3**), then the significance of the impact is (**11 x 3**) = **33** – which will make this impact of **moderate significance**.*

The significance of the impact on the parameters of the affected environment is rated as:

Low Significance	The project will not cause any major adverse or beneficial changes to the biophysical, social, or economic environment. Impacts experienced will abate almost immediately after cessation of activities and the biophysical, social or economic system should recover and return more or less to the natural state. No expensive mitigating measures will be needed to address any of these impacts. Ecological functions will continue undisturbed and no complaints from Interested and Affected Parties (I&APs) are anticipated. No rare and endangered species or sensitive areas exist in the area.
Moderate Significance	The project will induce moderate short to medium term changes to the biophysical, social, or economic environment. The impact would be induced outside the development area and also possibly on a sub-regional level. Over the medium term the impacts could fade away but the implementation of mitigation measures is normally required to eliminate these impacts. The impacts would be experienced for some time after cessation of activities but would not affect the biophysical, social, or economic environment severely. With mitigation, the biophysical, social, or economic system should recover but the return to the natural state would be very slow and in some instances may not be achieved. I&APs might express some concerns and complaints may be received on an *ad hoc* basis. Rare and endangered species or sensitive areas may exist in the area and could be marginally affected.
High Significance	The project will induce extensive long-term changes to the biophysical, social, or economic environment. The impact would be induced outside the development area and also possibly on a regional to national level. The possibility of secondary impacts arising from the project is high. Over the long term the impacts could fade away but the implementation of expensive mitigation measures is normally required to eliminate or mitigate these impacts. These impacts would be experienced after cessation of activities

and could affect the biophysical, social, or economic environment severely. With mitigation, the biophysical, social, or economic system could recover but the return to the natural state would normally not be achieved. Ecological functions will be permanently disturbed and major complaints from Interested and Affected Parties (I&APs) could be expected. Rare and endangered species or sensitive areas existing in the area might be critically affected.

Status Whether the impact on the overall environment will be positive (environment overall will benefit from the impact), negative (environment overall will be adversely affected by the impact), or neutral (environment overall will not be affected).

Confidence The degree of confidence in predictions based on available information and specialist knowledge.

The discussion in the EIA leading up to the assessment/rating of the impact and the baseline environmental conditions are measured up to the potential impact and the quantitative and qualitative analysis are evaluated (of a specific activity resulting in an impact) during the construction, operational and closure phase. In the discussion, the impact is categorized as a direct, indirect, or cumulative impact and scientific and professional judgment is applied to rate the significance of the impact. The ratings are also influenced by the presence or absence of mitigation measures and once the discussion is concluded, the ratings are displayed in a table format.

In the table, the cumulative impact is presented as surrounding activities (not necessarily agriculture) which can add to the direct or indirect impacts experienced by receptors. Through the scoring system, the weight of the impact is determined and then the impact is categorized.

Should the impact assessment as a minimum reflect 2-3 impacts of high significance and 2-3 impacts of moderate significance, the project shall be viewed as potentially flawed and continuation of the project should be seriously reconsidered or special engineering or biophysical/social intervention must be implemented.

The definition of indigenous vegetation is defined in the NEMA Regulations as: "vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding 10 years." Considering that vegetation and soil of the area under application have not been disturbed, through ploughing or clearing for more than 10 years, the current state of the vegetation is therefore regarded as 'indigenous vegetation'. This application will also require an application with the Department of Agriculture for a ploughing certificate.

Please note that all management of impacts and proposed mitigation measures have been discussed in detail in the Environmental Management Plan (Appendix D), under the heading "Management Objectives" of this report, and will therefore not be repeated in this section of the document.

ENVIRONMENT

Field and desktop studies were completed to establish which impacts might potentially be significant/insignificant and which impacts would require a specialist study.

The environmental parameters are identified and discussed below and potential impacts are classified. A complete Environmental Management Programme (EMP) is incorporated in the EIA to ensure all possible impacts are mitigated, managed, or eliminated. As a minimum, the EMP document contains:

1. The environmental impact assessment rating,
2. Specific mitigation measures and guidelines for the development to proceed in the most environmentally sustainable manner,
3. Relevant specialist reports identified during this scoping phase,
4. Maps,
5. Interested and Affected Party comments and objections (if any), and
6. Any additional information is required by the DMR.

RECEIVING ENVIRONMENT

REGIONAL CLIMATE

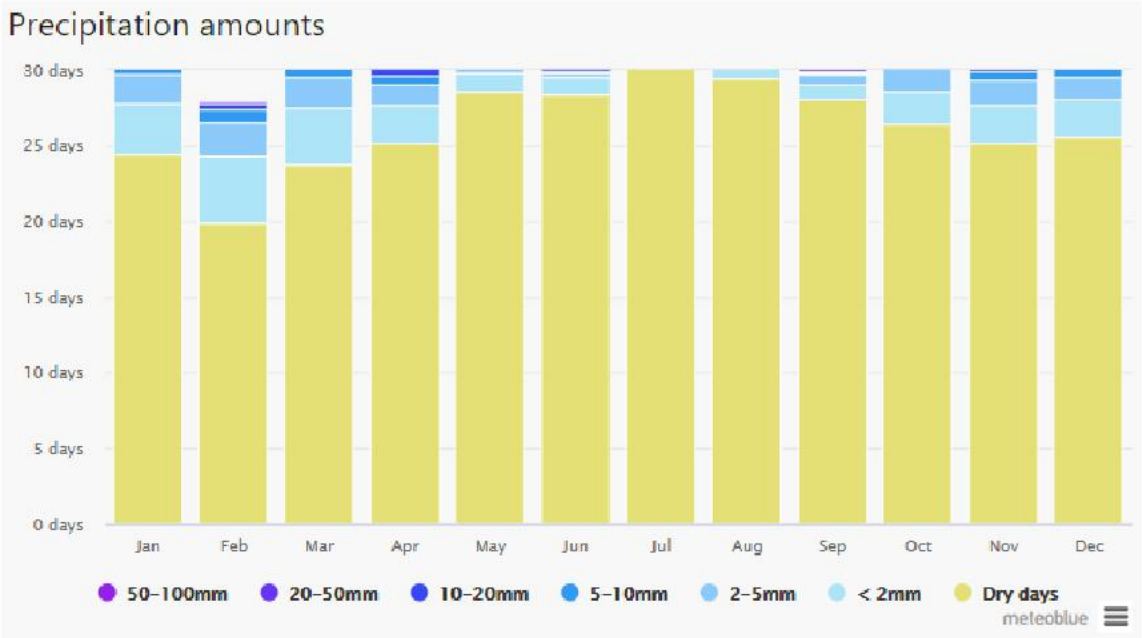
Climatic conditions such as temperature, rainfall, and wind velocity influence for example plant growth, erosion level of disturbed areas, dust generation, and air pollution levels as well as social impact in terms of quality of life. Climatic conditions can, therefore, influence the significance of impacts caused by developments. It is important to understand the role thereof when determining the impacts of specific development and the remedial measures that need to be implemented.

The study site falls within the Hot Desert Climatic (BWh) Region of South Africa, according to the Köppen Climate Classification System. Mild Desert Climate is characterised by warm to hot summers, high evaporation, and dry warm winters.

RAINFALL

The site is situated in a rainfall area that receives about 201-400mm per annum according to the AGIS Comprehensive Atlas, which is a general classification. Prieska has a summer rainfall between October to May.

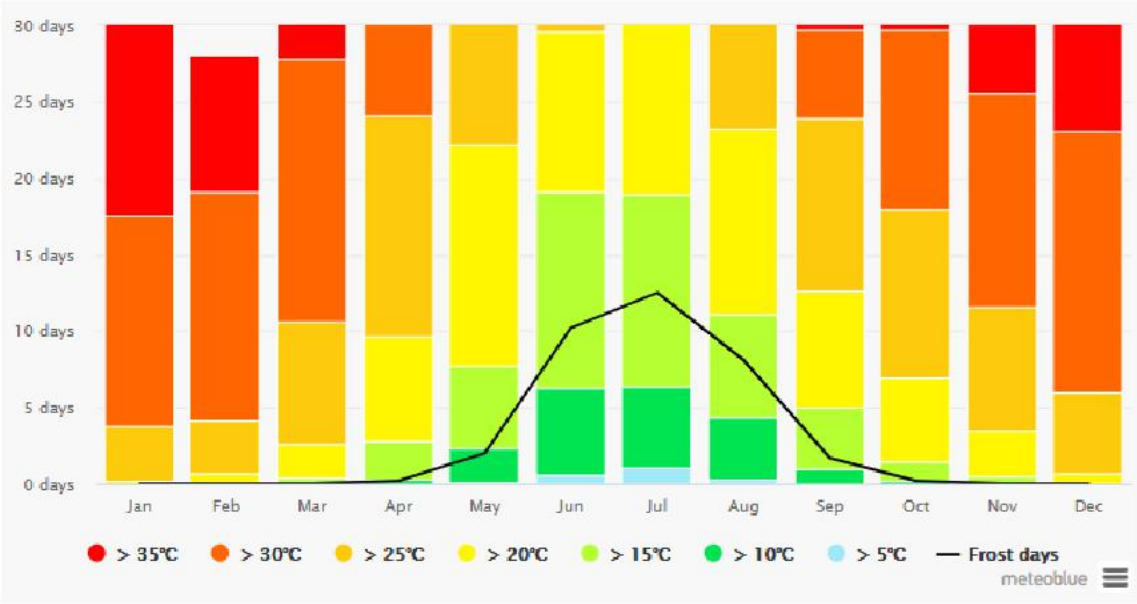
TABLE 3: PRECIPITATION AMOUNTS (SOURCE METEOBLUE)



TEMPERATURE

Daily mean maximum temperatures range between 30°C and 35°C and daily mean minimum temperatures between 0.1°C and 2°C. January is the hottest month of the year and July the coldest.

TABLE 4: AVERAGE TEMPERATURES (SOURCE METEOBLUE)



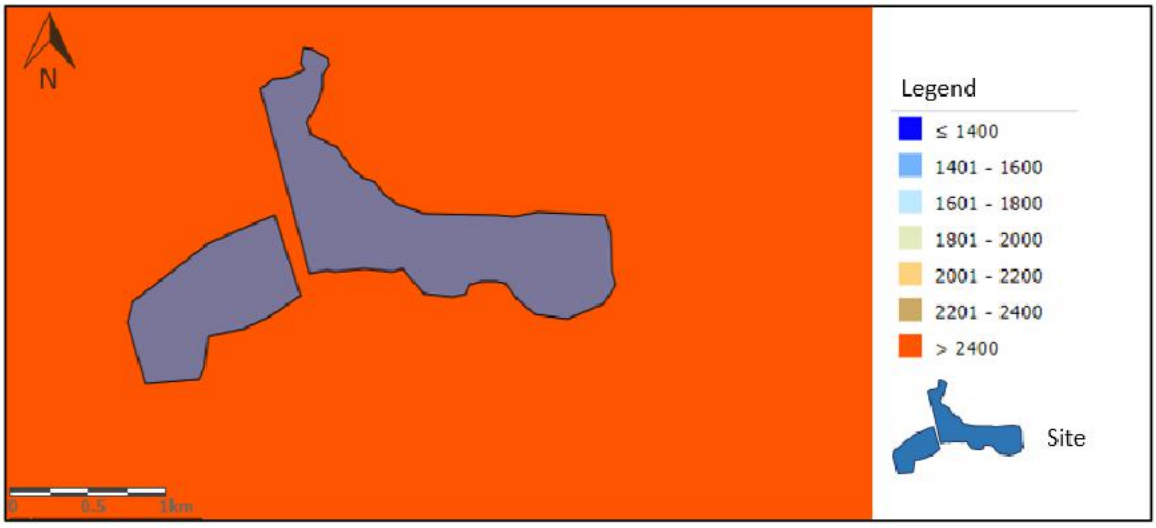


FIGURE 4: EVAPORATION EXPERIENCED ANNUALLY ACCORDING TO THE AGIS COMPREHENSIVE ATLAS

The proposed farm area falls within an area where the annual evaporation is very high, more than 2400mm.

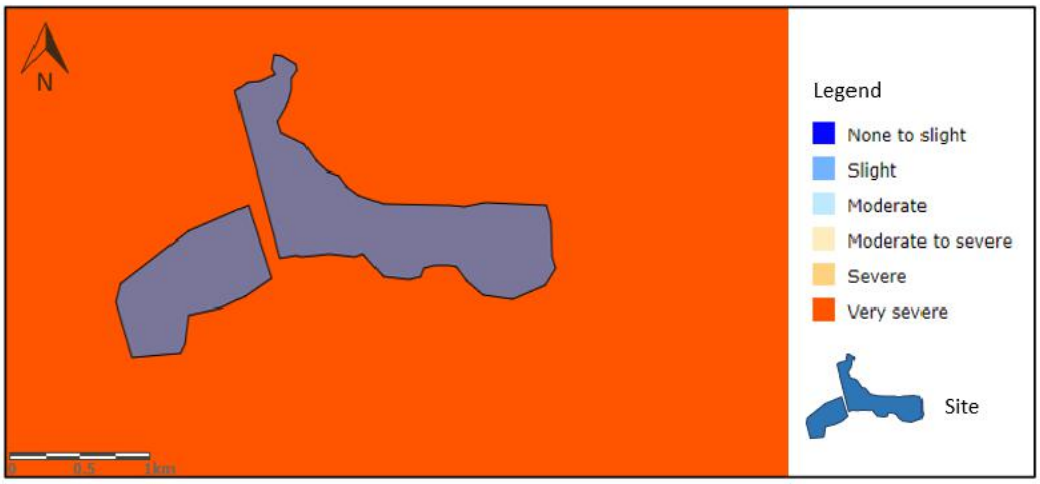


FIGURE 5: MOISTURE AVAILABILITY EXPERIENCED ANNUALLY ACCORDING TO THE AGIS COMPREHENSIVE ATLAS

The moisture availability is the ratio of actual to potential evapotranspiration. Evapotranspiration is the process by which water is transferred from the land to the atmosphere by evaporation from the soil, other surfaces (e.g. rivers, dams, wetlands, etc.), and by transpiration from plants. The moisture availability of the area is classified as being very severe. In other words, the evapotranspiration of the area is very high.

This is important for irrigation strategies. The low rainfall combined with the high evapotranspiration rates will result in a higher amount of water required for irrigation per hectare than a farm situated for example in the sub-tropics, where the rainfall is higher and the evapotranspiration is low. The Applicant must consider working out an irrigation scheduling to establish and maintain the proposed vineyard and protect the soil from degradation.

WIND REGIMES

The prevailing wind directions are predominantly westerlies and north-north-easterlies, with wind speeds, recorded highest during August to October (>38km/h but <50km/h).

There is a distinct seasonal variation between summer and winter wind direction with predominant winds in summer being westerlies (west and west-south-west) and predominant winds in winter being north-north-easterlies. Generally, wind speeds are also stronger during night-time compared to daytime conditions.

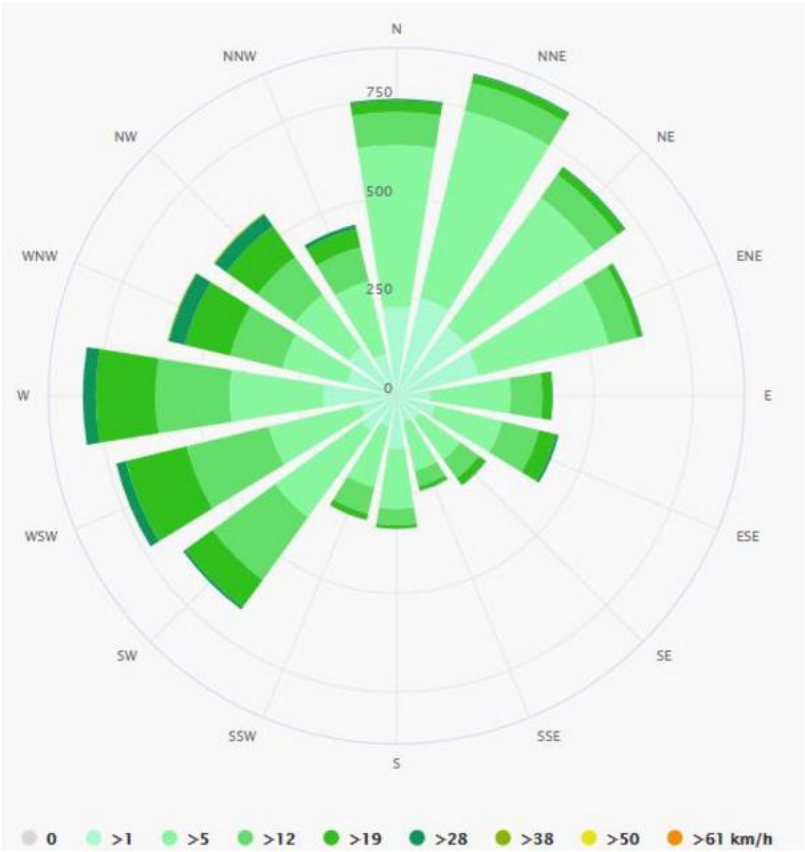


FIGURE 6: WIND ROSE OF PRIESKA AREA (SOURCE METEOBLUE)

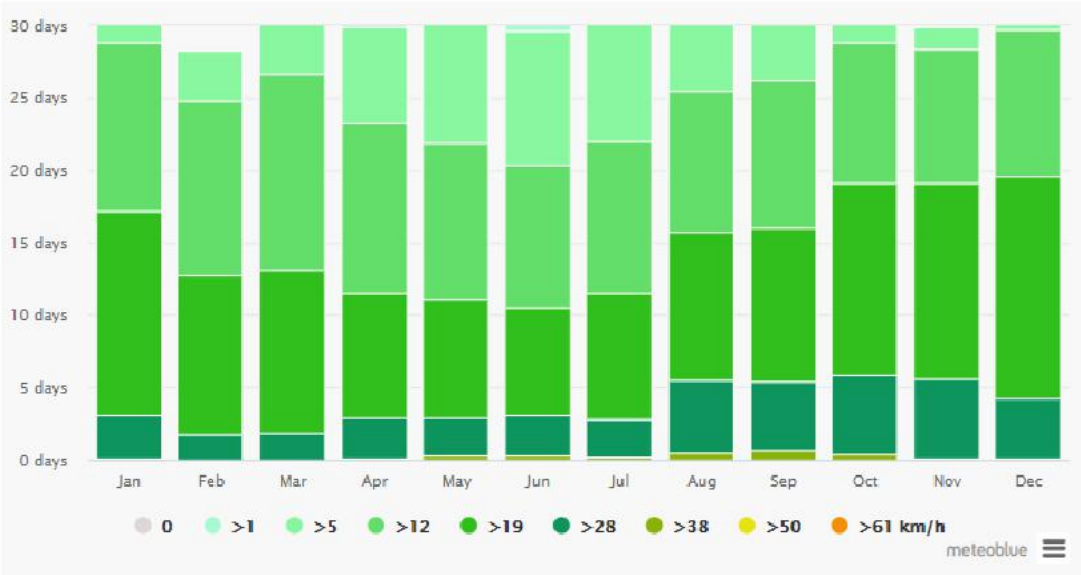


FIGURE 7: WINDSPEED OF PRIESKA AREA (SOURCE METEOBLUE)

1 Kemsley Street
Port Elizabeth
6001

TOPOGRAPHY

Morphology or the Topography of an area can be described as the form and structure of the landscape. The structure is given by the underlying geology and the form is given by erosion factors such as the rivers cutting through the geology to form valleys, or the wind eroding the tops of the mountains and filling in the valleys to form rolling hills and plains.

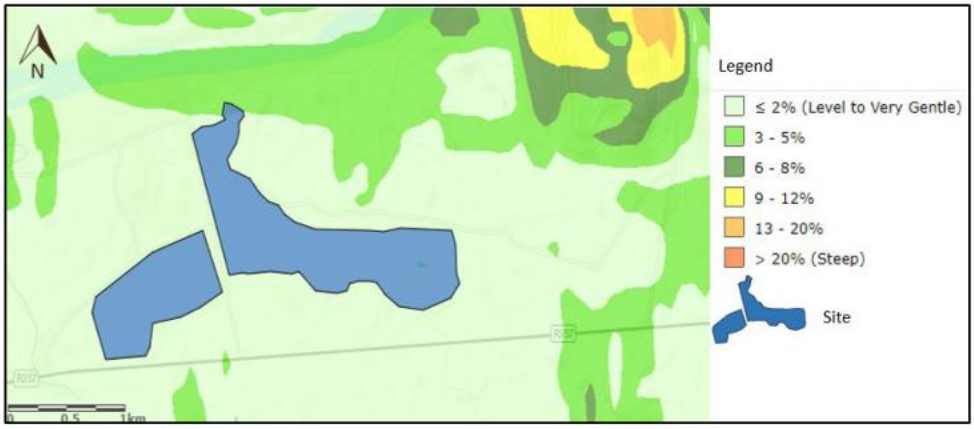


FIGURE 8: THE SLOPE PROFILE OF THE STUDY AREA ACCORDING TO AGIS

The overall site is fairly level with slopes ranging between 1.1% to 2.8%.

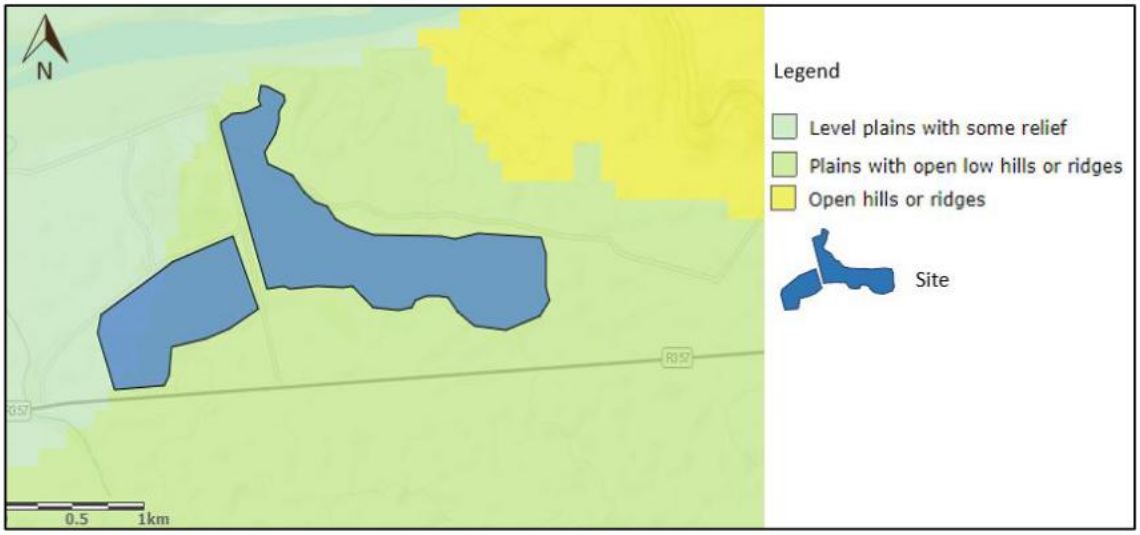


FIGURE 9: TERRAIN TYPES OF THE SITE ACCORDING TO AGIS

The majority of the site can be described as plains with open hills and ridges flatting out more towards the west that can be described as level plains with some relief.

More site-specific, there are five different vegetation units on the proposed site, each with a micro-topography. Unit 1 (Karroid component) is relatively flat with a slight slope of 2.8% from east to west and is about 6.8Ha in size. Unit 2, (Karroid with scattered grass component) is relatively flat with a slight north-western slope of 4.48% and is about 52.6Ha in size. Unit 3 (Karroid grassland) is flat with a slight eastern slope of 1.4% and is about 42.7Ha in size. Unit 4, (Karroid rocky component) is flat with a slight western slope of 1.8% and is about 101Ha in size. The drainage line, or Unit 5 that is excluded from the application, but has a slight north-western slope of 1.1% and is about 11ha in size.

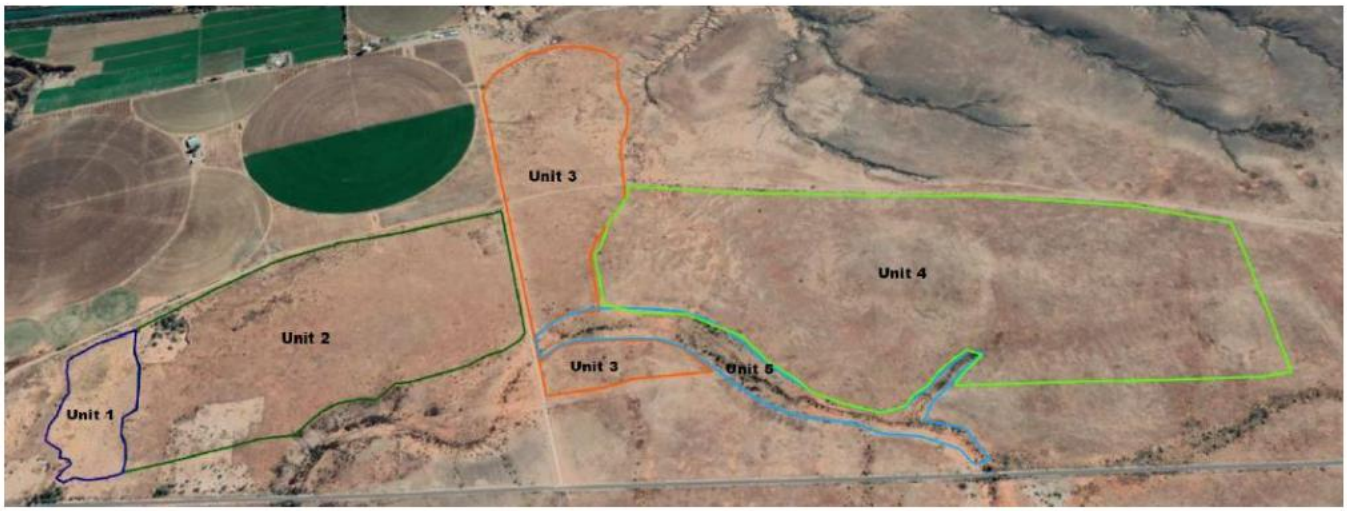


FIGURE 10: UNITS WITH DIFFERENT MICRO-TOPOGRAPHY AREAS ON THE SITE

Direct Impacts on the topography

Construction Phase:

During the construction phase, clearance of vegetation and ploughing of topsoil in Phase 1 (see Figure 2) will not lead to the transformation of the topography of the site. On the property, there are existing farm roads that will be used to gain access to the phases, therefore there will not be a need to construct additional roads. Since the clearing of vegetation and ploughing of topsoil will not impact the height and form of the landscape, and since no cuttings will be necessary on the access roads, the impact on the topography during the construction phase is rated insignificant.

Operational Phase:

During the operational phase, the vineyard will be established, which will elevate the perceived topography of the site, due to the height of the vine trees. The limited height increase in the landscape will be absorbed as a scenic attraction since generally, the establishment of a vineyard fits in well with the tourism ideology. The impact on the topography during the operational phase is rated very low.

In addition, no permanent infrastructure within the site is anticipated during the construction or operational phase. There might be the positioning of fences, possible chemical toilet (especially during harvest seasons), beacons and/or farming signs, but will have a limited impact. This interference will be similar to the impacts that farm residences and associated infrastructure pose in the landscape.

Indirect Impacts on the topography

There is no indirect impact related to the topography envisaged for this development.

Cumulative Impacts on the topography

There are no other activities in the surrounding area such as, e.g. quarries, township development, or wind turbine farms that will add to the cumulative impact on the topography of the area. There are neighbouring farms with established crops and in terms of the cumulative impact, the proposed activity will increase the crop appearance of the area, but will remain low as it will fit in with the surrounding area.

Impact on the topography

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Site Specific	1	Site Specific	1	Site Specific	1	Site Specific	1
Duration	Short Term	1	Short Term	1	Permanent	4	Permanent	4
Intensity	Low	2	Very Low	1	Low	2	Very Low	1
Probability	Likely	3	Probable	2	Likely	3	Probable	2
Cumulative Impact	Very Low		Very Low		Low		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Very Low**	**12**	**Insignificant**	**6**	**Low**	**21**	**Very Low**	**12**
Extent to which impacts can be reversed	Negative impacts can be mitigated through the proper establishment of vineyards and managing the topsoil.							

GEOLOGY & PALAEONTOLOGY

Geology

During an interval of some 150 million years, from Late Carboniferous through to Early Jurassic times, deposition of a very thick succession of Karoo Supergroup sediments took place within several intra-continental basins in the Northern Cape. The most extensive of these was the Main Karoo Basin. This basin now occupies the southern half of the province and in ancient Karoo times, it was situated within the interior of the Supercontinent Pangaea. The proposed site falls within the earliest Karoo sediments – massive glacial tillites of the Permocarboniferous Dwyka Group – are largely unfossiliferous, although thin intervals of interglacial and post-glacial mudrocks yield sparse fossils of marine invertebrates and fish (e.g. near Douglas) as well a small range of trace fossils generated by arthropods and fish. Reddish sandy and pebbly glacial outwash sediments contain plant fossils (leaves, wood, and other debris) of the Glossopteris Flora that soon colonised southern Pangaea following the final retreat of the Permocarboniferous ice sheets (Almond & Pether, 2008).

TABLE 5: FOSSIL HERITAGE OF THE NORTHERN CAPE (ALMOND & PETHER, 2008)

Geological Unit		Rock Types & Age	Fossil Heritage
Karoo Supergroup	Dwyka Group (C-Pd)	Glacial, interglacial and post-glacial siliciclastic sediments (e.g. tillites) Late Carboniferous – Early Permian *c*. 320-290 Ma	Trace fossils, organic-walled microfossilis, rare marine invertebrates (e.g. molluscs), fish, vascular plants.

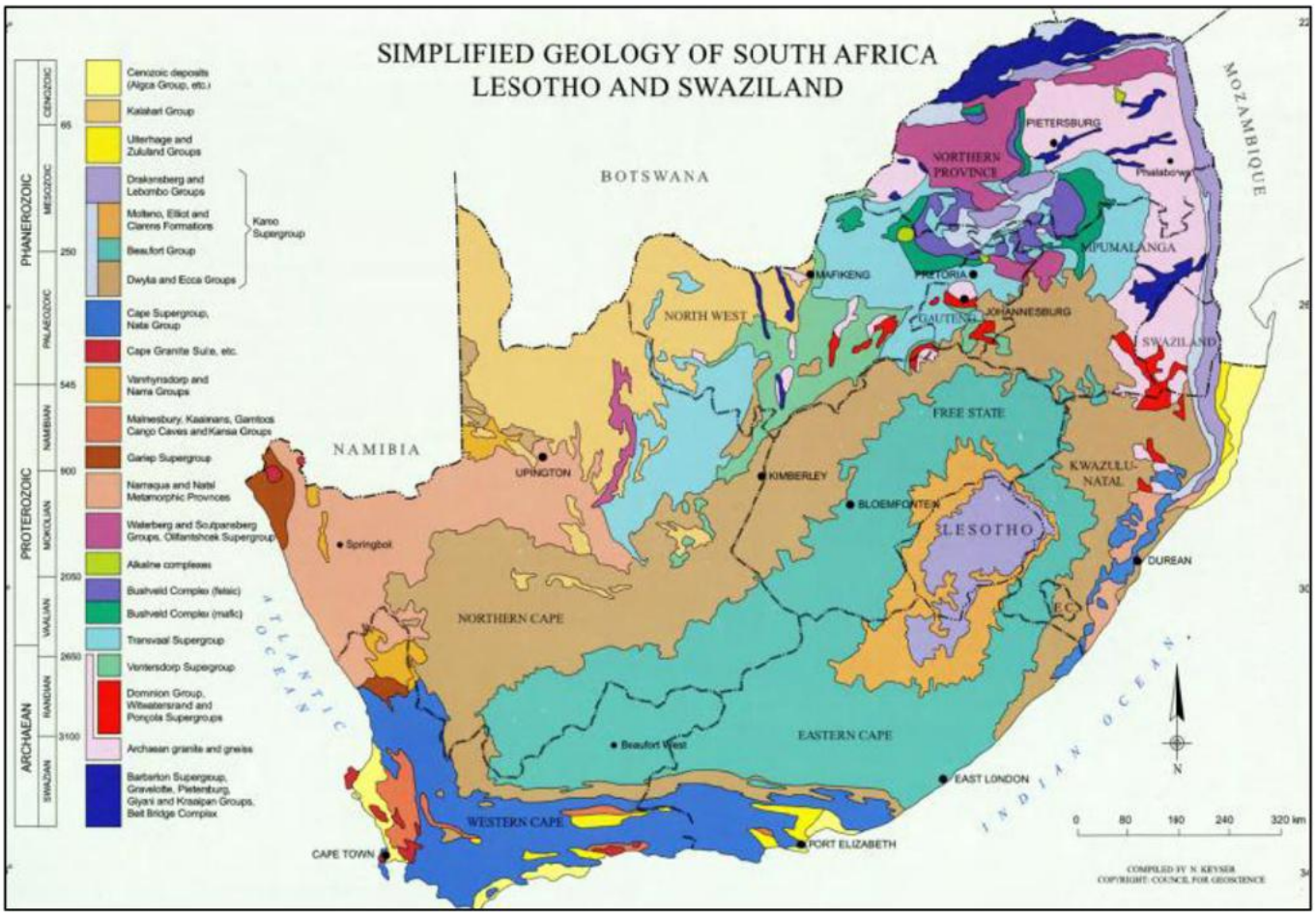


FIGURE 11: SIMPLIFIED GEOLOGY OF SOUTH AFRICA

The Dwyka-aged palaeovalleys bear evidence of glaciated pavements, consisting of well-preserved polished surface striations on basement rocks, which are found throughout the region. The Mbizana Formation is a largely heterolithic unit recognized in the upper part of the Dwyka Group of the Karoo Supergroup, according to Dr. Rossouw.

According to the 1:250 000 scale geological map 2922 Prieska, the study area is underlain by localized outcrops of Mbizana Formation mudstone and sandstone successions, tillites, and conglomerates (C-Pd). The Mbizana Formation represents valley and inlet fill deposits left behind on Ventersdorp basement rocks by retreating glaciers about 300 million years ago.

The clearing of vegetation and establishment of a vineyard will not impact the geology of the site.

Palaeontology

According to Dr. Rossouw, the banded iron formations (BIF) in the region possibly reflect Early Proterozoic environmental conditions following iron deposition as a result of the build-up of free oxygen in the oceans by cyanobacterial photosynthesis. Paleogene fossil assemblages are known from a crater-lake deposit within a volcanic pipe at Stompoor near Prieska and include a diversity of fish frogs, reptiles, insects, and palynological remains. Dr. Rossouw further reported that fluvial deposits from the ancient Koa Valley northwest of Prieksa and south of Pofadder, have yielded fossil vertebrate bone as well as fossil wood. The Mbizana Formation is not considered to be highly fossiliferous, but low diversity non-marine ichnofossil assemblages have been recorded as well as scarce vascular plant remains associated with Glossopteris Flora, while palynomorphs are also likely to be present within finer-grained mudstone facies. Except for a few bovid horn core remains found in lime quarries, there are no records of Quaternary fossils from the immediate vicinity of Prieska.

A fossilized horn core of an extinct alcelaphine has been retrieved from alluvial sediments along the Ongers River near Britstown, while Floristian type faunal remains have been excavated from an archaeological site at Bundu farm Pan near Copperton, according to the Heritage Assessment Report.

In terms of paleontology, Dr. Rossouw indicated in his report that no fossils or potential fossil exposure were observed within superficial sediments or within rarely exposed and moderately significant Mbizana Formation deposits. No impact is expected, but the potential occurrence can never be fully excluded.

SOILS

SOIL PROPERTIES:

Topsoil is a very precious, non-renewable resource with high conservation importance and is necessary for the production of grapes that the topsoil be protected. The potential of soils to produce crops is dependent on its depth, structure, texture, and sequence of soil horizons.

The opposite of topsoil preservation is topsoil degradation, which involves the removal of soil, and alteration or damage to soil and soil-forming processes, usually due to human activity. Stripping of vegetation will impact negatively on soil formation, natural weathering processes, moisture levels, soil stability, humus levels, and biological activity. It is therefore essential that where it occurs, it be preserved and protected or upgraded to improve the agricultural potential of the property.

There is an increase in awareness that soils are a non-renewable resource and worldwide, there are about 36 billion tons of soil lost annually due to water and wind erosion alone (Borrelli *et al.,* 2017). Soil health is

threatened by erosion, soil organic matter loss, soil nutrient imbalances, salinization and sodification, soil sealing, contamination, acidification, compaction and waterlogging (Lazcano *et al.*, 2020).

Decades ago vineyards were often established on marginal land, reserving the most fertile soils for the cultivation of grains and other food crops. Over the years vineyards have also been established on deep, alluvial, fertile soils resulting in the fact that vineyards can arguably occupy a broader range of soil types than any other crop (Lazcano *et al.*, 2020).

Since this is an application to clear natural vegetation and establish a vineyard for raisin production, it was important for a soil survey to be completed. A soil survey was conducted and the soil forms found on the study area included, Coega, Brandvlei, Glenrosa, Olienhout and Prieska. Vineyards are best suitable for soil that has a pH between 5.5 and 6.5. The required phosphorus should be 40-50ppm.

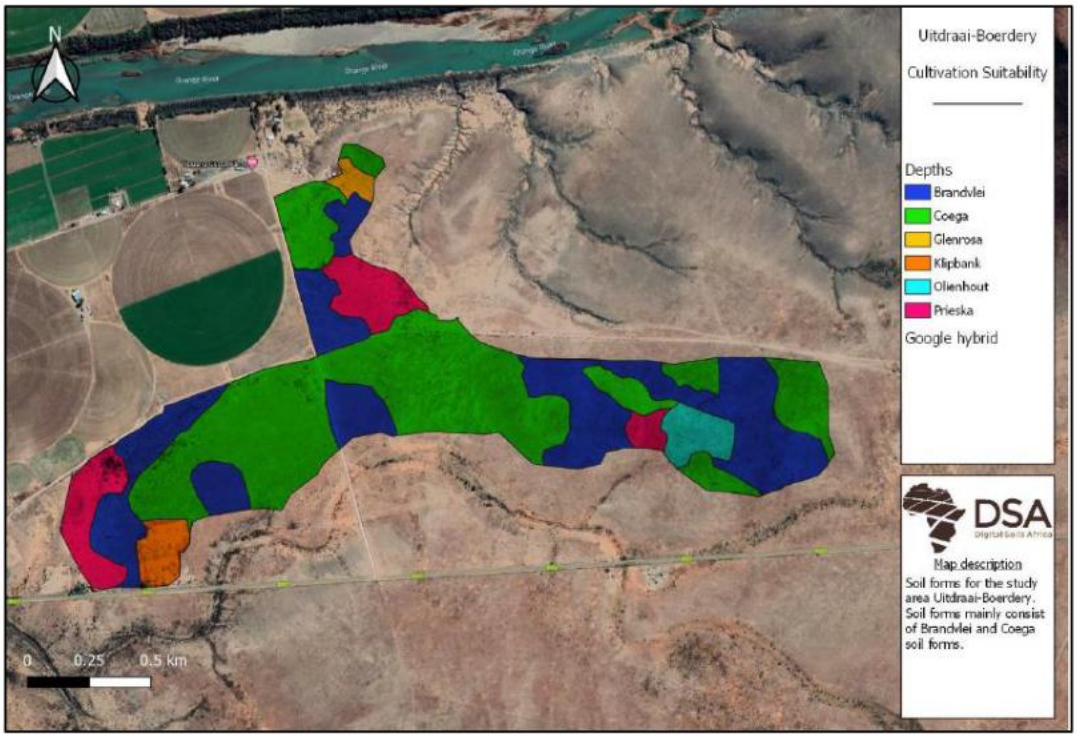


FIGURE 12: SOIL FORMS OF THE STUDY AREA (SOURCE SOIL REPORT)

The main risk for vineyard cultivation in the Uitdraai Boerdery study area, according to the soil report, is whether the underlying material being soft and hard carbonate will meet the depth requirements for Vineyard cultivations and if not if those horizons could be ripped. For the vineyard to be successful a depth of 600mm – 800mm is required. By breaking up the soil, deep ripping can free the way for roots to penetrate the soil and access water and nutrients, leading to yield increases.

1 Kemsley Street
Port Elizabeth
6001

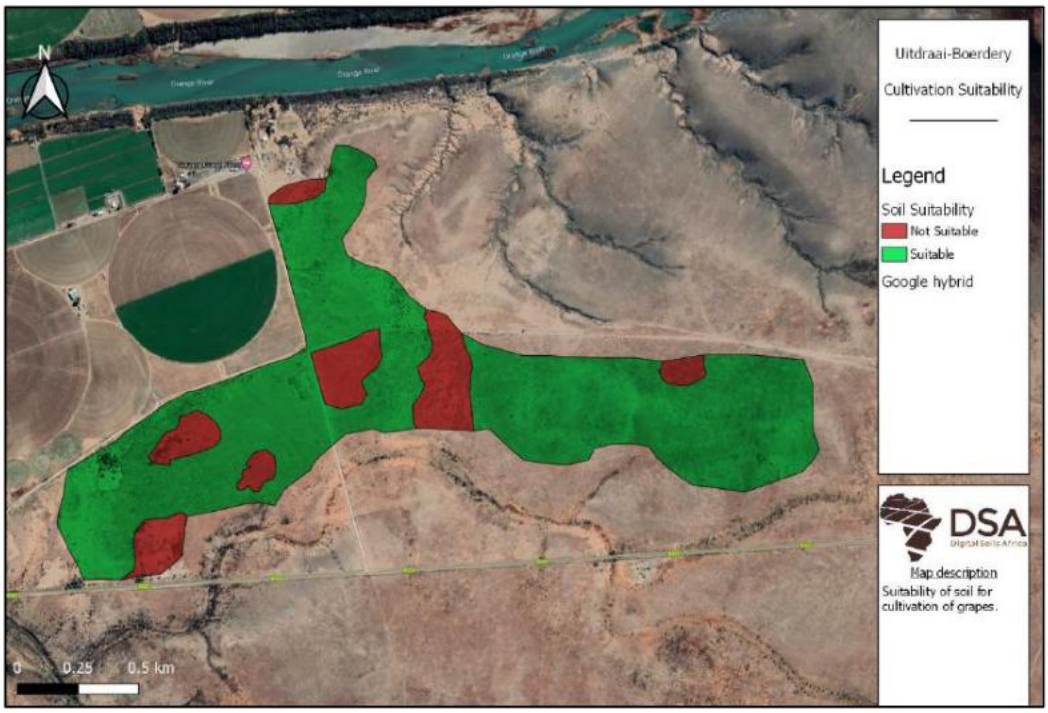


FIGURE 13: SUITABILITY AREAS FOR VINEYARD CULTIVATION (SOURCE SOIL REPORT)

The Brandvlei, Prieska and Olienhout soil forms depths ranged from 1000mm to 2000mm and were classified as deep with soft carbonate layers. The Coega soil from depts was between 200-800mm and classified as shallow soil with hard carbonate layers.

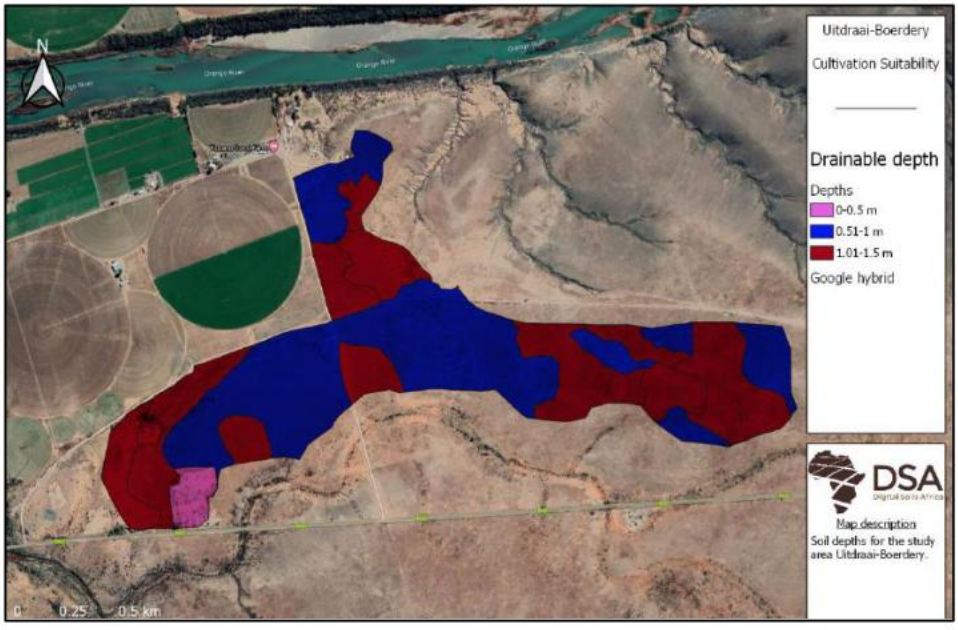


FIGURE 14: SOIL DEPTH AT THE STUDY AREA

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Chemical analysis of the soil was done and was found to be suitable for the cultivation of vineyards. The pH of the soil in the study area varied between 6-6.15 and the CEC of the soil should be above 10cmol/kg of which the CEC at the study area varied between 17-38cmol/kg.

The phosphorus in the soil is very low for virgin soils, with concentrations between 10-19mg/kg, as the recommended concentration is 40mg/kg and therefore the soil specialists recommended that triple superphosphate be applied to prevent plant deficiencies.

Ultimately the soil report concluded that about 145Ha is suitable for the cultivation of vineyards, according to the norms and standards provided by the Northern Cape Department of Agriculture. Drainage is of most importance and would require deep ripping of the soft and hard carbonate.

Direct Impacts on the soil

Construction Phase:

The construction phase is effectively the clearing of vegetation, plowing of soil, and planting of vine trees. As this will commence in Phase 1, the major concern, as indicated in the soil report, is the relatively shallow topsoil and the underlying subsoil, which varies between soft to hard carbonate. Generally, carbonate layers are indicators that material below the layer may impede vertical drainage. The concern is therefore if the site is over irrigated lateral drainage will occur.

During irrigation, generally considerable amounts of salts are applied with the water. When water is absorbed by plant roots through transpiration, the salts are precipitated in the soil and a long-term result is the increased concentration of salts called salinization. Since the drainage of this site is expected to be lateral, and salts may be carried from the site to abutting lower laying croplands. In such a case, salinization in the soil can hamper crop growth and in extreme cases, salinization will render the soil non-vegetative.

These effects can be negated with proper management of soils. If the soil is not managed according to the mitigation measures, there is a risk of soil salinization but the impact is rated low, considering it is only Phase 1 (25Ha) and if lateral drainage occurs, it will be diverted into the drainage line to the east of the phase or the gravel road to the west and will not reach the abutting vineyard on the neighboring property.

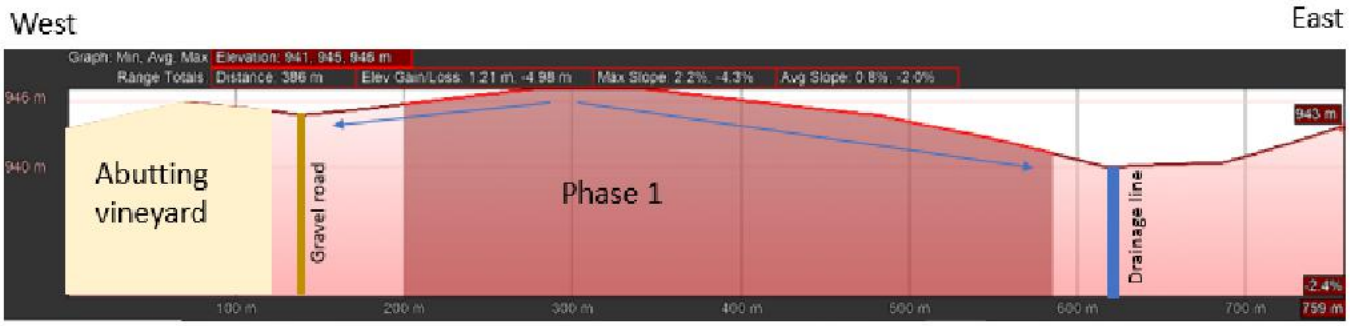

FIGURE 15: TOPOGRAPHICAL DIAGRAM OF PHASE 1 WHICH ILLUSTRATES IF LATERAL DRAINAGE OCCURS, IT WILL EVENTUALLY FLOW INTO THE DRAINAGE LINE OR GRAVEL ROAD. THE BLUE ARROW INDICATES THE POTENTIAL LATERAL DRAINAGE DIRECTION.

FIGURE 16: TOPOGRAPHICAL DIAGRAM OF PHASE 2 WHICH ILLUSTRATES IF LATERAL DRAINAGE OCCURS, IT WILL EVENTUALLY FLOW INTO THE DRAINAGE LINES SOUTH AND NORTH OF THE PHASES. THE BLUE ARROW INDICATES THE POTENTIAL LATERAL DRAINAGE DIRECTION. THIS DIAGRAM ALSO REPRESENTS POSIBLE LATERAL DRAINAGE OF PHASES 3&4.

With mitigation measures, the direct impact on the soil will decrease to very low. The clearing of vegetation and establishing of the vineyard will continue into the operational phase, as the vine trees take about 2 years before producing a profitable harvest.

Therefore, while the clearing and soil preparations commence in Phase 2, Phase 1 will be operational. As the development progress to Phase 3, Phases 1 & 2 will be operational, and so forth until all the phases are operational or in a state of producing a profitable harvest. Thus, there will be an overlap of the construction phase and operational phase until all the phases have been established.

Operational Phase:

The operational phase is the phase where soil management must take place to ensure that fruit-producing vine trees continue to produce a harvest, which does not lead to degradation of the soil or soil on abutting farm areas. A high water table with salt accumulation can result in severe crop decreases, the productivity of the soil, and thus a reduced income from the crop production (indirect impact) (Voster, 2015). Effective

soil management practices are critical for soil health to ultimately maintain environmental quality, crop yields, and grape quality, and to maintain soil productivity, a drainage system should be installed.

It is thus clear that drainage problems are the key to either yield losses or profitable yields during the operational phase. Due to the risk of salinization of soil on the property and possibly abutting properties, it is very important to manage the irrigation of the site and protect the soil from degrading. To achieve this it is very important to consult with an irrigation and drainage engineer to design an artificial drainage system. As a minimum, there should be at least an artificial drainage system along the boundary of the lowest point of the field, to ensure drainage does not migrate to abutting croplands but is directed into the drainage lines to the east and south of the proposed croplands.

Yield losses are the consequence of over- or under-irrigation and the problem can be greatly overcome by scheduling water use. Scheduling is the management of irrigation applications, supplying the correct amount of water at the right time, and ensuring that sufficient water is available to the plant (Voster, 2015). It involves the planned replacement of water in the soil profile that has been drawn off by the crop. The soil scientist must decide and design the irrigation scheduling. With mitigation, the impact is reduced to low-moderate. Without mitigation, the impact is rated moderate-high.

Indirect Impacts on the soil

Construction and Operational Phase:

Soils that are less fertile and more susceptible to degradation due to drainage issues can lead to low agricultural profitability and could result in loss of income and investment to the farmer, but also the loss of employment to those contracted to work on the farm. Thus, the indirect impact of the loss of soil properties due to mismanagement, is 1) reduced income from the crop production which could untimately lead to 2) the loss of employment.

If drainage is not managed it could lead to salinazation of abutting crop areas on neighbouring farms and financial loss to such farmers and possible employment loss. It is thus clear that the indirect impact has a negative socio-economic impact and soil management and irrigation is very important to prevent financial loss to the applicant, neighbours and workers.

From an ecological point of view, with degraded soil, it is very difficult to rehabilitate the site to host natural vegetation. Thus there is also a risk of ecological loss if the crops fail and the site has to be rehabilitated.

Considering the above, overall the impact is rated low-moderate with mitigation, but will increase to moderate-high without mitigation.

Cumulative Impacts on the soil properties

According to satellite imagery, it is clear that irrigation commenced in 1996 on the area immediately west of the site under the application. It is impossible to assess if it was a vineyard that was planted or other crops, however on the day of inspection in January 2021, it was harvest time for raisins on the abutting farm. Further north (across the Orange River) additional irrigation land is established and is typical of farming along the Orange River. Due to the topography east of the study area, which is more dissected terrain, it is unlikely that other irrigation areas will be established. The proposed area is the final area with fairly flat terrain to host crops that are situated near the Orange River.

Considering that an area of about 174Ha was investigated in the soil survey and that according to the Department of Agriculture Units 1 & 2 (see Figure 10) or the area on Erf 1 should be excluded from the ploughing certificate area, it will result in the addition of about 88.2Ha of crop farming to the area. The abutting areas were not investigated in terms of the impact of the crops on the soil properties over the past years and therefore a cumulative impact cannot be properly assessed. However, considering satellite imagery and the fact that since 1995 it seems that the area has always been under irrigation and that a successful harvest took place in January 2021, does imply that soil management principles are most likely applied by abutting neighbours, and if the applicant follows the mitigation measures the cumulative impact on soil properties is rated low.

Impact on the soil properties

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Site Specific	1	Site Specific	1	Site Specific	1	Site Specific	1
Duration	Medium Term	2	Short Term	1	Permanent	4	Long Term	3
Intensity	Low-Medium	3	Low	2	High	6	Medium	4
Probability	Likely	3	Probable	2	Definite	4	Likely	3

Cumulative Impact	Very Low		Very Low		Low-Medium		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low**	**18**	**Very Low**	**8**	**Moderate-High**	**44**	**Low-Moderate**	**24**
Extent to which impacts can be reversed	Negative impacts can be mitigated through proper soil management, which will include the placing of an artificial drainage system and irrigation scheduling.							

EROSION:

Soil erosion is a natural process that, without disturbance, would balance itself with the formation of new soil. Any development that destroys the natural protective canopy of vegetation speeds up the process of soil erosion. Soil properties determine the erodibility of soils and their ability to support vegetation and this needs to be understood in assessing the potential for erosion and the suitability for the proposed establishment of a vineyard. Soils susceptible to water erosion are normally silty, are weakly structured, have low organic contents, and have poor internal drainage.

The erodibility index is determined by combining the effects of slope and soil type, rainfall intensity, and land use. These aspects are represented by terrain morphology (soil and slope), mean annual rainfall, and broad land-use patterns.

WATER EROSION

The ability of rain to result in erosion is known as erosivity and is caused by the physical characteristics of rainfall, such as the quantity, intensity, and energy of the precipitation. Erosivity is divided into groups with 100mm increments. The erosivity index for this site is low and rated 101-200mm. The predicted soil loss is considered low according to the AGIS atlas.

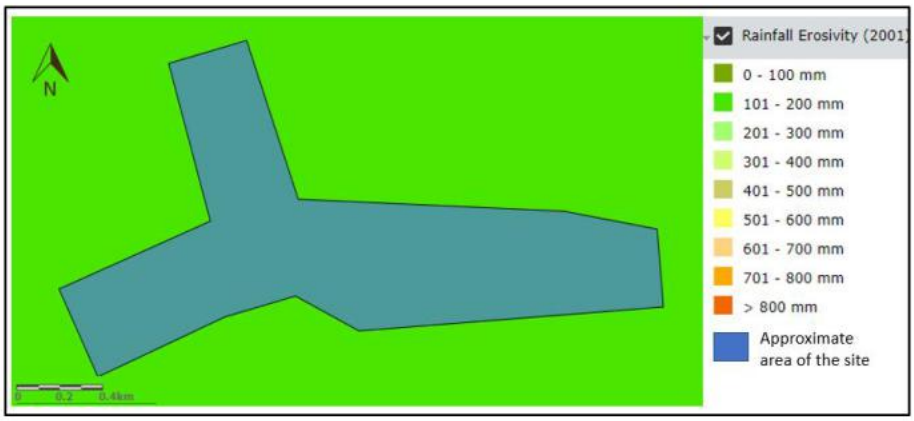

FIGURE 17: PREDICTED SOIL LOSS OF THE STUDY AREA AND GREATER SURROUNDS (AGIS COMPREHENSIVE ATLAS)

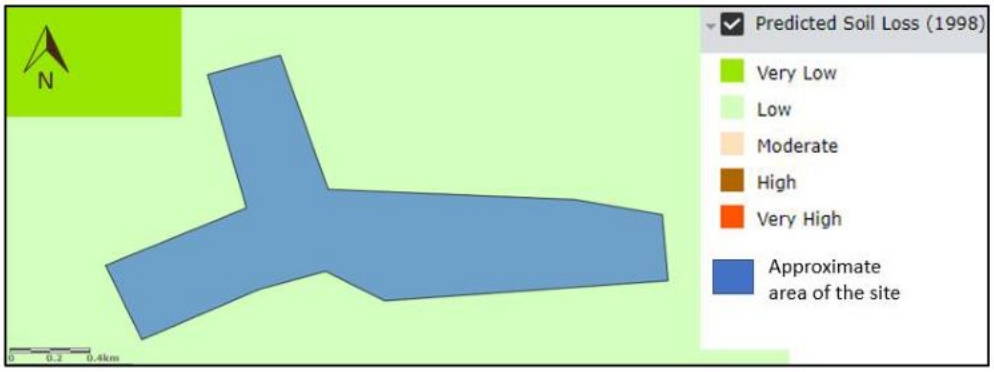

FIGURE 18: PREDICTED SOIL LOSS (AGIS COMPREHENSIVE ATLAS)

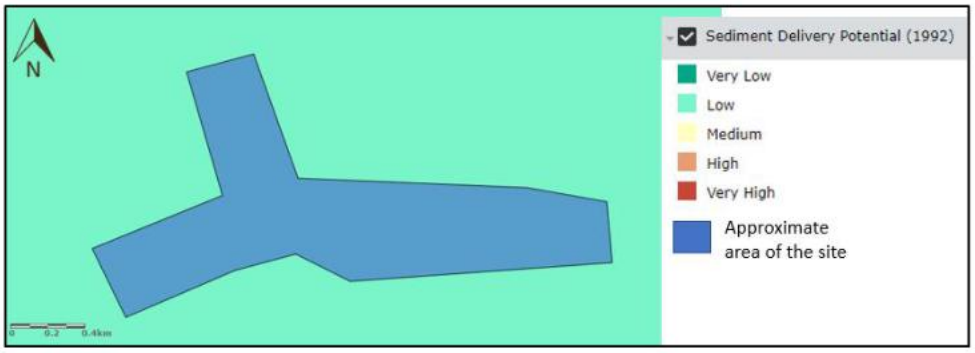

FIGURE 19: SEDIMENT DELIVERY POTENTIAL OF THE STUDY AREA AND GREATER SURROUNDS (AGIS COMPREHENSIVE ATLAS). THE SITE FALLS WITHIN AN AREA THAT IS CLASSIFIED AS LOW SEDIMENT DELIVERY POTENTIAL.

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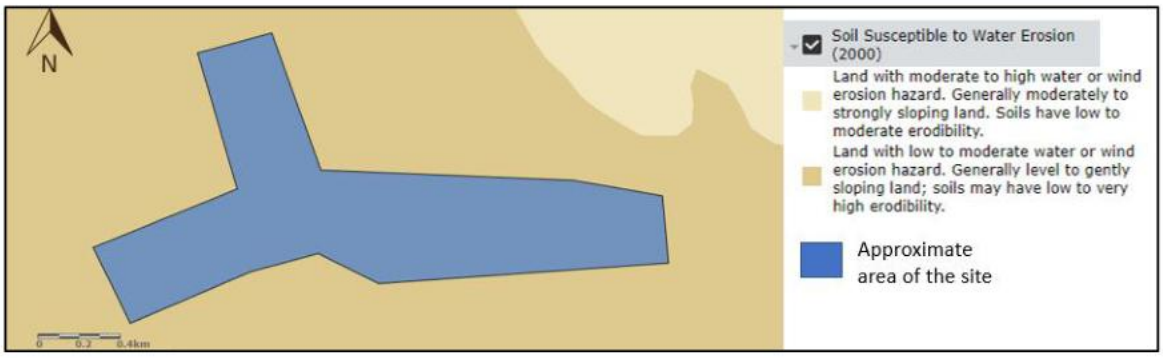

FIGURE 20: SOILS SUSCEPTIBLE TO WATER EROSION OF THE STUDY AREA AND GREATER SURROUNDS (AGIS COMPREHENSIVE ATLAS). THE SITE FALL WITHIN AN AREA THE IS CLASSIFIED AS LAND WITH LOW TO MODERATE WATER OR WIND EROSION HAZARD. GENERALLY, LEVEL TO GENTLY SLOPING LAND.

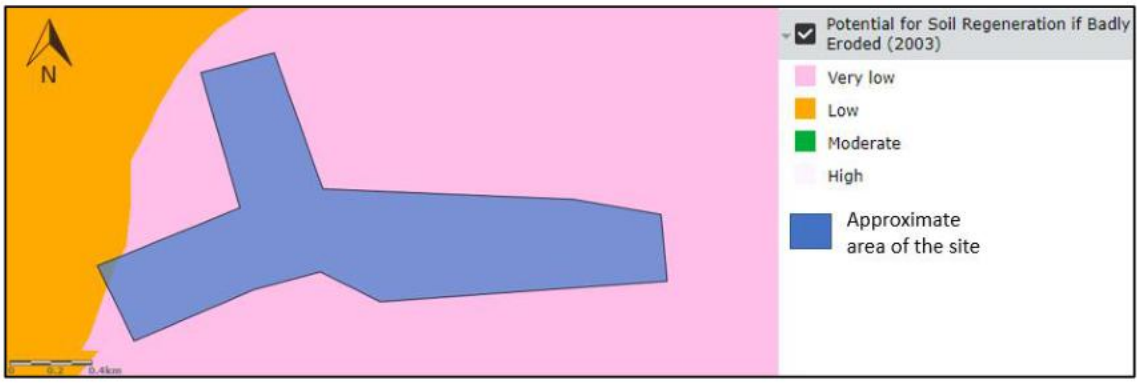

FIGURE 21: POTENTIAL FOR SOIL REGENERATION IF BADLY ERODED OF THE STUDY AREA AND GREATER SURROUNDS (AGIS COMPREHENSIVE ATLAS). THE SITE FALLS WITHIN AN AREA THE IS CLASSIFIED AS LAND THAT HAS A VERY LOW POTENTIAL FOR SOIL REGENERATION.

WIND EROSION

Wind erosion is very selective and is capable of carrying the finest particles - especially organic matter, clay and loam - for significant distances. The more structured and the coarser the soil, the less susceptible the soil is against wind erosion. The effect of wind erosion on the soil will also depend on the combination of the soil properties as mentioned above, together with the wind speed. The higher the wind speed, the more energy is available to erode soils with even coarse, structured particles. The intensity of wind erosion on soils is dependent on various physical factors related to the soil such as surface roughness, slope, protective soil cover (such as vegetation cover), the water content of the soil, stability of dry soil aggregates, and stability of soil crust. Additionally, factors related to wind such as wind velocity, duration of the wind, and angle of incidence, together with the aforementioned physical properties of the soil will determine the effect of wind erosion on soil.

Factors affecting the extent of wind erosion are the wind speed and the soil texture. If the wind speed exceeds about 20km/h over dry soils, the potential for wind erosion will increase (Roose 1996), since the highest recorded wind are generally during August to October of >38km/h but <50km/h, which is also the season of low rainfall. Also, according to the literature, the soil in the study area host loamy sands. Loamy sand, rich in particles between 10 and 100 microns in size, is the most vulnerable soil (Roose 1996), of which the optimum size for wind erosion is about 80 microns. Considering the literature review, there is a potential for wind erosion at the site. The site will be most vulnerable to wind erosion during the construction phase.

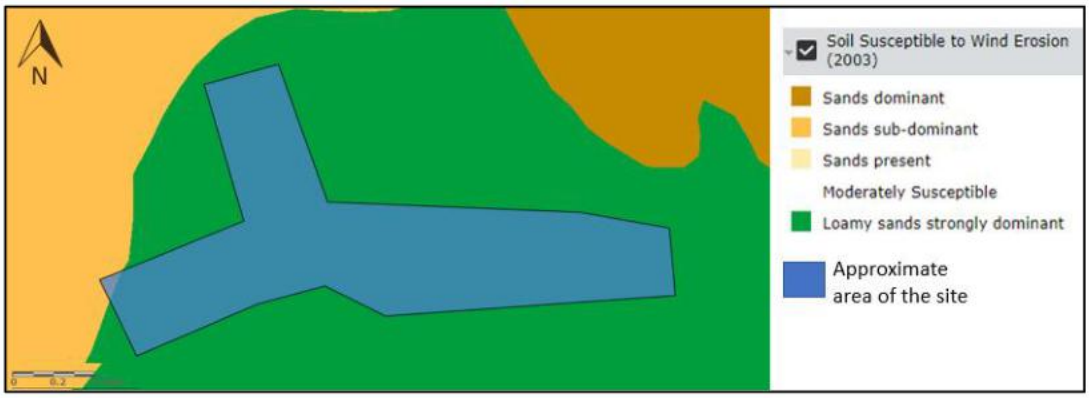

FIGURE 22: WIND EROSION SUSCEPTIBILITY OF SOILS IN THE STUDY AND SURROUNDING AREA (AGIS COMPREHENSIVE ATLAS). THE SITE FALLS WITHIN AN AREA THAT HAS LOAMY SANDS THAT IS STRONGLY DOMINANT.

To verify the literature review, fieldwork was conducted and according to the soil report, the EC is below 400mS/s. As for texture, all soils have a clay content below 35% and due to Exchangeable Sodium Percentage (ESP) being very low the salts will be dominated by Ca and Mg. This results in a low risk of dispersion and soil erosion. These findings are in line with the desktop study findings suggesting that water erosion has a low potential, however, wind erosion is still predicted to be a possible impact.

Direct Impacts on the soil erosion

Construction Phase:

Vineyards are more vulnerable to soil erosion during the construction phase or early development. Many non-bearing vineyards are maintained with clean tillage between rows to promote vine growth without competition from weeds. Also, small vines have not yet developed much of a canopy to intercept rainfall before it reaches the bare soil. It is, therefore, crucial to plan, design, and implement the best soil conservation methods before establishing the vineyard. This must be done in consultation with the irrigation engineer and the soil scientist.

For this project, during the construction phase, about 25Ha will be cleared from vegetation on Phase 1 and topsoil will be ploughed to establish vine trees. This action will continue into Phases 2-4. The clearing of vegetation will not cause depressions or change in natural topography and will follow the natural incline of the area, which will reduce the erosion impact further since the site is already relatively flat and the soil properties further reduced the risk of erosion. Although the risk is low, it is still good practice to implement measures to prevent any possible erosion.

There are a few mitigation measures that can be implemented at the vineyard to prevent erosion and can be decided on during the planning phase before construction, and these include:

- Diversion ditches – are soil structures constructed at intervals across a slope to collect water from slopes and divert it into natural drainage lines. Diversion ditches must be seeded and gently graded to slow water down to reduce its erosive force. The irrigation engineer can assist if this method is implemented.

FIGURE 23: EXAMPLE OF A DIVERSION DITCH WITH ARTIFICIAL DRAINAGE OUTLET TO REDUCE EROSION BY REMOVING EXCESS WATER FROM THE VINEYARD (SOURCE MARTINSON, 2019)

- Buffer strips around the vineyard – grassed areas around the perimeter of the vineyard which will protect drainage lines by filtering surface water that leaves vineyards before it gets to streams, drainage lines and/or depressions. Generally, about 15m of grassed areas is adequate for a buffer strip.
- Artificial drainage/subsurface drainage helps protect water quality by reducing the surface runoff that would otherwise occur when soils become saturated with water and it also allows water to filter through the soil that will remove many contaminants that would be present in surface runoff. The artificial drainage must be designed by an irrigation engineer.
- Vineyard layout – the planting of vine trees should be planted in rows across the slope and not up and down the slope.

The above planning and designs are part of the construction phase which should be constructed before the clearing of vegetation and the planting of the vine trees. Further planning during the construction phase should also include vineyard floor management, which will impact the positioning of the vine trees. Floor management options include:

1. Permanent Sod between vine rows. Generally, about a 50-80cm wide weed-free strip under the vines is maintained while leaving permanent sod in the middle of the row (Martinson, 2019).

FIGURE 24: EXAMPLE OF PERMANENT SOD BETWEEN ROWS (SOURCE MARTINSON, 2019)

FIGURE 25: EXAMPLE OF MULCH APPLIED IN THE MIDDLE OF THE ROWS (SOURCE MARTINSON, 2019)

2. Mulch such as hay is commonly applied between vine rows. It is generally expensive to apply but has many beneficial effects, since it helps retain soil moisture, increases the availability of soil nutrients, provides a barrier to reduce the impact of raindrops, and in some studies, it also assisted in increasing the yield (Martinson, 2019).

FIGURE 26: EXAMPLE OF SEED COVER CROPS (SOURCE MARTINSON, 2019)

3. Seeded cover crops are another practice used by some farmers. Typically a no-till seed is planted between the vine rows, which is mowed or killed with a contact herbicide and left. The decomposing material has chemical substances that prevent new weeds from germinating and extends that 'weed-free' time (Martinson, 2019). This also results in the reduction of ploughing in between vine rows which reduced soil erosion potential and have the added benefit of allowing more timely operation of equipment after rainfall and reducing soil compaction from machinery.

With correct planning and implementation of mitigation measures, the risk of erosion is rated very low during the construction phase.

Operational Phase:

With the correct planning and measures implemented during the construction phase, reducing the erosion risk at the site will simply depend on the management of the implemented structures (floor management options discussed above) and monitoring thereof. Over the years vineyard floor management practices have reduced the impact of soil erosion.

Bare soils without vegetation cover are susceptible to increased compaction, surface runoff and erosion, therefore the applicant, together with the irrigation engineer and soil scientist must decide on the best vineyard floor management plan. During the operational phase and through environmental auditing, the effectiveness of the floor management plan can be evaluated and if needed adjusted. It should be regarded as a flexible plan that is dependent on the outcome of the audit and advice from the engineer and soil scientist. With mitigation, the impact is rated low, but can increase to low-moderate without mitigation.

Indirect Impacts on the soil erosion

Construction and Operational Phase:

From a socio-economic point of view, increase wind erosion can lead to a dust plume hovering over the site and could blow across to neighboring crops, depending on the wind direction and strength. The indirect impact is people (workers) breathing it in and also the possible impact on crop yield, although this is a hard impact to quantify or conceptualize (Norcal Ag Service, 2019). Fields exposed to too much dust can produce fewer yields, more weeds, and lower-quality crops and consequently results in a smaller harvest and lower profits. Over the long-term period of low profits, the negative effects on the health of the business can result in loss of employment.

In cases of extreme dust exposure, there can be an impact on photosynthesis (Norcal Ag Service, 2019), which can affect the plant's ability to breathe and subsequently limits growth potential. However, it is difficult to quantify the precise result of dust on crops, because it is difficult to analyze due to all the potential variables at work. There has been a case study where successful cultivation of maize occurred directly abutting a quarry where crushing of material resulted in extensive dust fall out on the crops. In the case study, if dust had an impact on the photosynthesis of the maize, it did not result in a smaller harvest. Regardless though, there is a correlation between dust exposure and lower levels of photosynthesis absorption, but the impact on harvest volume remains difficult to quantify.

Considering the above, in terms of the indirect impact of wind erosion that potentially can cause dust a fall out on abutting vineyard and crops, it is concluded that no confident assessment can be made whether the dust will or will not have an impact on harvest yields.

High dust levels can however introduce harmful fungus and mold and can cause mass infection and fruit rot, which will lead to harvest loss and loss of income. Excess dust can also increase the likelihood of dust mite infestation, which negatively impacts the health of plants. Mites settle on plants and reduce the ability to absorb sunlight (photosynthesis) and plants become deprived of essential nutrients. To control fungus, mold or mites, requires costly pesticides and can compromise grape quality. Also, if dust becomes problematic, is that while crops suffer the weeds thrive, which further exacerbate the problem of delayed or stunted growth.

Another indirect possible socio-economic impact is the perception of tourists visiting the vineyard or surrounding area. High levels of dust can tarnish the high-end experience visitors expect from vineyard touring or visiting the inland. At this stage, the surrounding area does not host tourist attraction activities

or facilities. It is the objective of the Siyathemba Municipality to establish a tourism attraction along the R357, and if managed well, there is a possibility that the proposed site/farm can fit in with this objective.

From an environmental point of view, an indirect impact can be the siltation of streams. During the construction phase, the possible impact of wind erosion and resulted dust generation will be the highest risk due to the clearance of vegetation. Fortunately, southerlies are not dominant winds in this region and it is unlikely that silt will be deposited into the Orange River system as a result of vegetation clearing and ploughing on the study area. The cumulative impact as a result of immediately abutting crop areas will be more pronounce regarding this potential impact.

The silt that will generate can however be deposited in any of the drainage systems south and east of the study area and can result in the loss of valuable topsoil on the vineyard area. Regarding the silt deposit in the drainage lines, the vegetation cover in the drainage lines will effectively trap silt and prevent it from being deposited in any stream, thus the impact is negligible.

Regarding the possible use of pesticides to control fungus, mold, mites, and weeds, another negative, indirect environmental impact is the possible degradation of the soil and water quality, depending on the chemical reactions and sensitivity of toxins from the receiving environment.

To control dust and reduce the potential loss of topsoil, one phase at a time must be developed and vineyard floor management practices must be put in place. The indirect impact is rated moderate without mitigation, but can be reduced to low with mitigation.

Cumulative Impacts on the soil erosion

During the site visit erosion was noted to areas where vegetation cover was limited and at the steeper slopes towards the drainage lines, of which most fall outside of the application area. On the abutting farm (vineyard area) no erosion was noted. It is the opinion of the author that the cumulative impact on erosion is limited and with proper soil management the risk of increased erosion is low.

Regarding the cumulative impact on wind erosion and effectively dust fall out, will depend on the harvest seasons and crops. If areas on neighboring farms are harvesting at the same time (e.g. maize, wheat, etc.) then cumulatively exposed areas will increase and should strong winds be experienced during such times could intensify the impact. The addition of the proposed vineyard will however not increase the cumulative dust fall impact on abutting areas to a significant level and is rated low with mitigation.

Impact on the soil erosion

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Site Specific	1	Site Specific	1	Site Specific	1	Site Specific	1
Duration	Medium Term	2	Short Term	1	Medium Term	2	Short Term	1
Intensity	Low-Medium	3	Low	2	Medium	4	Medium	4
Probability	Likely	3	Probable	2	Definite	4	Likely	3
Cumulative Impact	Very Low		Very Low		Low-Medium		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low**	**18**	**Very Low**	**8**	**Low-Moderate**	**24**	**Low**	**18**
Extent to which impacts can be reversed	All negative impacts can be successfully mitigated and reversed through soil management, implementation of drainage structures, irrigation scheduling, protection, and vineyard floor planning.							

SOIL POLLUTION:

Soil pollution can occur during hydrocarbon spills occur, or when 1) used oils and lubricants are purposefully drained into the soil, 2) storage facilities are destabilized or 3) if ablution facilities contaminate soils. Also when pesticides are used.

Direct Impacts on the soil pollution

Construction Phase:

During the clearing of vegetation, a bulldozer will be used which will require some quantities of diesel fuel, oils, and hydraulic fluids and in return, it produces used oils and lubricants. It is essential that these substances are handled correctly and that workers/contractors are properly trained in this regard; otherwise, they could inadvertently cause unwanted environmental impacts, such as draining used oils into the soil. If needing to drain hydrocarbons on-site due to emergency repair work on the machine, it must be drained into drip pans and immediately siphoned into appropriate containers and dispose of on the same day. The servicing of all vehicles and machines will be restricted to the offsite workshop. Considering that it will only be one bulldozer and possible truck, no impact on soil is anticipated in terms of pollution.

All of the trucks and earthmoving equipment should be well maintained, fuel storage or establishment of a sewage system will not take place at the proposed study area. No bulk diesel fuel, oils, and lubricants will be stored at the site. No chemicals or hazardous substances will be stored at the site, any fertilizers or pesticides will be stored off-site at the farm shed.

In the event of small spills, the natural bio-degradation of hydrocarbons could be slightly slower than in well-aerated soils, but the use of fertilizers or oil surfactants could assist in breaking down limited spills in a short space of time.

Due to the limited amount of vehicles that will be used on the site the worst-case scenario would lead to very small hydrocarbon spills that will penetrate the soil immediately and will percolate to lower levels. The sub-soil layers however have a moderately-high un-penetrable profile thus any hydrocarbon spill could be scoped up. The use of fertilizers could assist in breaking down limited spills in a short space of time which will preclude them from reaching the drainage lines of lateral drainage occur. The impact is rated low under worst-case scenario conditions and insignificant under normal circumstances due to the limited spills anticipated in the study area.

In terms of sewage, a chemical toilet should be provided at the study site once clearance commences, to prevent the surroundings from being used for ablutions. Due to the small number of people anticipated being onsite during the construction phase (2-5 people) limited soil pollution is expected and a similar impact on the coliforms count in the soil and water is anticipated. The chemical toilet system must be maintained according to specifications stipulated by Municipal by-laws or by a local health inspector. Due to the absence of ablution facilities, no effluent will be generated that could affect soils and groundwater sources inside or outside the study area. The anticipated soil pollution risk due to sewage spills are rated low under worst-case scenario conditions and insignificant under controlled conditions.

Domestic waste will be produced at the site but the waste streams (tins, paper, food) will be limited to the driver of the bulldozer and truck. Waste can be kept in the vehicles and must not be dumped outside. The contractor and farm owner must take responsibility, since littering of the surroundings through wind action, could affect livestock and the surrounding environment. During the construction phase, this will be a negligible impact, however during the operational phase (harvest time) when there are multiple workers onsite the impact will increase. Ultimately the waste production will be very limited at the site and the impact on soils and surrounds is rated very low with mitigation.

Operational Phase:

During harvest time, there are multiple workers onsite. To prevent domestic waste pollution, waste receptacles with scavenger-proof lids must be provided and placed at easily accessible points. It must be emptied regularly and removed from the site. Also, chemical toilets must be provided, one toilet for every 10 people, and can be removed from the site once the harvest season is over.

During the operational phase, the vineyard needs to be maintained. Fertilization does not need to be carried out each year, it will depend on the vineyard management strategy and the fertilizer used. Importantly, is that fertilization is based on soil and/or leaf analysis results to ensure the best possible conditions for the grapevine to grow. Fertilization will not necessarily result in soil pollution, however, it can lead to organic pollution of surface water systems (the enrichment of surface water due to an increase in nitrates, phosphates, ammonium, etc.) due to the likely lateral drainage of the system. This will be discussed further under the heading 'Water'.

In terms of pesticides, farmers need to prevent damage to the vines throughout the whole growing season against diseases and pests through constant monitoring. The most crucial times for grape disease and pest control are during the spring and summer months and pesticides will inevitably be used at some stage. The type and application of pesticides are crucial for two main reasons, financial- and environmental cost.

The concern is during the application of pesticides when it is sprayed on the vineyard and some of the small drops drift to surrounding areas with air currents or portion of the pesticide miss the vine canopy and fall on the ground then soil pollution is a possibility that can lead to destroying the soil biodiversity. There are a few mitigation measures that can be applied to reduce the impact. These include:

- Spray on-time
  On-time spraying will help protect the vines and result in the rational use of pesticides. The weather conditions (e.g. temperature, humidity, and rainfall) affect fungus growth and disease spread.

Spraying pesticides when it is not necessary is costly, and result in ineffective protection. There are applications available (such as eVineyard app) that can help with determining the optimal spray timing based on in-vineyard climate data. Stage and generations of different vine pests can also be determined by calculating growing-degree days.

- Using the spraying equipment correctly

  Good equipment for spraying must be used and air and water parameters must be adjusted to get the best possible coverage. Understanding the equipment settings will optimize the sprayer's capability for the best possible coverage. Equipment would need to be adjusted several times during the growing season as the canopy grows. Also, depending on the pest, product use, and climate will determine spraying the whole canopy or only parts of it and obviously, the sprayers must be adjusted accordingly.

  It is also important to note that repeated application can increase pest resistance, while its effects on other species can facilitate pest resurgence, therefore crops mustn't be over-sprayed.

- Check the weather before spraying

  Wind speed must be a consistent direction and preferably between 3-15km/h, windspeeds below 3km/h can suspend droplets in the air, which can then evaporate or drift. Windspeeds stronger than 15km/h will result in a high loss of spray from the target area and droplets will drift.

  As far as possible, pesticide spray should not be applied during southerlies and easterly winds, since the Orange River or abutting crops on the neighboring farm is in the direct path of these winds. The label instructions must always be followed.

  Temperature and relative humidity also influence the spray efficiency. The higher the temperature and the dryer the air, the faster the spray droplet will evaporate and drift and can miss the target canopy. Thus at the site, this is very likely considering the climate of the Northern Cape. Ideally spray should be applied at temperatures below 25°C with a relative humidity of >40% (Urska, 2019). In Australia, the Delta T chart is used to prevent the evaporation of droplets (see Figure 27). The best conditions, according to the chart, is when the Delta T is between 2 & 8 (or the yellow strip) and often the most optimal conditions for spraying are in the early morning.

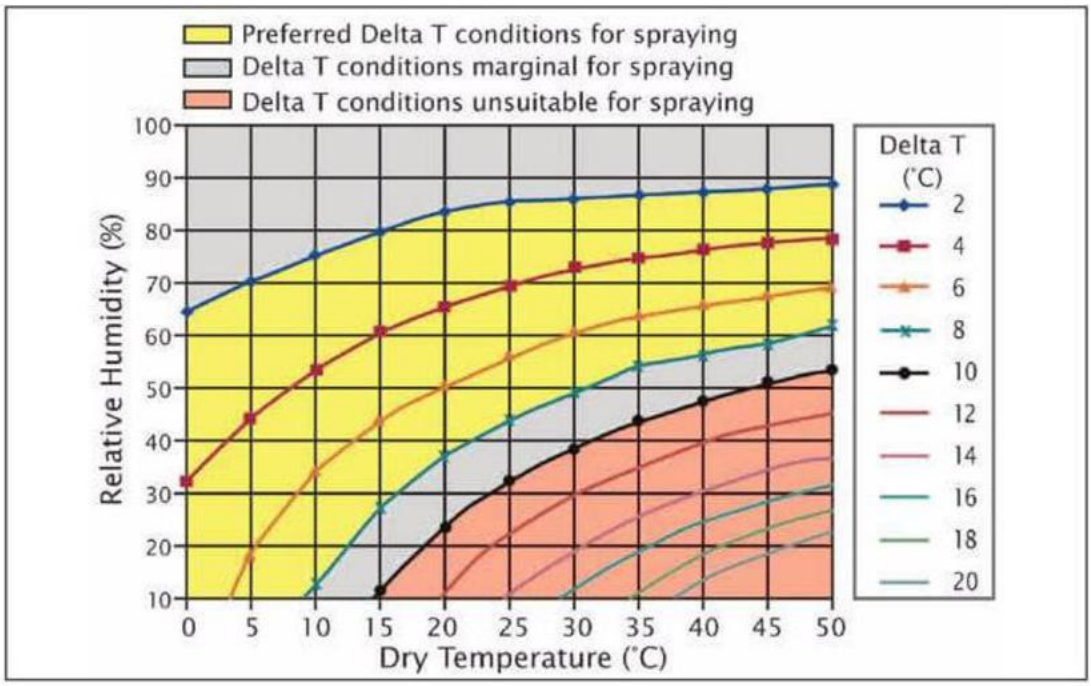

Photo (by Nufarm): Delta T chart to avoid evaporation of droplets when spraying vineyards.

FIGURE 27: DELTA T CHART TO AVOID EVAPORATION OF DROPLETS WHEN SPRAYING VINEYARDS (SOURCE URSKA, 2019)

- Choose the right pesticide
  An important element of spray optimization is to choose the right product based on the disease and pest susceptibility and to know the product mode of action; such as 1) contact insecticide works by immediate physical contact with the pest, while 2) systemic products work secondarily by entering the plant and required the insect to ingest it. It is recommended that for contact insecticides and fungicides finer droplets are better, while coarser for systemic products (Urska, 2019).
  It is also better to adjust application quantity base on canopy size rather than in kilogram or liters per hectare. This is because while the surface of the vineyard remains the same year-round, the size of the canopy changes, and it can reduce the volume of pesticide use.

Biodegradability, frequency of use, effects on other organisms, and accuracy of application are the most important factors to consider in choosing which pesticide to use.

If the pesticides are applied incorrectly or without consideration of the above, there is a risk that it can contaminate soil, water, and other vegetation. In addition to killing insects or weeds, pesticides can also be toxic to a host of other organisms including birds, fish, beneficial insects (such as bees) and non-target plants. With mitigation, the impact is rated moderate-high, with mitigation the impact is reduced to low-moderate.

Indirect Impacts on the soil pollution

Construction & Operational Phase:

The most likely indirect impact due to soil pollution will be the incorrect application of pesticides. The possible domestic waste, sewage, and hydrocarbon spillage will be negligible in terms of indirect impact. The concerning indirect impact is the application of pesticides.

There is a health risk on production workers, formulators, sprayers, mixers, loaders, and agricultural farm workers during the application of pesticides. Exposure can cause short-term adverse health effects such as stinging eyes, rashes, blisters, blindness, nausea, dizziness, diarrhea, or chronic adverse effects that can occur months or years after exposure.

Soil pollution caused by pesticides can also kill beneficial soil microorganisms and reduce soil fertility. This will lead to a financial impact and can ultimately cause the die-off of the vineyard.

Pesticides can contaminate water through runoff from treated plants and soil, while wind can carry droplets to other fields, grazing areas, human settlements, and undeveloped areas, potentially affecting other species. This can cause sickness or death in other organisms including birds, fish, beneficial insects, and non-target plants, thus impacting the biodiversity of the area.

There is also a financial risk to other farmers if pesticides are applied incorrectly. In one case study in the Free State, a pesticide was applied to a cherry orchard, but the farmer failed to warn a bee farmer on the abutting property and all the beehives died, resulting in an R2million loss to the bee farmer.

Not only can the incorrect application of pesticides negatively affect the environment and health, but it is also highly costly and if it is applied incorrectly it can have a significant economic impact, as the farmer can lose the crops, abutting neighbours can sue for crop loss,

It is therefore important to follow the mitigation measures to reduce the potential impact on human- and environmental health. With mitigation, the impact is rated low-moderate but can increase to moderate-high without mitigation.

Cumulative impacts on the soil pollution

Agriculture is one of the largest economic drivers in South Africa. The proposed activities on the study site are no exception and are situated next to a vineyard and other croplands. This region along the Orange

River is valuable irrigation land and it is guaranteed that fertilizers and pesticides have been applied on surrounding farms. Many pesticides have been measures in South African waters (Quinn *et al,* 2011). Pesticides in the aquatic environment have the potential to affect all end-users, including both humans and wildlife. On its own, the proposed application would not have a high impact, but cumulatively, pesticides in the environment can have detrimental impacts, especially concerning that the site is situated fairly close to the Orange River.

The serious health risks associated with certain pesticides are not only for occupational exposure but also end-used exposure (Quinn *et al,* 2011), and a few studies have reported the levels of insecticides in wildlife species. Pesticides have been detected in wild bird species, as well as in indigenous fish species, indicating pesticide contamination within various habitats. The usefulness of pesticides cannot be denied, however, the negative effects on the environment and human health can also not be ignored. In South Africa, several environmental and anthropogenic factors have to be considered before the impact of large-scale (cumulative) pesticide use can be assessed (Quinn *et al,* 2011).

South Africa, and specifically the Northern Cape, is a water-poor region and there is a fine balance between the economic benefits of exporting agricultural products against the loss of water through crop irrigation and water quality degradation. As discussed by Quinn *et al*. (2011), to ensure sufficient dilution of all agrochemicals in South Africa to an acceptable water quality level (used in a typical farming situation applying current-use pesticides), is greater than the amount of water needed for irrigation. Therefore, the proposed activity must mitigate the impact as much as possible to ensure that the cumulative impact is not increased.

Alternatives to the use of pesticides must also be investigated by the applicant, such as using genetically modified crops, sprays of the bacteria, *Bacillus thuringiensis* (Bt) have been used to control insect pests and have been reported to limited effects on most non-target species (Quinn *et al,* 2011), but comes at a high cost financially, less than desirable level of pest control, and poor crop coverage. The applicant must investigate the proper pesticide application for the vineyard to produce raisins.

For this specific site, if pesticides are not applied during southerlies the risk of drift spray towards the Oranje Rivier will be limited, the same applies for easterlies (drift spray will not be directed towards abutting neighbouring crops).

It is predicted that the activity will not contribute to the cumulative impact on the Orange River or abutting croplands if the mitigation is followed. In addition, any possible soil or groundwater pollution as a result of pesticides will drain away from the Orange River or abutting crop lands due to the lateral movement of drainage, which further reduces the possible cumulative impact.

Impact on the soil pollution

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Site Specific	1	Site Specific	1	Local	2	Local	2
Duration	Medium Term	2	Short Term	1	Long Term	3	Short Term	1
Intensity	Low-Medium	3	Low	2	High	6	Medium-High	5
Probability	Likely	3	Probable	2	Definite	4	Likely	3
Cumulative Impact	Very Low		Very Low		Low-Medium		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low**	**18**	**Very Low**	**8**	**Moderate-High**	**44**	**Low-Moderate**	**24**
Extent to which impacts can be reversed	All negative impacts can be successfully mitigated and reversed through soil management, implementation of drainage structures, irrigation scheduling, protection, vineyard floor planning, proper planning of applying pesticides.							

LAND USE AND LAND CAPABILITY

Although land use is not a feature of the environment as such, it does represent the current status of the land surface as a whole, and therefore also reflects the condition of the environment. Land use is reflected by land-use patterns, based on terrain morphological units.

Conservation is the maintenance of environmental quality and resources or a particular balance among the species present in a given area. The resources may be physical, biological, or cultural.

The study area is zoned agricultural and as can be seen in the below figure, the area west of the site is used for commercial irrigation. The site itself can be mostly described as an area with thicket, bush clumps, and high fynbos, with pockets of shrubland and low fynbos.

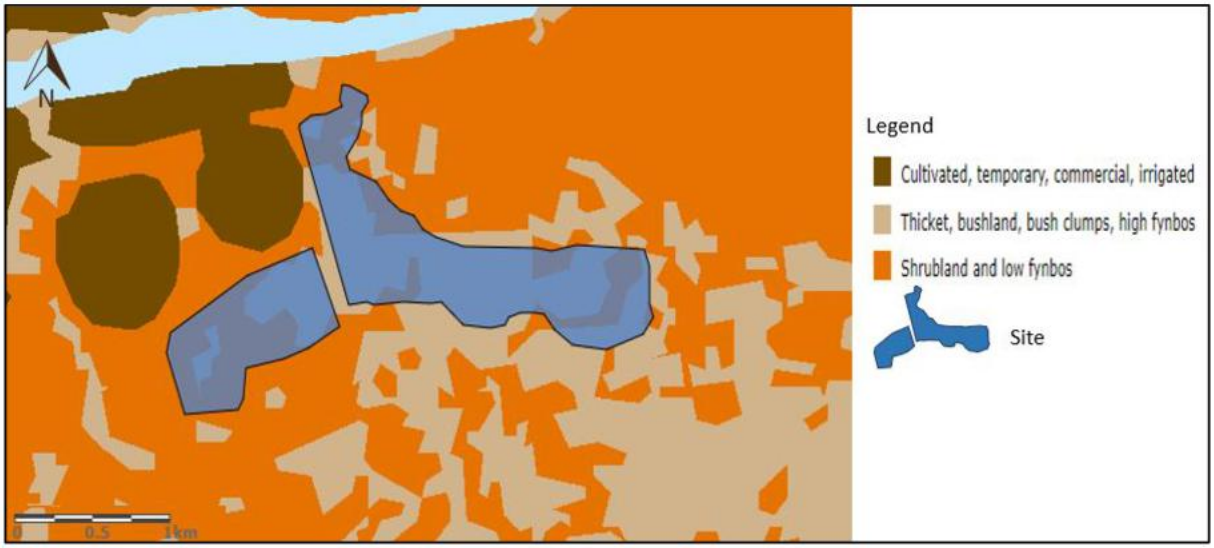

FIGURE 28: LAND COVER CLASSIFICATION ACCORDING TO AGIS COMPREHENSIVE ATLAS

One of the biggest factors affecting the grazing potential in the Northern Cape is the erratic rainfall. A study completed by Visser (2017), indicated that grass veld in the Northern Cape had a high protein shortage during the winter seasons, but during the green season, it had higher protein content within a few days after good rains. It was clear that during winter, the use of high crude protein supplements was necessary if the area is used for small stock farming. Farmers in this area aim to produce small stock ready for slaughter directly from the veld. The reason for this being the long distance from grain-producing areas, resulting in uneconomical feed lotting of sheep due to high transport costs of grain and animals (Visser, 2017). Farmers, therefore, rely mostly on natural pastures to provide sufficient energy, protein, and a balanced combination of minerals for the growth and production of sheep.

As discussed earlier, the raisin industry plays a key role in stimulating rural economies and in 2019 produced a total GDP in the region of R 4.1 billion and resulting in total Capital utilisation of R5.1 billion.

In comparison with livestock production in South Africa, only 70% of agricultural land in South Africa can be utlilized for livestock and game and species are found in all provinces, with high concentrations in the eastern higher rainfall regions. Statistics in 2010 indicated that only by 13.6 million beef cattle, 1.4 million dairy cattle, 24.6 million sheep, 7 million goats, 3 million game species, 1.1 million pigs, 113 million broilers, 31.8 million layers, and 1.6 million ostriches (Meissner *et al*., 2013). In relation to field crops and horticulture, livestock products increased from 42% to 47% of gross agricultural value, mainly due to the

rise in demand in the consumer market, particularly for meat. The sector has always been a major employer, but the employment rate has declined steadily since 2000 because of increased minimum wages, fewer commercial farmers, and increased property size.

From an ecological point of view, according to Meissner *et al.*(2013), the livestock sector in South Africa is a major role player in the conservation of biodiversity through a variety of well-adapted indigenous and non-indigenous breeds and rare game species.

Statistics on livestock farming in the Northern Cape however was not available, but considering the lower rainfall and the fact that during winter, stock farmers must provide supplements for livestock, indicates that both raisin and livestock farming can have advantages and disadvantages.

Considering the current low conservation status of the site and the zoning, a change in agricultural practice would not detrimentally affect the ecological value of the property concerned, but would rather boost the economic status thereof when establishing a vineyard. The clearing of vegetation to establish a vineyard for the production of dried vine fruit will conform to the land use abutting the farm and increase the land capability in terms of agricultural potential.

The development of agricultural land from grazing into crop production would also not compromise the needs and the wellbeing of future generations.

Direct Impacts on Land use

Construction Phase:

The stripping of topsoil and clearing of the vegetation of Phase 1 (about 25Ha), construction of artificial drainage, vine floor design, and the establishment of vine trees will result in the loss of grazing (direct impact) and subsequent temporary loss of income to the landowner (indirect impact). The land use of the property will not change and remain agricultural use. The change in agricultural activities will, however, be offset against the net profits of the raisin production within two years, which the landowner had weighed up against the current GDP produced by the grazing unit. The GDP for raisins will be substantially larger than those generated by the current grazing capacity of the site.

If the vineyard establishment is however unsuccessful, it will be difficult (not impossible) to rehabilitate the site back to a grazing unit. The fundamental difference of the Karroid grassland from all of the other grassland ecosystems is largely due to the significantly different climate. The highly variable and low

summer rainfall is the limiting growth factor and not the temperature or the duration of the growing season. Although the grassland is slow-growing due to the low rainfall, it can support animal production year-round and grazing is an important 'driver' in these systems (SANBI, 2013), as was discussed above.

The plant species in the Karroid grassland are driven primarily by adaption to drought and most of the species are perennial and long-lived, persisting vegetatively over long periods with a significant amount of reproduction that takes place through seed production. This means that plants can persist in the form of dormant seeds in the seed bank through periods of drought (SANBI, 2013). Generally, karroid shrubs spread into the more arid parts of these grasslands during drier cycles, but are replaced by grasses again when periods of higher rainfall return, and thus the seed can be dormant for some time. Thus, these grasslands are quite resilient to impacts over a short-term (five-year) period and may be expected to recover from inappropriate management within the course of several growing seasons, if topsoil has not been lost. (SANBI, 2013). The conclusion is thus if the vineyard is unsuccessful during the first 5 years, there is a likely chance that it can be rehabilitated back to a karroid grassland unit.

As a contribution and a step towards reclaiming the protected plant species from the site, the transport/transfer of species identified in the vegetation report must take place and be transplanted to Erf 1. If, for whatever reasons the vineyard fails, species from Efr 1 can then be harvest and used for rehabilitation.

To mitigate this potential impact during the construction phase, the planning of the vineyard must be done correctly. The impact during the construction phase is rated very low with mitigation but low without.

The placing of signs, fixed beacons, and fences at the site will have no impact on the land use.

Operational Phase

Once the vineyard is established and producing a harvest there will be no impact on the land use if the soil is managed correctly to prevent soil degradation and ultimately failure of the vineyard. If mitigation is however not implemented and the vineyard is unsuccessful after a few years, the land use will remain agriculture, however, it will not be a productive agricultural unit. As mentioned above, after 5 years there is a possibility that the dormant seed bank could be lost and it will be difficult and very costly to rehabilitate the site into a functional grazing unit.

Considering the low conservation status of the property, the proposed establishment of a vineyard would not detrimentally affect the ecological value of any property concerned, but would rather increase the

economical value of the property (if managed correctly). It is the author's view that this particular development can be integrated with the surrounding land users, who are currently farming without endangering sensitive natural and cultural resources or abutting land users. With mitigation, the impact is rated low, but without mitigation, the impact on land use is rated moderate-high.

Indirect Impact on the land use

Construction & Operational Phase

If soil management is not carried out and soil degradation results in the failure of the vineyard, the indirect impacts are economically and environmentally.

From an economical point of view, the expected R15 million annual income, the 35 employment opportunities during the construction phase, the 23 permanent employment opportunities during the operational phase, including over 300 seasonal employment during harvest time, of which 85% will be for previously disadvantaged people, will be lost. It is clear that if the vineyard is unsuccessful, there will be a high negative financial impact on the applicant, as well as employees and their households who are dependent on the income. From an economical point of view, the impact is rated low-moderate (positive) with mitigation, but reduce to moderate (negative) without mitigation and the result of a failed vineyard.

From an environmental point of view, about 111.22Ha of natural veld will be disturbed and transformed into the vineyard, however, the vegetation report completed by Dr. van Aardt, indicated that when the vegetation onsite is considered, it does not represent species of ecological importance. Overall Dr. van Aardt is of the opinion that the site is not listed as an endangered or protected ecosystem and the study area has limited connection to other environments with natural conditions that represent the Northern Upper Karro. Therefore the transformation of this unit into a vineyard will not lead to the degradation of a protected or endangered ecosystem, and since the connectivity is already compromised, it is better from an environmental point of view to develop this section, rather than another more intact portion of land. From an environmental point of view, the impact is rated low with mitigation but increase to low-moderate without mitigation.

Cumulative Impact on the land use

Cumulatively, if the vineyard is established, it would increase the total area under cultivation in this region by about 111.22Ha, but since the land use (agriculture) will remain the same, there is no cumulative impact. Most of the cumulative impacts related to the establishment of the vineyard are related to incorrect soil management and application of pesticides, which has been discussed previously.

Impact on the land use

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Site Specific	1	Site Specific	1	Site Specific	1	Site Specific	1
Duration	Medium Term	2	Short Term	1	Permanent	4	Short Term	1
Intensity	Low-Medium	3	Low-Medium	3	High	6	Medium	4
Probability	Likely	3	Likely	3	Definite	4	Likely	3
Cumulative Impact	None		None		None		None	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low**	**18**	**Very Low**	**15**	**Moderate-High**	**44**	**Low**	**18**
Extent to which impacts can be reversed	Impacts on land use and land capability can be successfully reversed through correct soil management.							

FLORA

Vegetation plays an important role in maintaining ecosystems, stabilizing soils, maintaining the aesthetics of an area and in providing income for landowners. Therefore, when development is anticipated the

vegetation structure needs to be analyzed, and rare or endangered plant species must be identified. Vegetation structure is mostly determined by the geology and climatic factors.

There are an estimated 5 400 plant species in the Northern Cape that occur in six large biomes: the Nama Karoo Biome, Succulent Karoo Biome, Savanna Biome, Grassland Biome, Fynbos Biome, and Desert Biome. More than 30% of the plants found in the Northern Cape are endemic and most of these occur in the Succulent Karoo along the West Coast of South Africa. Many of these plants are rare or threatened, with very limited distribution.

A tree aloe that is a typical landscape feature of the Northern Cape is the kokerboom, or quiver tree (*Aloe dichotoma*). This tree aloe is found growing mainly on the rocky habitat of the hills along the Orange River. In places it occurs in dense "forests", and good examples of these occur just south of Kenhardt and between Pofadder and Pella. The Doringberg hiking trails near Prieska pass by these gentle aloe giants, and close to 4 000 trees can be seen in the Kokerboom forest on the Kokerboom hiking trail near Kenhardt. Necessitated by the harsh climatic conditions, the kokerboom has adapted to survive. Low air humidity, low soil moisture and intense sunshine levels have made it necessary for it to absorb every available scrap of moisture. It, therefore, has a superficial root system enabling it to absorb moisture quickly (Experiencenortherncape).

A vegetation survey was completed by Dr. van Aardt and according to the vegetation report, the study site is not regarded as a site of ecological importance when studying the vegetation nor does the site have any high conservation value. Five different vegetation units were identified by Dr. van Aardt and are indicated in the below figure. These were:

Vegetation unit 1 (Erf 1 and to be excluded from development): Karroid component;
Vegetation unit 2: (Erf 1 and to be excluded from development): Karroid with scattered grass component;
Vegetation unit 3 (or Phase 1 and 4 of the development): Karroid grassland;
Vegetation unit 4 (or Phase 2 & 3 of the development): Karroid rocky component; and
Vegetation unit 5 (Excluded tom the development): Drainage line.

FIGURE 29: VEGETATION UNITS OF THE STUDY AREA ACCORDING TO THE VEGETATION SURVEY REPORT

Vegetation unit 1 is natural with some invasion by alien invasive plants in the form of the tree *Prosopis gladulosa*. The vegetation is composed of a lot of naturally occurring vegetation of the Northern Upper Karoo.

Vegetation unit 2 is degraded due to previous possible extraction of gravel in the unit, but it does host some protected plants such as *Boscia albitrunca, Nerine laticoma,* several *Mesembryanthemum* species, and *Aloe clavifora* as well as areas covered with dense stands of *Senegalia mellifera* and *Rhigozum trichotomum* which indicates overgrazing.

Vegetation unit 3 is dominated by shrubs (*Rhigozum trichotomum, Roepera incrustata, R. lichtensteiniana* and various *Lycium* species) and grasses (*Enneapogon cenchroides, E. desvauxii, E. scoparius, Stipagrostis ciliate, S. uniplums,* and *Eragrostis lehmanniana*) that are characteristic of the Northern Upper Karoo. The area also has the presence of *Boscia albitrunca* and therefore has a medium conservation value.

Vegetation unit 4 is dominated by scattered shrubs with a low cover-abundance of various grass species. It is however evident that the vegetation in this unit is also characteristic of the Northern Upper Karoo dominated by *Rhigozum trichotomum, Roepera lichtensteiniana, R. incrustata, Enneapogon chenchroides* and *Orepetium capense.*

Vegetation unit 5 has several individuals of the alien invasive tree *Prosopis glandulosa* but is considered an area with high ecological sensitivity due to the area being a drainage line with an important ecosystem function.

With the above-mentioned factors, the site is not listed as an endangered or protected ecosystem with only the drainage line as an important ecological feature with ecological functions, which is excluded from the development. The areas surrounding the site towards the north, west, and south are transformed due to agricultural activities or national roads. Another disturbance such as the old Prieska-Douglas road and the Eskom servitude is also present in the area under study. Vegetation towards the east is still in a natural condition and representative of veld in the Northern Upper Karoo. However, the area has limited connection to other environments with natural conditions that represent the Northern Upper Karoo, according to Dr. van Aardt. The full report can be viewed in the appendix attached.

Several protected species were found, however, these species are also present and plentiful in the natural areas surrounding the site. It would however be recommended that some of the geophytes be transplanted in other natural areas. Several large trees of the protected *Boscia albitrunca* were found at the site. If development does take place, the botanist recommended that effort is made to protect as many as possible of these species. Permits need to be obtained before any of these species can be removed. No red data species were found to be present at the site.

All alien invasive species, especially the *Prosopis glandulosa* should be removed and eradicated from the site as a high priority.






FIGURE 30: VEGETATION FOUND AT THE SITE

Direct Impact on the flora

Construction & Operational Phase:

The direct impact during both phases of the development is the complete removal of natural vegetation and the replacement of vine trees. Depending on the floor plan, crops might or might not be established between the rows, however, if successful, the removal of natural vegetation will be permanent and to the extent of about 111.22Ha.

Several protected species were found, all of them had conservation status of Least Concerned or not listed. The vegetation report recommended that some of the geophytes identified onsite (e.g. *Ammocharis coranica, Eriopermum roseum, Ledebouria apertiflora, L. revuluta, Chlorophytum fasciculatum, Dipcadi bakerianum, Nerine laticoma,* and *Tulbaghia leucantha* should be transplanted to Erf 1. The *Aloe claviflora* was also identified and can also be transplanted to Erf 1.

The vegetation report recommended that an effort be made to protect as many as possible of the *Boscia albitrunca* (commonly known as the shepherd's tree) and that permit to remove these trees must be obtained before the species can be removed.

The alien invasive *Prosopis glandulosa* must be removed and eradicated from the site as a high priority.


Ammocharis coranica


Eriopermum roseum


Ledebouria apertiflora


L. revuluta


Chlorophytum fasciculatum


Dipcadi bakerianum


Nerine laticoma


Tulbaghia leucantha


Aloe claviflora


Boscia albitrunca


Prosopis glandulosa (alien species)

FIGURE 31: DIFFERENT PROTECTED PLANT SPECIES IDENTIFIED ON SITE AND ALIEN SPECIES

The floor plan could include allowing natural vegetation to establish between the rows, however, it is most likely that sod, mulch, or no-till seed crops will be established. The floor plan is the most critical aspect to ensure the re-establishment of vegetation between rows, which would encourage bio-mass accumulation, improve the humus content, and stabilise soil, which in turn would prevent erosion and protect the soil from degradation.

If for whatever reason the vineyard is not successful, the probability of the site being rehabilitated to represent Northern Upper Karroo vegetation will then also be more likely, since the floor plan would have ensured that there are a sufficient percentage of vegetation surface cover and over time, other species will

migrate on the rehabilitated land and eventually the Northern Upper Karroo vegetation will through natural succession migrate into the rehabilitated vineyard area.

It is however not the intent of the applicant for the vineyard to be unsuccessful, therefore the direct impact on the flora is permanent, the intensity is between high and medium, due to the fairly large portion of the area regardless of the low conservation status (111.22Ha once fully developed) and the probability will be definite. Thus with a floor plan and conservation or offset plan to transfer the geophytes, or *Aloe claviflora* and alien eradication plan, the significance level is rated moderate, without any mitigation the impact increase to moderate-high.

ALIEN VEGETATION CONTROL

Prosopis glandulosa

The *Prosopis glandulosa* is a very aggressive invader, especially in sub-tropical arid and semi-arid natural grasslands. It is very drought and salt tolerant and can rapidly out-compete other vegetation. Seeds are spread widely by grazing animals and will persist for long periods in the seed bank. Invasion generally involved an increase in plant density rather than an increase in its range, and quickly block paths and make areas impenetrable.

There is no efficient and cost-effective method to completely eradicate *P. glandulosa* and many studies have proven that total kill and exclusion of *P. glandulosa* is almost impossible since once a site is invaded, encroachment and reinvasion are most likely. Rather the control will be more important (CABI, 2019).

Fire can be used as part of an integrated control program / or in conjunction with other methods. Fire can be used to prevent the re-establishment of young *P. glandulosa*. Young seedlings are sensitive to fire, but large trees are not affected due to the thick bark and resprout quickly after a fire.

For larger trees, the use of herbicides that produce deadwood (fire fuel) will ignite and support a sustained fire with more likelihood of killing the remaining trees (CABI, 2019). The use of fire should however always be done with caution, as fire can easily get out of control and could impact abutting properties and destroy other valuable habitats.

Mechanical control methods include site clearance involving tractor operations in which roots are severed below ground level to ensure tree kill. These operations include root ploughing and chaining, which are often the most effective mechanical means, using a mouldboard plough pulled behind a caterpillar tractor, or a heavy chain pulled between two machines (CABI, 2019).).

With root ploughing, large trees must first be felled by hand, but this treatment has been used to remove stumps of up to 50cm in diameter without difficulty and has a treatment life of 20 years or more (CABI, 2019). However, this method is most expensive and is only recommended on areas with deep soils that have a high potential for subsequent increased forage production. The soil should neither be too wet or too dry for effective root ploughing.

With chaining, the soil moisture is also important, if the soil is too dry, the stem will break leading to coppicing, if it is too wet, the soil and understorey is damage. The ideal is for soil to be dry on the surface but moist below.

For smaller, unbroken trees or smaller portions of invaded land, hand clearance by sending work teams into the invaded pasture to fell all trees and seedlings and uproot stumps can be applied. It is generally more labor-intensive and expensive for the landowner, but remains practical (CABI, 2019).

Chemical control treatments involve the use of herbicides to kill trees, with the most effective being stem or aerial applications of systemic herbicides (CABI, 2019). The most effective chemical for high tree kill is clopyralid which is used in the USA, but dicamba, plicloram, and triclopyr have also been successfully used.

Biological control includes the using species of seed-feeding bruchid beetles or animals grazing the area. Some studies have shown that the germination of ingested seed following passage through different animals could reduce the spread of *P. glandulosa*. Thus, replacing free-ranging cattle with particularly sheep and pigs in conjunction with other control methods could drastically reduce the spread.

It has also been found that bruchid beetles (*Algarobius prosopis* and *A. bottimeri*) can destroy substantial amounts of seed-produced trees and thus severely limiting the potential for invasion and have been successfully introduced in part of control programmes in South Africa. The advantage with bruchids is their observed host specificity, with many species found to feed only on *P. glandulosa*. Other seed-feeding insects such as the *Mimosetes protractus* and *Neltumius arizonensis* were also introduced in South Africa in conjunction with the bruchid beetles and were successful in establishing themselves in large numbers and having a significant effect on *P. glandulosa*. Maximum damage to seed was found where grazing was controlled to prevent livestock devouring the pods before the insects could destroy them. The seed-feeding weevil (*Coelcephalapion gandolfoi*) have also proven to be very successful in specifically only targeting *P. glandulosa*.

Ultimately integrated control is the better method. Mixed mechanical, chemical and fire methods have proved more effective than alone, but are costly and required a high-level of management. Thereafter the correct management of soil coverage should be implemented with regular monitoring and removal of young *P. glandulosa*.

Indirect impact due to the removal of vegetation

Construction & Operational Phase

One of the indirect impacts of clearing vegetation is the destabilization of soil, dust generation, and erosion, which was discussed previously under the heading 'Geology and Soil' in detail and will therefore not be repeated here.

Another is the destruction of habitat, thus the indirect impact will be on the fauna, which is discussed in detail below this section, under the heading 'Fauna' and therefore will not be repeated here.

There is no other indirect impact associated with the removal of vegetation.

Cumulative Impact on the Flora

The clearing of 111.22Ha of natural vegetation will ultimately contribute to the total areas cleared in the region for the establishment of cultivated lands. Since the area is surrounded to the east and south by natural veld and the fact that the site is not considered an endangered or protected ecosystem the cumulative impact on clearing of vegetation is rated low.

Impact on the flora

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Site Specific	1	Site Specific	1	Site Specific	1	Site Specific	1
Duration	Permanent	4	Permanent	4	Permanent	4	Permanent	4
Intensity	Low-Medium	3	Low	2	High	6	Medium	4
Probability	Definite	4	Definite	4	Definite	4	Definite	4
Cumulative Impact	Very Low		Very Low		Low		Low	

Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low-Moderate**	**32**	**Low-Moderate**	**28**	**Moderate-High**	**44**	**Moderate**	**36**
Extent to which impacts can be reversed	Impacts on vegetation are compensated as the adjacent area to the east of the site and south hosts similar habitats. The impacted vegetation can be mitigated to some degree through a conservation plan/offset plan by transplanting some plants to Erf 1 and control alien vegetation.							

FAUNA

Animals play an important role in maintaining the functioning of any ecosystem, for example, pollination, spreading of seeds, removing of pests, trimming of vegetation, etc. The largest part of the Northern Cape falls within the Nama-Karoo biome with a vegetation of low shrubland, grass, and trees limited to watercourses. The region is typically an arid environment and the terrain and general landscape do not represent much topographical variation. Therefore faunal species are generally widespread across the region, although some key biotopes such as rivers or pans, or the presence of a particular plant species can become an obvious niche for particular animal species that can result in a concentrate of species at a certain location.

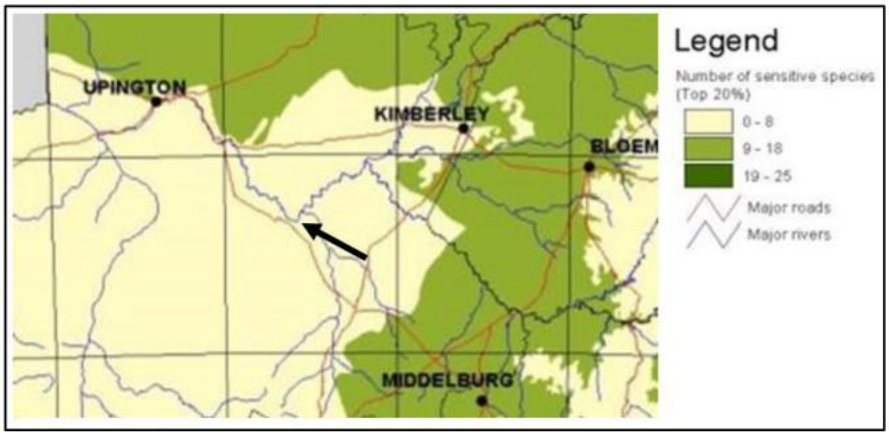

FIGURE 32: SENSITIVE MAMMAL SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

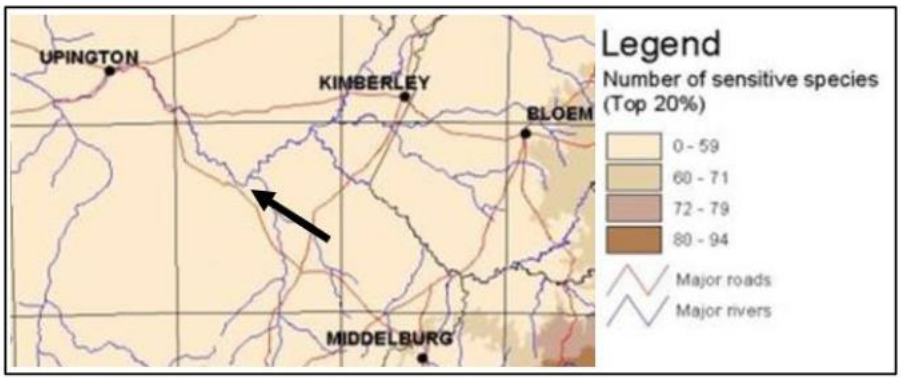

FIGURE 33: SENSITIVE BIRD SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

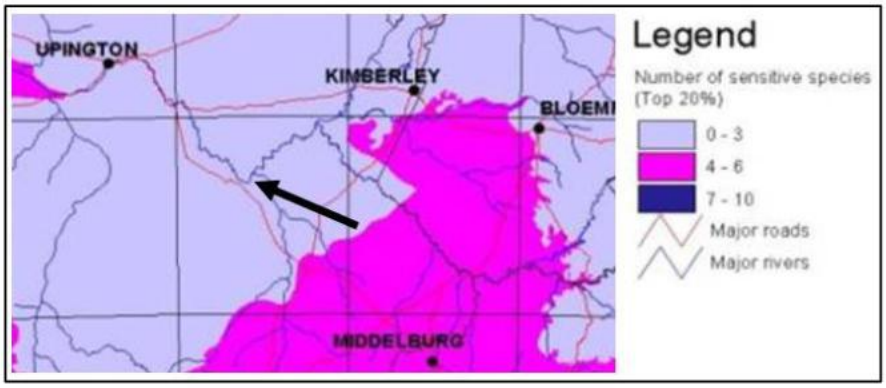

FIGURE 34: SENSITIVE REPTILE SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

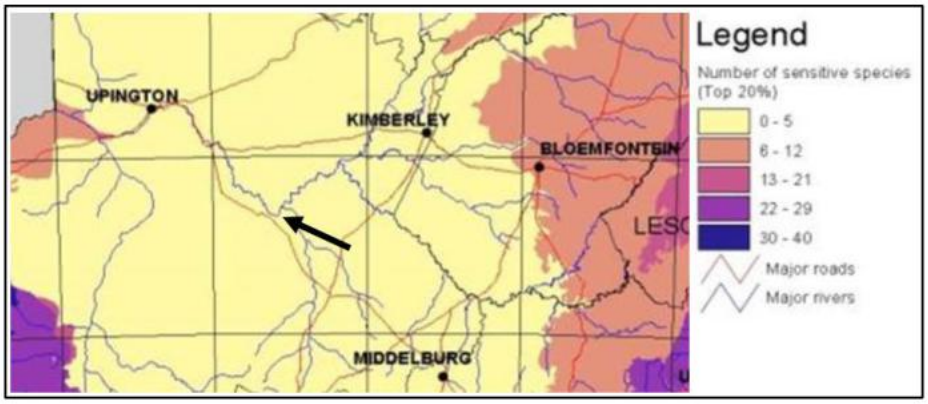

FIGURE 35: SENSITIVE BUTTERFLY SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

The occurrence of faunal species within the proposed area is likely, however, it is farm properties and generally fenced-in camps, which hinders the mobility of some of the larger wildlife that cannot jump a fence or the smaller wildlife that cannot borrow. Typically, many of the species encountered in the region are species such as the Common Duiker (*Sylvicapra grimmia*), Springbok (*Antidorcas marsupialis*), Steenbok (*Raphicerus campestris*), Blesbok, (*Damaliscus pygargus phillipsi*), Smiths red rock rabbit (*Pronolagus*

rupestris), Scrub Hare (*Lepus saxatilis),* Spring Hare (*Pedetes capensis*), Meerkat (*Suricata suricatta*), Ground Squirrel (*Xerus inauris*), Rock elephant shrew (*Elephantulus myurus*), Suricate or Stokstertmeerkat (*Suricata suricatta*), Rock dassie (*Procavia capensis*), Yellow Mongoose (*Cynictis penicillata*), and Aardvark (*Orycteropus afer*).

Some reptiles can include the Leopard tortoise (*Stigmochelys pardalis*), Cape Cobra (*Naja Nivea*), Puff adder (*Bitis arietans),* Mole snake (*Pseudaspis cana*), Bibron's gecko (*Pachydactylus bibronii*), Southern rock agama (*Agama atra*), Ground agama (*Agama aculeata*), Striped skink (*Plestiodon fasciatus*), Cape skink (*Trachylepis capensis*). Amphibians such as the Common caco (*Cacosternum boettgeri),* Giant bullfrog (*Pyxicephalus adspersus*), Karoo Toad (*Bufo gariepensis),* Common platanna (*Xenopus laevis)* might also occur in the region.

This arid region hosts at least 215 bird species of which 68 species are endemic or near-endemic species, 18 red-listed species, and 5 red-listed endemic species. Several large terrestrial bird and raptor species, of which the most important are Ludwig's Bustard (Neotis ludwigii), Kori bustard (Ardeotos kori), Secretarybird (Sagittarius seppentarius), Karoo Korhaan (Eupodotis vigorsii), Verreaux's Eagle (*Aquila verreauxii),* the Tawny eagle (*Aquila rapax)* and Martial Eagle (*Polemaetus bellicosus*), Lanner falcon (*Falco biarmicus*).

The Northern Cape is home to an assemblage of arid sone adapted smaller bird species including larks, such as Spike-heeled Lark (*Chersomanes albofasciata*), sparrow-larks, chats and other. Form a conservation perspective, the Red Lark (*Calendulauda burra)* and Sclater's Lark (*Spizocorys sclateri),* who are both listed as regionally threatened species (vulnerable and near-threatened respectively). They have very restricted ranges. Other species can include the Spotted Eagle-owl (*Bubo africanus*), Martial Eagle (*Polemaetus bellicosus*).

Other potential bird species include the Sociable weaver (*Philetarius socius*) which builds huge grass nests to the critical infrastructure of developments which can cause problems.

On the day of site inspection, the following animal species were noted at the site, the mongoose (*Herpestidae*), the steenbok, the spotted thick-knee (*Burhinus capensis*), storks (*Ciconiidae*), the African sacred ibis (*Threskiornis aethiopicus*); and the black-headed heron *(Ardea melanocephala)* and the sociable weaver.

<u>Direct Impacts on the fauna</u>

Construction & Operational Phase:

Removal of vegetation will destroy habitat and have a direct impact on animals living in the study area. During the construction phase, continuing into the operational phase, the clearing of vegetation will put animals at risk of being killed and nesting places being destroyed.

In terms of animal migration (which is not just birds, but also includes mammals, fish, reptiles, amphibians, insects, and crustaceans), the three most common reasons for migration in ecology are due to local climate, local availability of food, and mating reasons. Vegetation towards the east is still in a natural condition and representative of veld in the Northern Upper Karoo and there is a drainage line south of the site which can provide corridors for movement. However, the site is currently divided into camps and fenced, thus in the current status, it is already restricting the connection to other environments for mammals and certain reptiles. Borrowing mammals, birds, and insects are more mobile and can migrate across camps without restriction and the development will not detrimentally affect the migration patterns of these animals.

During the vegetation survey, no special ecological niche was identified that would provide specific micro-habitat to a specific faunal species. The conclusion was that the site does not represent an endangered or protected ecosystem, thus it is highly unlikely that the destruction of habitat will lead to the impact on any specific faunal species that is dependent on a specific micro-habitat for survival or occurrence.

In terms of fish, amphibians, and most crustaceans, they would be restricted to aquatic environments, and since all drainage lines and the Orange River are excluded from the site, the proposed development will not impact these animals or their movement.

Noise generated by vehicles will cause most animals to vacate the site temporarily. Noise on site will be generated by the bulldozer and possible trucks and output will probably range from 65-75dB at the source. The hearing anatomy of animals is very sensitive to noise. Studies have shown that acoustically oriented birds have reduced species richness and abundance and different community compositions in experimentally noise-exposed areas relative to comparable quiet locations (Masayuki, 2020). The study also found both acoustically oriented grasshoppers and odonates without acoustic receptors to have reduced species richness and/or abundance in relatively quiet areas that abut noise-exposed areas. Since farming activities are existing in abutting areas, this will not be a new impact and acoustically oriented animals would be accustomed to the impact.

Most of the noises would be low-pitched and would have a lesser impact on animals than what high-pitched noises would have since their hearing systems are much more sensitive to the latter. This will cause animals to vacate the study site during construction and operations and would prevent them from getting hurt or killed. Animals do, however, grow accustomed to increased noise levels and would return to the

surrounding niche areas during quieter times or nighttime. This has been observed at many developments, such as quarry sites, other farming sites, even in towns near nature reserves, where early morning tracks and droppings are clear indications that developing activities do not permanently affect faunal populations as in the case of extensive hunting or air pollution.

Through environmental awareness programs workers can be sensitized to the handling of animals/ nesting places found on site. In addition, the clearing of vegetation would be restricted to limited areas and the slow clearance rate would provide adequate time for migration of any animals remaining on-site to be sustained in similar adjoining habitats. As a standard, the phase that will be cleared must be swept before it is cleared of vegetation to relocate any animals found on site.

Limited hydrocarbon spillages anticipated would not detrimentally affect fauna on site as it would be localized and dealt with in an expedited manner. Hydrocarbons and the servicing of vehicles will not take place on-site hence no impact is anticipated in this regard.

In conclusion, removal of the vegetation in the study area will not result in the extinction of any species or a decrease in species numbers and the impact on the faunal diversity of the site is rated low. Thus the impact can be mitigated and is rated very low with mitigation. If certain species were to be affected they would simply vacate the proposed cleared areas during the day and return during the night.

Indirect impact on fauna

Construction & Operational Phase:

The increase of workers on site, especially during harvest time, could lead to indiscriminate hunting/trapping/poaching as a potential problem and the necessary discipline and monitoring have to be enforced. The applicant will take responsibility for any animal (wild or domestic) that is proved to be killed by members of farm staff. Strict control measures will be put in place and severe penalties will be applicable if any animal on site is poached.

Another impact on fauna is related to the use of pesticides during the operational phase. If exposure is direct to pesticides it can be toxic to a host of fauna, such as birds, fish, beneficial insects (such as bees), etc. However, fauna can also be indirectly exposed to pesticides, for example, if pesticides are applied at the vineyard, it can impact insects and a bird can eat the worm or insect that was exposed to the pesticide, and pesticide residues move up through the food chain.

However, not all pesticides have detrimental effects on all wildlife, nor do pesticide residues necessarily lead to serious consequences for wildlife. The level of impact will be related to the toxicological properties of the pesticide, the level of pesticide residue or its breakdown product (metabolite), the ecological characteristics of the exposure, the sensitivity of a species to the chemical, and the degree to which the species is exposed. It is therefore not a simple assessment and the source of transportation of residue can be via air, water, soil, or food.

In some studies, it was found that exposure to pesticides (directly or indirectly) can also alter an organism's behavior and impacting its ability to survive. In birds, for example, exposure to certain pesticides can impede singing ability, making it difficult to attract mates and reproduce; or affects the bird's ability to care for offspring resulting in the death of the young (Beyond Pesticides). In bees, it was found that even near-infinitesimal levels of systemic pesticides result in sublethal effects impacting mobility, feeding behaviors, and navigation. Deformations of offspring have been found after exposure to hormone-mimicking pesticides classified as endocrine disruptors.

Pesticides can contaminate water through runoff from treated plants and soil, while wind can carry droplets to other fields, grazing areas, human settlements, and undeveloped areas, potentially affecting other species. As previously discussed, the usefulness of pesticides cannot be denied, however, the negative effects on the environment and human health can also not be ignored.

It will be highly likely that the applicant will apply pesticides at some stage to the vineyard once it is operational (established). The only mitigation measure to protect fauna species is to choose the correct pesticide and application method as previously discussed. With mitigation, the impact is rated low-moderate but can increase to moderate-high without mitigation.

Cumulative Impact on fauna

Farming can have a cumulative impact on fauna or not. It depends on the level of responsible farming methods to protect the habitat while providing food and income. Generally, agriculture and the overexploitation of plants and animal species can lead to a significant threat to biodiversity loss and even lead to exposing wildlife and livestock to one another's diseases.

If habitats are destroyed to establish crops, or areas are fenced to control grazing, the farming practices can change the availability of high-quality food at certain times of the year to certain wildlife, and the more farms the larger areas of habitats are impacted cumulatively.

On the other hand, some avifauna prefers transformed lands. For example, the Ludwig's Bustard (*Neotis ludwigii)* is globally 'Endangered' because of a projected population decline resulting from high collision mortality on power lines throughout its southern African range (Shaw *et al.*, 2016). A study completed by Shaw *et al.* (2016) found that compared with the 1980's, Ludwig's Bustards were more strongly associated with transformed lands. In 2010 seventy percent (70%) of the observations of Ludwig's Bustards were on pastures, with fewer seen on crops (9%), stubbles (12%), or ploughed/fallow fields (8%). Thus it would seem that transformed habitats can have a positive impact on other fauna.

On its own, the proposed application would not have a high impact, but cumulatively, an addition of about 111.22Ha will be transformed within this region.

Considering the location of the study site, the abutting area east of the site host similar habitat and due to the topography will not be transformed into croplands. If certain species were to be affected by the proposed development of a vineyard, they would simply vacate the proposed area and find shelter in the drainage lines or area east of the site or they would simply vacate the site during the day and return during the night and over the weekends.

Also, the impact on faunal movement on the property is existing and the proposed development will not contribute to additional impediment of animal migration, thus no cumulative impact is expected in this regard. The overall cumulative impact is rated low with mitigation.

Impact on the Fauna

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Site Specific	1	Site Specific	1	Local	2	Local	2
Duration	Medium Term	2	Short Term	1	Long Term	3	Short Term	1
Intensity	Low-Medium	3	Low	2	High	6	Medium-High	5
Probability	Likely	3	Probable	2	Definite	4	Likely	3
Cumulative Impact	Very Low		Very Low		Low-Medium		Low	

Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low**	**18**	**Very Low**	**8**	**Moderate-High**	**44**	**Low-Moderate**	**24**
Extent to which impacts can be reversed	Through environmental training, correct farming techniques and correct applications of pesticides the fauna can be protected.							

SENSITIVE SITES

The National Protected Area Expansion Strategy (NPAES) was developed to expand protected areas in South Africa to increase ecological sustainability and adaptation to climate change. The proposed study area does not fall within any National Protected area, nor is close to any formal or informal protected area. The Gariep Focus area is about 12km north-west and about 18km east from the proposed site.

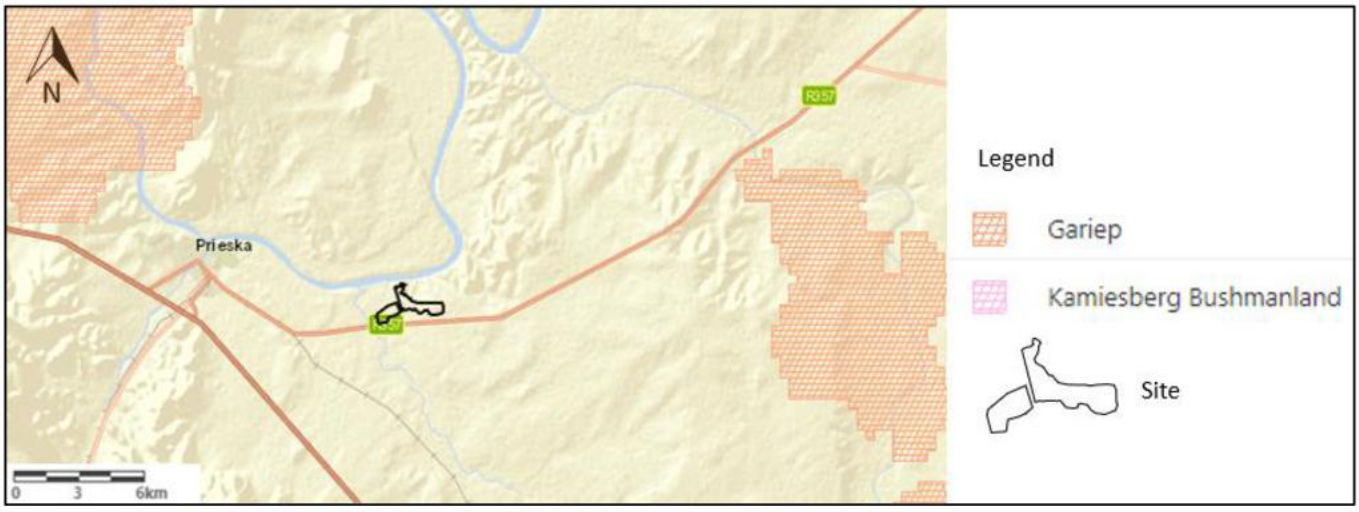

FIGURE 36: THE NATIONAL PROTECTED AREA EXPANSION STRATEGY INDICATES THAT THE GARIEP FOCUS AREA IS SITUATED MORE THAN 12KM FROM THE SITE.

The Northern Cape has a full Protected Area Expansion Strategy developed by the Northern Cape Department of Environment with support from the National Department of Environmental Affairs. The PAES priorities are largely a subset of the Critical Biodiversity Areas from the systematic conservation plan that were identified on implementation priority. SANParks priorities were fully included in the provincial PAES.

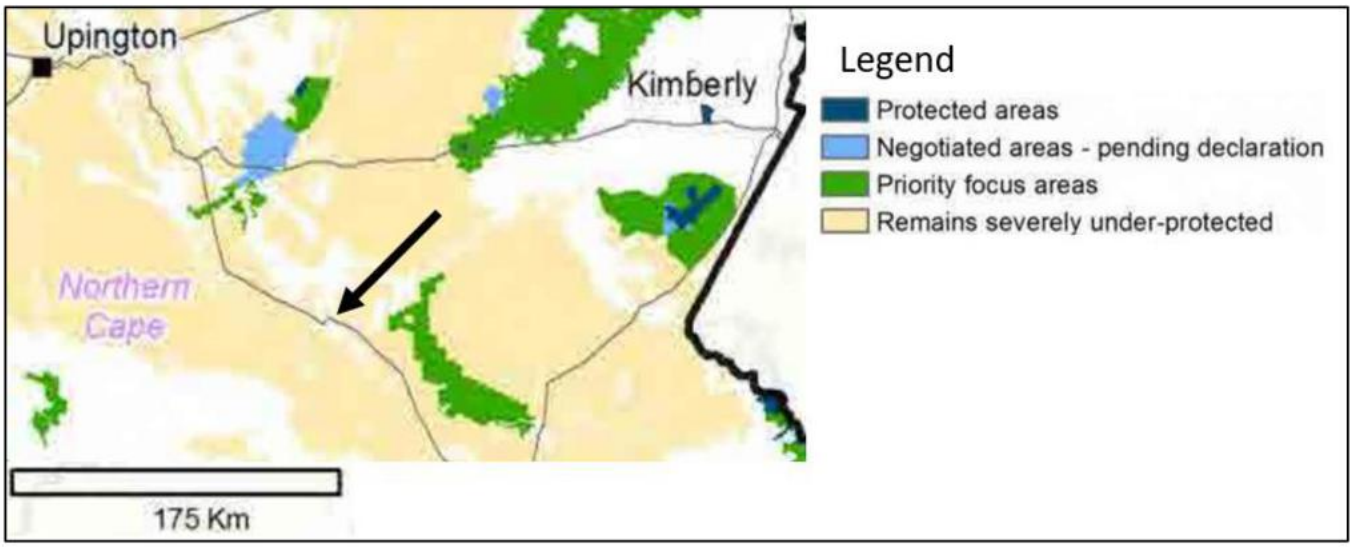

FIGURE 37: PRIORITY AREAS FOR THE PROTECTED AREA EXPANSION IN THE NORTHERN CAPE.

The priority areas in the Northern Cape are in the Succulent Karoo areas of the Namakwa District, Bushmanland, the southern Nama-Karoo as well as in the expansion areas of the existing national parks in the province. The main biodiversity features are the Succulent Karoo and southern Nama-Karoo priorities, as well as river and wetlands. Arid Savanna and some Desert ecosystems are currently not fully included in these priorities. As indicated in the map above, the site does not fall within a focus area.

According to the Northern Cape Biodiversity Conservation Plan, the site falls within a Terrestrial CBA 1 area. Critically Biodiversity Areas (CBA) play an important role in supporting ecological processes. This is particularly the case with riparian areas, some key catchment areas, and key pieces of corridors. CBA areas should preferably not be further developed, no further intensification of land-use activities should be permitted and they should be prioritised for rehabilitation, where possible.

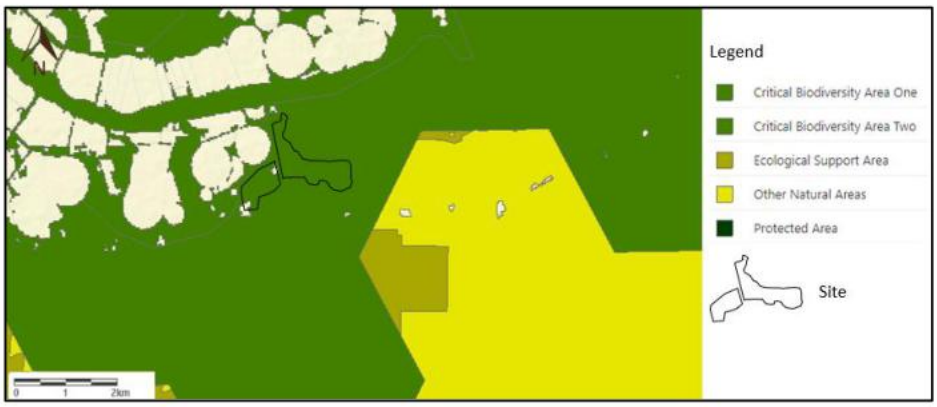

FIGURE 38: THE SITE FALLS WITHIN A TERRESTRIAL CBA 1 ACCORDING TO THE BGIS OF THE NORTHERN CAPE BIODIVERSITY CONSERVATION PLAN.

Critical biodiversity areas (CBA) map and guidelines assist in decision-making when considering the biodiversity status of an area and the proposed land-use or development proposal. The overall aim is to avoid loss and degradation of natural habitat in critical biodiversity areas (CBA's), whilst managing sustainable development in other natural areas remaining. Although the CBA maps constitute the best available biodiversity information, they can never replace a site-assessment and are always to be viewed as the biodiversity informant only in the triple bottom line of sustainable development, i.e. social, economic, and natural environments (Vromans, D. C et al. 2008).

TABLE 6: CBA CATEGORY AND LAND MANAGEMENT OBJECTIVES

CBA category	Land Management Objective
CBA 1	Natural landscapes: Ecosystems and species fully intact and undisturbed • These are areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. • These are landscapes that are at or past their limits of acceptable change
CBA 2	Near-natural landscapes: • Ecosystems and species are largely intact and undisturbed. • Areas with intermediate irreplaceability or some flexibility in terms of the area required to meet biodiversity targets. There are options for the loss of some components of biodiversity in these landscapes without compromising the ability to achieve targets. • These are landscapes that are approaching but have not passed their limits of acceptable change.
Ecological Support Areas (ESA)	Functional landscapes: • Ecosystems moderately to significantly disturbed but still able to maintain basic functionality. • Individual species or other biodiversity indicators may be severely disturbed or reduced.