DRAFT EIA REPORT FOR THE CLEARING OF VEGETATION ON PTN 2 & REMAINDER OF FARM ZWEM KUIL NO. 37 AND REMAINDER OF FARM SMITSKLOOF NO. 38, PRIESKA

ZWEMKUIL GORDONII CC

JULY 2022

Reference: **NC/EIA/03/PIX/SIY/PRI1/2022**

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BACKGROUND

Digital Soils Africa (Pty) LTD (DSA) was tasked by Zwemkuil Gordonii CC to conduct environmental investigations and complete the Environmental Authorisation Application for the authorisation of Portion 2 and the Remainder of the Farm Zwem Kuil No. 37 and the Remainder of Farm Smitskloof No. 38, Prieska in the Northern Cape, for crop production.

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 Zwemkuil Gordonii CC (also referred to as the Applicant) 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.

The Applicant would like to develop 504.7 Ha of which about 406Ha of vegetation will be cleared to establish pivots for irrigating maize/wheat/lucerne crops and also vineyard and nut trees. Of the 504.7 Ha about 98.7 Ha will be used as an offset area for rescued plants.

Currently the majority of the site host intact vegetation with some evidence of overgrazing and past cultivation. Soil samples were taken and analysed to investigate if the soil is suitable for establishing crops. The soil study indicated that the A and B horizons are characteristically sandy and therefore will facilitate good drainage. The drainage restricting layers were the major determining factor for suitability. Approximately 5% of the area has a shallow depth and is not suitable for irrigation or vineyard, while essentially 15% is suitable for vineyard production under drip irrigation. The rest of the area is suitable for all irrigation.

From an environmental point of view, 504.7Ha area should be under application, although only 406Ha would most likely be disturbed, the rest of the 98.7Ha that are located between the proposed ploughing areas should be used as an off-set area and to preserve if for conservation purposes and possible transplant of vegetation, depending on the outcome of the vegetation report.

An application to cultivate virgin soil (commonly known as a plough certificate) will also be applied for at the Department of Agriculture to ensure all legal requirements for such a development are met.

The Applicant has existing water use rights and therefore does 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 Dimela Eco Consulting and found that the vegetation on the site ranged from modified to natural vegetation. The grass layer displayed a patchy dominance of grass species (*Eragrostis, Enneapogon* and *Stipagrostis* species), while the tree layer was mostly dominated by *Senegalia melifera* (swart haak), except along the Orange River, where *Vachellia karroo* (sweet thorn) dominated. Dominance of species varied

depending on soils substrate (e.g. sandy, red sandy and pebbly soils). Several ephemeral and dry drainage lines were recorded, characterised by a higher number of tree species.

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 19.5km south and about 30km southeast of the proposed site. The site does not fall within any of the focus areas of the Northern Cape Protected Area Expansion Strategy, but according to the Northern Cape Biodiversity Conservation Plan, the site falls within a Terrestrial CBA 1 area.

The Siyathemba Municipality has mapped the environmental sensitivity of the municipal area in the SDF. The sensitivity is rated from 0-6 (0 being no sensitivity, 1 being low sensitivity, 6 being high sensitivity). 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 2 and thus has low sensitivity.

Considering all the maps available and data presented, it was 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. While most of these plans are broad-based, regional/national plans are wide-scale plans and do not consider the land-use of the area and surround or site-specific features and locations. Others are more regionally specific like the Siyathemba Municipality SDF is a localised plan. Thus broad-based, regional/national plans might indicate that a site is not sensitive, but localised plans might indicate otherwise, or *vice versa*.

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 much of the vegetation on the site was in a good ecological condition, and due to its size and limited disturbances, rates high in its functional integrity and scores a medium Site Ecological Importance (SEI). Most of this vegetation also falls within CBAs, which should ideally remain in a natural state. However, areas that were historically cleared and highly disturbed were rated as very low and low SEI. Also, most of the vegetation on the site is not unique and the Upper Nama Karoo vegetation is not considered threatened. Furthermore, no plant species of conservation concern were recorded or are expected to be present in these groups.

The site falls within the Nama Karoo Biome. Most of the area under investigation falls within the Upper Gariep Alluvial Vegetation. This vegetation occurs on flat alluvial terraces and comprises complex alluvial thickets dominated by *Vachellia karroo* (sweet thorn) and *Diospyros lycioides* (blue bush), flooded grasslands, reed beds and ephemeral herblands on the sandy riverbanks. This vegetation is considered Vulnerable. More than 20% has been cultivated. The most study area along the Southern Section falls within the Northern Upper Karoo which comprises shrubland dominated by dwarf karoo shrubs, grasses, and the tree *Senegalia melifera* subsp *ditensis* (black thorn).

In terms of the ecological drivers and processes in savanna, Dimela Eco Consulting indicated that the Karoo vegetation comprises a mixture of grasses and dwarf shrubs, with grass abundance linked to the average annual rainfall. Higher rainfall usually results in higher grass abundance, while grazing also plays a role. Fire is not an important driver of the Karoo ecosystem as the rainfall is too low to support regular fire events. The establishment

of cultivated areas is unlikely to affect ecological processes, however, it is recommended that open spaces or green stepping stopes should remain between cultivated areas.

PERSONAL PARTICULARS OF APPLICANT

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Responsible person:
Mr. Jurie Loots will be the responsible person for this application. Jurie Loots is a member of the Dirk Loots Familie Trust and Ernst Loots is a family member that gave consent to this development.

ENVIRONMENTAL CONSULTANT

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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.

Jan-Dirk Marx is currently completing his MSc in Soil Science focusing on soil degradation. He also assisted in fieldwork and report writing for the period of his masters. Jan-Dirk is a SACNASP candidate scientist.

TITLE DEED DESCRIPTION

Portion 2 and the Remainder of Farm Zwem Kuil No. 37 and the Remainder of Farm Smitskloof No. 38, Prieska, Northern Cape

REGIONAL SETTING

SITE LOCATION

The site is situated north-east of Prieska in the Northern Cape (29° 26' 05.43"S; 23° 03' 03.81"E most centre point of the site) on Portion 2 and the Remainder of Farm Zwem Kuil No. 37 and the Remainder of Farm Smitskloof No. 38, within the Siyathemba Municipal area. The farm can be reached by travelling along the R357 for about 18km onto the Muishoek road. This Muishoek road turns into a gravel road and the farm is reached about 30km straight along this gravel road until a T-junction is reached. Zwem Kuil farm is left off the T-junction, for another 5km.

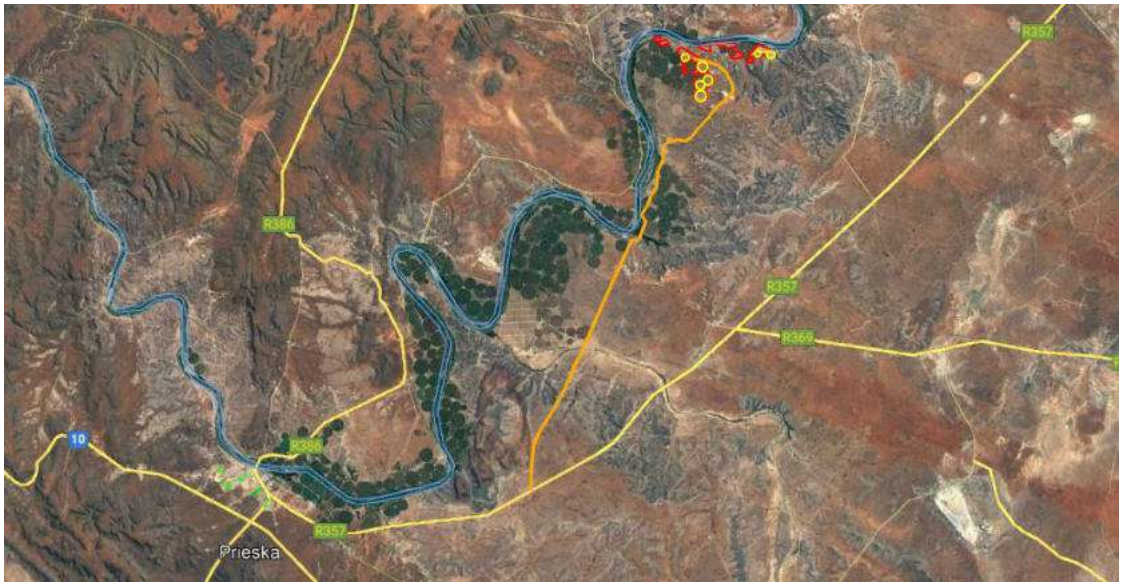


FIGURE 1: SITE LOCATION. THE ORANGE RIVER IS THE BLUE LINE, THE MUISHOEK ROAD IS THE ORANGE LINE, THE PROPOSED SITE IS REPRESENTED BY THE RED AND YELLOW POLYGONS.

LAND DESCRIPTION / INFORMATION

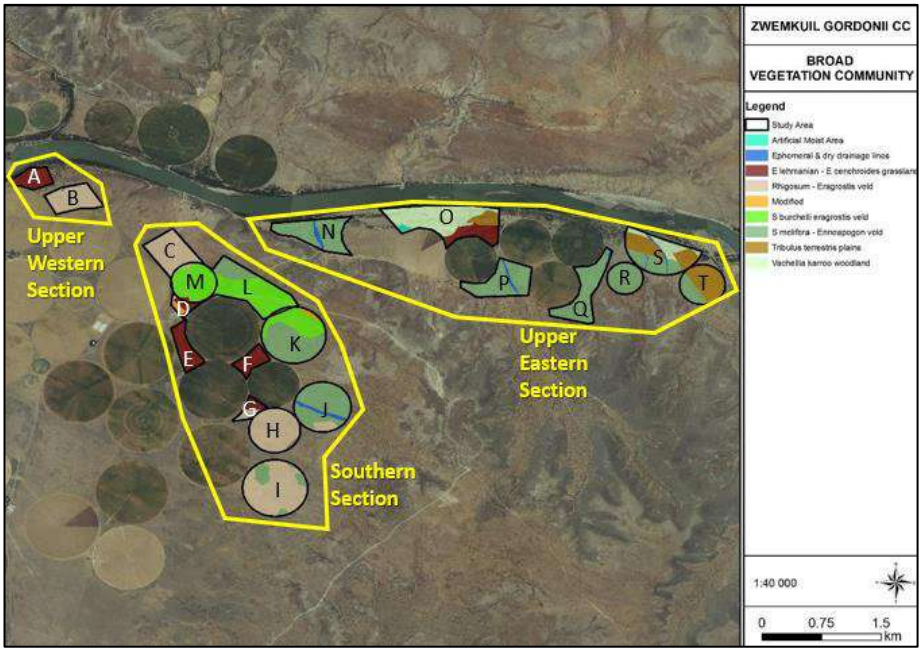


FIGURE 2: DIFFERENT SECTIONS OF THE SITE, OVERLAID WITH THE VEGETATION SITE DEMARKATION.

The site can be divided into three broad sections: The Upper Western Section (which are areas A & B identified from the vegetation survey), the Upper Eastern Section (which are areas N, O, P, Q, R, S, T), and the Southern Section, which are the rest of the areas under application (see Figure 2).

Dimela Eco Consulting indicated that a historic aerial image dated 1993 shows the project area and that south of the Orange River, the land was uncultivated. By the year 2005, several pivots were already established and more recently, Google Earth Satellite imagery of the sites and surroundings includes more recent pivots as well as diamond mining to the east of the proposed sites.

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 crops 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 approval for cultivating virgin soil (commonly referred to as a plough certificate) from the Directorate Land Use and Soil Management of the Department of Agriculture.

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 however situated close to the Orange River on a fairly flat, undulated landscape.

TABLE 1: DESCRIPTION OF LISTED ACTIVITIES ASSOCIATED WITH THE PROJECT

Act. No.	Listings	Coordinates of listed activities (centre point coordinates of the listed activity location)
GNR 325: Activity 15	The clearance of an area of 20 hectares or more of indigenous vegetation.	29° 26' 05.43"S; 23° 03' 03.81"E

PLANNING PHASE

Although 504.7 Ha are under application, only 406 Ha will potentially be cleared from vegetation to establish crops. Thus, during the planning phase, the location of the crops and pivots must be determined based on soil suitability and other potential environmental factors (e.g. wetlands, streams, ecological sensitive areas, etc.). There are existing pivots on the farm and the applicant would like to establish another 7 (seven) pivots for maize and lucerne crops and utilise the areas between the existing pivots on the farm for either vineyard or pecan nut crops.

The soil report and findings were the leading factors in deciding to allocate the crop areas. Deep soil depths, favoured soil types, and drainage led to the best soil suitability areas. The soil report identified a fairly large area in the northern part of the Southern Section, as unsuitable for irrigation, mixed with a portion suitable for vineyard production, under drip irrigation as the soil could be mechanically altered to accommodate vineyards. The area for vineyard production was approximately 76 Ha. The areas not suitable for irrigation or vineyard production were the Coega and parts of the Glenrosa, Vaalbos, Plooysburg, and Brandvlei soil forms. Soil that had a freely drainable depth of <700 was unsuitable for irrigation and vineyard production.

Considering the soil findings, the vineyard should be restricted to the northern part of the Southern Section, but should not exceed more than 10% of unsuitable soil in the area. This principle should apply to the rest of the site, where the soil was identified as suitable and not suitable.

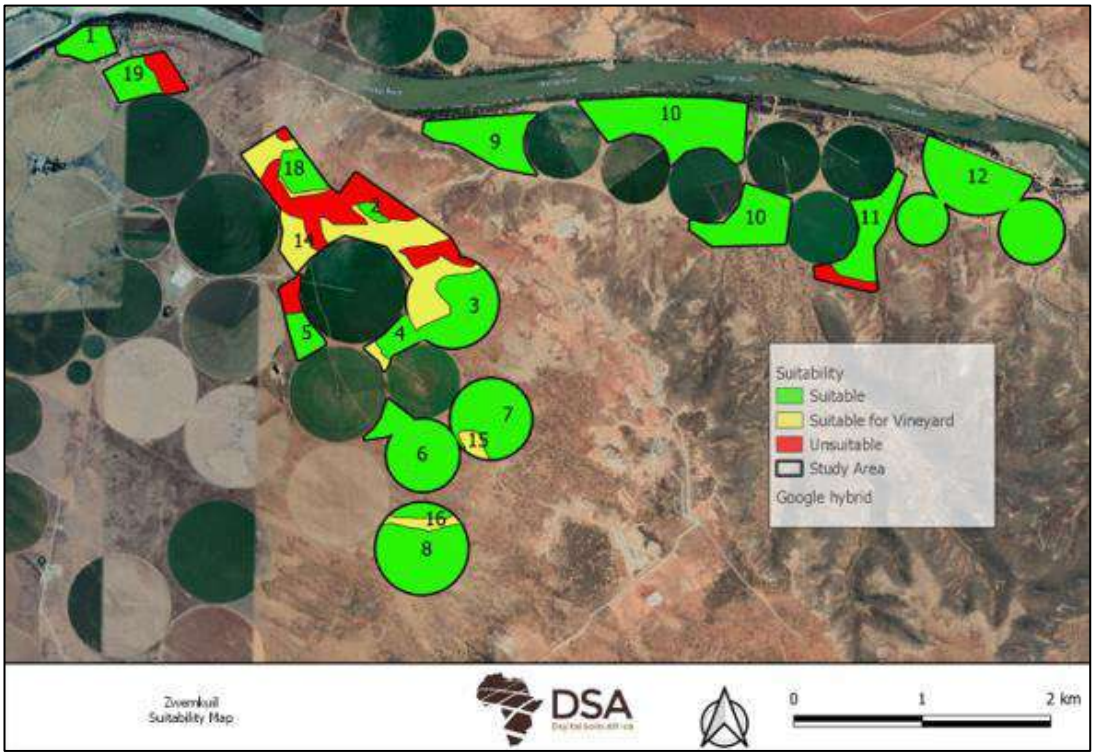


FIGURE 3: SOIL SUITABILITY MAP FROM THE SOIL REPORT

In terms of the vegetation and ecological sensitivity, the vegetation on the study area ranged from modified to natural vegetation. The grass layer displayed a patchy dominance of grass species (*Eragrostis, Enneapogon* and *Stipagrostis* species), while the tree layer was mostly dominated by *Senegalia melifera* (swart haak), except along the Orange River, where *Vachellia karroo* (sweet thorn) dominated. Dominance of species varied depending on soils substrate (e.g. sandy, red sandy and pebbly soils). Several ephemeral and dry drainage lines were also noted, characterised by a higher number of tree species. The vegetation was broadly delineated by Dimela Eco Consulting.

Please note that a fine scale vegetation assessment was beyond the scope of the vegetation report and that variation exist within mapped units.

Dimela Eco Consulting concluded that much of the vegetation on the sites were in a good ecological condition, and due to its size and limited disturbances, rates high in its functional integrity and scores a medium Site Eclological Importance (SEI). Most of this vegetation also falls within CBAs, which should ideally remain in natural state. However, areas that was historically cleared and highly disturbed rated as very low and low SEI. Also, most of the vegetation on the site is not unique and the Upper Nama Karoo vegetation is not considered threatened. Furthermore, no plant species of conservation concern were recorded or are expected to be present in these groups.

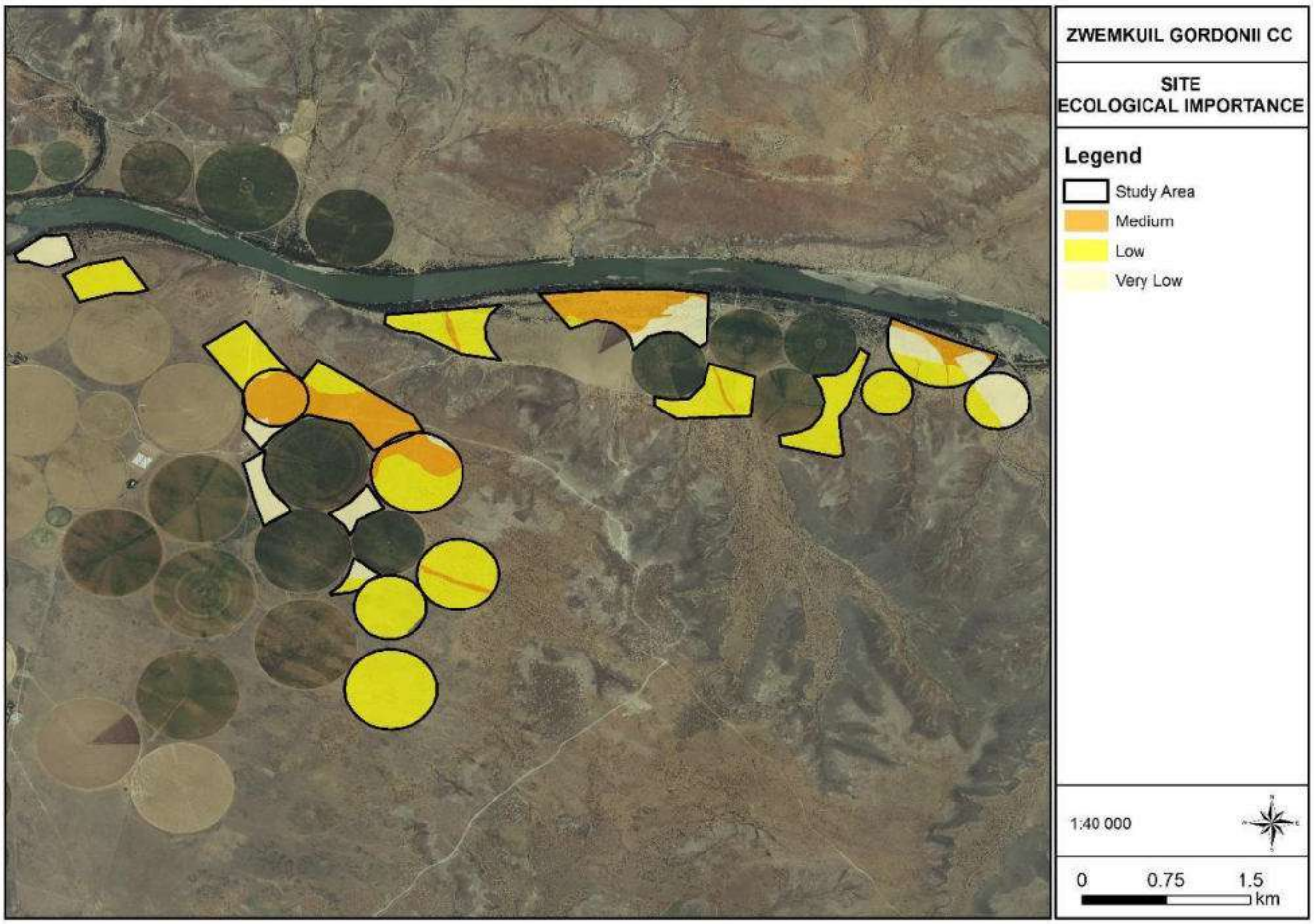


FIGURE 4: SITE ECOLOGICAL SENSITIVITY (DIMELA ECO CONSULTING)

If the soil suitability map (Figure 3)and the site ecological sensitivity map (Figure 4) are compared, it would appear that the areas identified mostly as unsuitable in terms of soil cultivation and areas identified as medium in terms of ecological importance overlap the same area.

Ultimately, the report from Dimela Eco Consulting, therefore, has no objection to the clearing of the proposed sites, provided that mitigation measures as listed in the report be adhered to as a minimum. The soil report indicated that approximately 5% of the study area has a shallow depth and is not suitable for irrigation or vineyard, while essentially 15% is suitable for vineyard production under drip irrigation. The rest of the area is suitable for all irrigation. It was recommended that the pivot placement does not exceed more than 10% of unsuitable soil.

Considering the above, from a planning perspective, the applicant should consider the following:

- Exclude Blocks L & M (Figure 2) from being developed due to soil suitability and moderate ecological sensitivity status.
- Utilise Block C, D, K for vineyard production under drip irrigation.
- Utilise Blocks E, F, K, G, H & J for pecan nut production.
- Utilise Blocks A, B, I, N, O, P, Q, R, S, & T for maize/wheat/lucern production.

If the above plan is followed, then ultimately, the study area under application is 504.7 Ha, but if the proposed areas are developed only 352Ha will be cleared from vegetation while the rest of the 152.7Ha will be left undisturbed. However, if Blocks L and M are included then 406Ha will be cleared from vegetation while the rest of the 98.7Ha will be left undisturbed and can be used as a nursery if plants are identified to be transplanted and conserved.

CONSTRUCTION PHASE

The clearance of vegetation will take place over the next 5 years. The construction phase will result in the clearing of natural veld on the allocated suitable areas according to the soil report and preparing the soil. Soil tillage, particularly primary tillage, is the foundation of any crop production system and is the biggest cost factor (du Plessis, 2003). According to du Plessis (2003), the most important processes affected by soil tillage include infiltration and evaporation of water. Because water availability during the growing season is the single most important factor in crop production in South Africa, soil tillage must be aimed at optimising infiltration and minimising evaporation.

The laboratory results indicate that the chemical parameters are manageable. The exchangeable sodium percentage (ESP) values are low and the pH values indicate that salinity is not a major risk. The study area (excluding the Brandvlei soil areas) is of low risk to salinization, with low ESP and EC together with good drainage. A fertilization plan on soils with low CEC should be implemented to ensure maximum crop production.

Thus during the construction phase and into the operational phase, soil management will be the most important principle to apply to manage the chemical parameters and prevent soil degradation.

In terms of general soil requirements for vineyard production during the construction phase:

- Vineyards are best suitable for soil that has a pH between 5.5 and 6.5 and requires phosphorus between 40 to 50 ppm and a soil depth of between 600 mm and 800 mm is required. Therefore the areas allocated for vineyards in the soil report should be used for this crop and the areas should be pegged out.
- The soil should be deeply ripped to allow the roots to penetrate the soil and access water and nutrients.
- The soil texture at the site is generally very sandy, with clay percentages generally under 20%, thus dryland vineyards will not be suitable for these soil types as no water would be retained. During the construction phase, after the site has been cleared and ripped and vine trees planted, a drip irrigation system should be installed that would be better suited for the soil type.
- The pH is not within the optimal range and acidic fertilization should be applied; it is also expected that soil pH will decrease with continued cultivation.

In terms of general soil requirements for Pecan nut production during the construction phase:

- Pecan nut trees perform best in fertile, well-drained, deep soil which consists of a medium texture. The soil depth should at least be 2 m deep.
- The soil should not be calcareous as calcareous soil causes deficiencies in micro-nutrients, especially zinc. The pH recommendation for pecan-nut trees is 6.5 to 7. Suitability for pecan-nut trees were defined as suitable (depths of 1000 mm and non-calcareous) and moderately suitable (depths of 1000 mm and calcareous) and the areas allocated for pecan nuts in the soil report should be used for this crop and the areas should be pegged out.
- Pecan-nut trees prefer soil that is freely drained and has a sandy loam texture. All the soils meet the textures requirements.
- The pH(KCl) of the soil samples is between 5.7 and 7.4. More acidifying fertilizers should be applied in the alkaline soils (Red apedal of profile 75 and Orthic of profile 88). A slightly acidic pH was found for the rest of the area. Liming is not required on the alkaline soils as it is anticipated that the pH will lower with continued cultivation and irrigation. More alkaline soils could lead to micro-nutrient deficiencies.
- Calcuim carbonate (Found in Coega and Brandvlei and soils with Neocarbonate horizons) exerts a major influence on P fixation. The phosphorous within the soil (6-8 mg/kg) is low. Phosphate availability is largely dependent on the pH. Soil pH values below 5.5 and between 7.5 and 8.5 limit phosphate availability to plants due to phosphorous being highly fixated at very low pH soils (pH 3-4) and moderately fixated at pH 7.5-9. Therefore, the more alkaline soils of Zwemkuil could experience P deficiency.
- The Zinc requirements within areas where pH is higher than 7 (Red apedal of profile 75 and Orthic of Profile 88) are especially at risk for zinc deficiencies.
- Thus, the pH is not within the optimal range and acidic fertilization as well as Zn should be applied; it is also expected that soil pH will decrease with continued cultivation.

In terms of general soil requirements for maize/other crops:

- Once the vegetation is cleared, the soil will be deep ripped, which will further improve drainage
- Once the soil is prepared, the maize or wheat will be planted.

Most of the workforce will be sourced locally or provincially.

OPERATIONAL PHASE

After about 5 years after the commencement of the project, all the areas applied for should be cleared and crop production should be established. It will be managed and maintained by the farmer and will be a permanent establishment. It is also the intent of the Applicant to rest the maize and crop fields annually through rotating crops. Resting camps will be grazed by cattle, feeding on crop residue and pasture land would be established.

In terms of the vineyard:

- During the operational phase regular soil sampling will inform the farmer of best management practices concerning alkalinity/acidity.
- It is recommended that phosphate be applied to prevent plant deficiencies.

In terms of the pecan nut crops:

- Regular soil sampling will inform the farmer of best management practices concerning alkalinity/acidity.

As with the operational phase, the workforce (upkeep of the land) 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 be decommissioned. However, should crop production cease, the site will be used for pasture. Should the Applicant elect to decommission the crops and pasture land at any point in the future, the necessary authorization must be obtained and the correct decommissioning protocol must be followed. The relevant Government 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 a near-natural state with natural vegetation cover. 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) was made and a Scoping Report, EIA, and EMP must be 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) 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 Bloemfontein	The Applicant has an existing water use right, DWS was however consulted during the public participation process.
National Environmental Management: Protected Areas Act	DEA	A Flora and ecological sensitivity 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 Land Reform in the Northern Cape	Application for cultivating virgin soil was submitted to the Agriculture department (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) was made and a Scoping Report, EIA, and EMP will be supplied to ensure management of such development and was subjected to Public Participation.
National Heritage Resources Act (No 25 of 1999):	SAHRA	Application to SAHRA was made and a Heritage Assessment Study was completed and submitted on SAHRIS.
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

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, or is rented by the Applicant, which has water use rights.

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

The soil report indicated that approximately 76 Ha were suitable for vineyards under drip irrigation, while 330Ha is suitable for maize, wheat, lucerne, and pecan nuts. Because the proposed pivots and clearing of vegetation are between existing pivots or extensions thereof, the ecological connection will not be fragmented. A desktop study of the vegetation indicated that in the Upper Western Section, most of the Upper Eastern Section and a portion of the Southern Section are situated on the Upper Gariep Alluvial Vegetation type, while the rest of the Southern Section is situated on the Northern Upper Karoo vegetation type.

In terms of the Upper Gariep Alluvial Vegetation, the conservation status is: Vulnerable. Only about 3% statutorily conserved in Tussen Die Riviere, Gariep Dam and Oviston Nature Reserves. More than 20% were transformed for cultivation (vegetables, grapes) and the building of dams. Exotic woody species such as *Salix babylonica*, *Eucalyptus camaldulensis*, *E. sideroxylon*, *Prosopis* and *Populus* species have become common dominants in patches of heavily disturbed alluvial vegetation (Mucina and Rutherford, 2006).

In terms of the Northern Upper Karroo the conservation status is: Least threatened. Target 21%. None conserved in statutory conservation areas. About 4% has been cleared for cultivation (the highest proportion of any type in the Nama-Karoo) or irreversibly transformed by the building of dams (Houwater, Kalkfontein and Smart Syndicate Dams) (Mucina and Rutherford, 2006).

In terms of alternative site layout, irrigated lands are prone to salinization and water-logging because of added salts brought in by irrigation water. The properties of soil must adhere to the infiltration of water through the soil as well as the built-up of sodium and salt. It was, therefore, essential to investigate the soil properties for the sustainability of the proposed irrigation project and to prevent situations where the soil could reach the extent where it cannot be vegetated anymore.

The suitability of the area was defined into a few categories namely, Suitable, Suitable for vineyard, Suitable for Pecan nuts, and Unsuitable. Soils not suitable for irrigation, but which had freely drainable depths of at least 700 mm, i.e., soils with a depth of 700 – 1000 mm, would be suitable for vineyard production, with the prevision that the soils are

broken, and deep ripping is done. According to the soil report, soils with a freely drainable depth of 1000 mm, which included the Hutton, Augrabies, Prieska, Addo, and sections of the Plooysburg, Prieska, Glenrosa and Vaalbos soil forms were suitable for irrigation. The soil forms not suitable for irrigation (Sections of the Plooysburg, Vaalbos, Brandvlei, Prieska, and Glenrosa) were suitable for vineyards under drip irrigation as the soil could be mechanically altered to accommodate vineyards (76 Ha). The areas not suitable for irrigation or vineyard production were the Coega and parts of the Glenrosa, Vaalbos, Plooysburg, and Brandvlei soil forms. Soil that had a freely drainable depth of <700 was unsuitable for irrigation and vineyard production.

Therefore the findings in the soil report are very specific and alternative pivot layouts or crop production would not be recommended to prevent soil degradation and crop failure. Considering the suitability of the soil for irrigation (see Figure 3) most of the area is suitable for maize, lucerne, wheat, etc, except for the northern part of the Southern Section of the study area, which, according to the soil report is mostly suitable for vineyard production.

As previously discussed under the 'Planning Phase', if the soil suitability map (Figure 3) and the site ecological sensitivity map (Figure 4) are compared, it would appear that the areas identified mostly as unsuitable in terms of soil cultivation and areas identified as medium in terms of ecological importance overlap the same area.

Based on the observations and recommendations of the soil and ecologically sensitive reports, a layout option of pivots/development will be to:

- Exclude Blocks L & M (Figure 2) from being developed due to soil suitability and moderate ecological sensitivity status.
- Utilise Block C, D, K for vineyard production under drip irrigation.
- Utilise Blocks E, F, K, G, H & J for pecan nut production.
- Utilise Blocks A, B, I, N, O, P, Q, R, S, & T for maize/wheat/lucern production.

An alternative layout will be to include Blocks L & M for development.

If the first option plan is followed, then ultimately, 352Ha of the 504.7 Ha that is under environmental application will be developed, while the rest of the 152.7Ha will be left undisturbed. However, if the second layout plan is followed and Blocks L and M are included then 406Ha will be cleared from vegetation while the rest of the 98.7Ha will be left undisturbed and can be used as a nursery if plants are identified to be transplanted and conserved.

Considering the above, the first layout plan will result in reduced environmental disturbance (because of the reduced size), however, considering both the recommendations of the soil specialists and the ecological report the second option is feasible and from an economical point of view will yield higher value. Therefore no alternative site layout will be considered, and it is recommended that Blocks L & M be included in this development, on the condition that it is developed according to the recommendations of the soil specialist. This will result in the benefit of socio-economic improvement and job creation opportunities while remaining an agricultural unit. Developing this farm will be the best viable land-use option for the applicant who is also the landowner.

Therefore, no alternative site, no alternative land use, and the 'no-go' option (see discussion below) will not be considered or evaluated.

The full process of 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.

NEED AND DESIRABILITY OF THE PROJECT

The purpose of this Environmental Authorisation Application is for the Applicant to obtain permission from the Department to develop 504.7 Ha of which about 406 Ha of vegetation will be cleared to establish crops and pasture land, alternating years. Resting camps will be grazed by cattle, feeding on crop residue and pasture land would be established. During the resting period, attention will be given to soil upgrading, as suggested in the soil report.

The benefit of crop rotation is of great value to farmers not only from a financial perspective but also from an environmental and social-economic perspective. Rotation can also help manage diseases caused by pathogens that survive in the soils or in crop debris and pathogens whose populations decline in the absence of a susceptible host (Seminis, 2020).

In terms of insect management, crop rotation is not effective for managing insect pests, but crop rotation can be used to break the life cycle of such insect pests with limited mobility and narrow host ranges.

According to Seminis (2020), crop rotation can also be used to help manage weed problems, because different crops compete with weed species in diverse ways. Crops vary in their time of planting rate of canopy development, canopy height, row spacings, and harvest times, which creates varied environmental conditions that can prevent the buildup of a few weed species.

Thus from a socio-economic perspective, crop rotation can reduce the financial risk on the Applicant, not only saving him money on the costs of herbicides but also reducing the risk of a potential loss on abutting crops as a result of pathogens or insect pest outbreaks.

From an environmental and financial perspective, and in terms of soil moisture management, normally the late summer and early autumn rainfall results in some moisture storage and retention in the soils for the next production season. However, in the event of a drought, especially if monocultures such as maize are planted, the farmer can potentially face a dire situation of being unable to plant the next maize at the start of the season (Grain SA, 2016). Crop rotation and moisture conservation practices can reduce drought risks and will ensure that a variety of crops can be planted over a much longer period from October to January in a particular summer production season.

From a nutrient requirement and soil management perspective, crops differ in their nutrient requirements and their abilities to extract nutrients from the soil. Legumes such as lucerne help fix nitrogen in the soil and when it dies, the

fixed nitrogen is released and becomes available to other plants. A mature maize plant, on the other hand, has total nutrient uptake of 8.7g of nitrogen, 5.1 g of phosphorus, and 4.0 g of potassium. Resulting in each ton of grain produced removes 15.0 - 18.0 kg of nitrogen, 2.5-3.0kg of phosphorus, and 3.0-4.0 kg of potassium from the soil (du Plessis, 2003).

Thus the benefit of rotating maize with lucerne will increase soil nitrogen and carbon content in the soil (Huynh, *et al*. 2019). In the Huynh, *et al*. study, maize was rotated with lucerne and it was found that crop rotation led to a higher yield than continuous maize planting as a result of this soil relationship. It also found that the significant effect of crop rotation on the yield of the following maize crop continued after two cycles of a 4-year crop rotation. This soil relationship will also reduce the application of fertilizers and reduce the potential impact on water resources.

The influence of agriculture practices on water quality (activities on farms that leads to an increase in nitrogen (N) release into water resources) has promptly improved farming practices to optimize the use of fertilizer N and reduce N loss to surface and groundwater. According to Al-Kaisi (2021) crop rotation can play a major role in minimizing the potential risk of nitrate leaching to the surface and groundwater by enhancing soil N availability, reducing the amount of N fertilizer applied, and minimizing the potential risk of N leaching. This can lead to a positive impact and the receiving environment.

Overall, the advantages of proper planning of a crop rotation system will ultimately include better moisture conservation, reduced financial risk, reduce mechanization costs and improve crop and soil health to ensure a sustainable farming future, and therefore the desirability of this project.

Maize and wheat will be planted, rotating with lucerne the following year and so forth and in terms of the need for this project, maize and wheat are an important field crops in South Africa, serving as the staple food for the majority of its population, particularly for low-income households (Ala-Kokko, 2021). Maize is also the major feed grain for the animal feed industry.

In South Africa, there is a surplus of maize production, which forces industry role players to utilise maize in one of two ways (BFAP, 2015). The first option involves exports. South Africa exported 2.5 million tons of raw maize (or 19 percent of maize production) during the 2013/14 season, with leading export destinations including Japan, China, Mexico, Namibia, Zimbabwe, and Mozambique. The second option is to transform maize into secondary or value-added products,1 such as maize meal, animal feed, and starch (BFAP, 2015).

The maize industry is important to the economy both as an employer and earner of foreign currency because of its multiplier effects (Mogala, 2017). This is because maize also serves as a raw material for manufactured products such as paper, paint, textiles, medicine, and food. The industry is divided into commercial and developing agriculture.

Although fluctuating, there has been a general increase in the contribution of the maize industry to the gross value of South African agricultural production (GVP) from 2006 of about 10 billion rands to 2016 of just under 30 billion Rands. The Northern Cape contributes to 9% of maize production in South Africa.

About 45 000 people are employed in agriculture in the Northern Cape, which represents approximately 16% of employment. The province supports livestock farming (mainly goats and sheep with cattle in the north), table grapes, dates, cotton, cereal crops, and vineyards along the banks of the Orange River and large varieties of crops including cotton, groundnuts, wheat, and maize on irrigated lands (including the large Vaalharts scheme) (Young, 2017).

In terms of wheat, the Northern Cape produces about 262 800 tons per year (DAFF, 2016). According to Coale (2017), wheat is important to South African food security. South Africa has become a net wheat importer, due to the significant drop in wheat area planted since the abolishment of the fixed price marketing system provided by the wheat board in 1997. Further, recent political uncertainty has resulted in the South African Rand devaluing (by 58% to the USD during 2012–2017), leaving South Africa exposed to risk in global wheat and exchange rate markets and increasing its food insecurity vulnerability. Thus, an assertive effort has been made to break South Africa's dependence on imported wheat by increasing wheat yields per hectare (Coale, 2017).

South Africa experienced its worst drought in 23 years in November 2015 and food insecurity spiked. According to STATSSA (2016), the number of 41% of households in the Northwest territory and 32%, 31%, and 26% in the Eastern Cape, Northern Cape, and the Free State respectively ran out of money to buy food. This disparity was driven by the fact that cereal prices (mainly maize and wheat) rose by an estimated 53.7% for the same time period (STATSSA, 2016). A situation that one would like to avoid in the future.

Four years later, South Africa is set to grow in importance as a grain exporter in 2020-21, on the back of an increased corn harvest and increased demand from its neighbors. The country's economy, like many, is reeling from the effects of the COVID-19 pandemic, although it has not directly had a major effect on farm output (Lyddon, 2021).

For the year 2020-2021, the International Grains Council (IGC) placed South Africa's total grains production at 18.6 million tonnes, up from 18 million the previous year. The total includes 2.1 million tonnes of wheat, compared with 1.5 million in 2019-20. The country's corn crop in 2020-21 is put at 15.8 million tonnes, down from 16 million the year before (Lyddon, 2021).

Lyddon further reports that South Africa's total grain imports in 2020-21 are put at 2.2 million tonnes, down from 2.9 million the year before. Its grain exports are forecast at 2.8 million tonnes, up from 2.1 million. Forecast imports include 1.9 million tonnes of wheat, down from 2.4 million in 2019-20. Exports include 2.7 million tonnes of corn, compared with 1.9 million the previous year. This is important since maize and wheat are the staple food for the majority of South Africans and it reduces food insecurity. If less wheat and maize are imported it benefits the households reliant on the staple food, if more wheat and maize are exported, it benefits the farmer and Gross Domestic Product (GDP) of the area which is a positive economic impact.

At this stage, lucerne will be planted on alternative years during the rest period for the land. Lucerne has excellent qualities for grazing, but it can cause bloat, which can be treated.

In terms of the vineyard, 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.

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 averages 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 rates, 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, creating jobs, earning foreign currency and stimulating 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.

In terms of pecan nut production, according to Global Africa Network (2020), production of pecan nuts grew from 5 000 tons in 2010 to 10 500 tons in 2015, and the figure continues to rise as world markets react positively to the South African product. At one time it was thought that pecan nuts were better suited to tropical and subtropical climates, but the consensus is now that the Northern Cape is ideal for the cultivation of the versatile and healthy nut.

It costs around R140 000/ha to establish and grow the trees (at 100/ha), which includes soil preparation, hiring of equipment such as bulldozer and tractor disc, contractors, trees, labour, installing an irrigation system, etc. Thus

there is an initial outlay of costs with benefits to employees, contractors and nurseries but no economic benefit to the farmer, as it takes six to eight years for a tree to start producing nuts, and around 10 years until a farmer can start turning a profit. According to Dugmore (2011), it takes one mature pecan nut tree of about eight years old to produce an average of 20kg/year of pecan nuts at the average nut-in-shell (NIS) price paid to the farmers producing larger nuts from the hotter, drier regions above R80/kg (Botha, 2018). Or, alternatively, the income from 50kg of pecan nuts harvested from two trees is equivalent to that from 1t of maize. According to SAPPA records, the pecan nut industry in South Africa is expanding by 2 000ha/year and therefore holds large economic benefit to the farmer and employment opportunities to the community.

Most of the agricultural economy consists of extensive farming of sheep and goats, as well as game farming. However, there is intensive agriculture along the Orange Riet Canal System, along the upper Orange River (Coleberg-Hopetown area), and along the middle Orange River area. Prieska is a centre of irrigation farming.

If this project is approved, it is expected that at least 50 previously disadvantaged individual employment opportunities on the farm would be created. Although this would seem a small number, for those families, it would mean a steady monthly income and other benefits over and above monthly salaries. The permanent work for these families must be seen as a small but positive contributor to the upliftment of farmworkers in this region.

This development will not only benefit the Applicant but will also create job opportunities for a few low-income households that will assist in poverty alleviation. It is thus clear that crop production, as proposed by the Applicant, will contribute to economic growth within the Siyathemba Municipal area and achieve the IDP objective of ensuring sustainable jobs.

NO DEVELOPMENT OF THE SITE ('NO-GO' OPTION)

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: generally, an area in a good ecological condition, which rates high in its functional integrity. However, there are large portions in the study area that was also historically cleared and highly disturbed and rated a very low site ecological importance. In addition, most of the vegetation found on site is not unique and the Upper Nama Karoo vegetation is not considered threatened. In conclusion, no plant species of conservation concern were recorded or are expected to be present in this study area. Therefore from an environmental perspective, the development of the site would not result in a detrimental ecological loss.

From an economic and agricultural point of view, it is better to develop the area and improve the agricultural potential of the land and add value to the region's GDP. Any economic benefit will help improve social benefits to the local community and create employment opportunities.

The minor losses that will occur in terms of loss of grazing capacity will be offset against crop production and will increase job opportunities and the capital value of the property.

The EIA will assess the impacts of the 406 Ha area only.

PUBLIC PARTICIPATION PROCESS

All the details of the public participation process undertaken so far (Scoping Phase), 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 Oewer Newspaper and one notice board was placed at the boundary of the property along the public gravel road. During the public participation of the Scoping Phase, no person raised any objections to the project.

No person/entity/governmental office registered as a result of the public notices.

Therefore no public input was provided to establish any alternative options, however, the one issue regarding drainage will be incorporated 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 into the final EIA.

ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT

Since no alternative site location, layout or land use has been considered, the environmental attributes associated with the proposed development footprint 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 considering the geographical, physical, socio-economic, and heritage aspects.

In terms of geology and palaeontology, the development will largely impact geologically recent and well-developed superficial overburden. Surface limestones (*T-Qc*) and geologically recent aeolian sand overburden (Qs) in the region are generally not considered to be fossiliferous in the absence of intact (Neogene) terrace gravels, pans, springs, and pre-Holocene alluvial exposures (Paleo Field Services, 2022).

Dr. Rossouw further indicated that the visible evidence of Stone Age/Prehistoric presence in two out of 16 areas is considered minor in terms of overall impact. The low-density, *ex situ* stone tool components observed in Areas 5 and 8 have been mapped and recorded. All the areas are assigned an archaeological site rating of Generally Protected C (Low significance).

In terms of the soil, three attributes were considered (soil properties, soil erosion, and soil pollution). In terms of the soil properties, the total and freely drainable soil depths of the study area are moderate to deep with most of the soils ranging from 1.51-2.00 mm in depth. A small portion of the area had depths shallower than 500 mm. The Coega and parts of the Glenrosa soils were associated with the 0-0.50 m soil depths. The restricting layers encountered were Hard Carbonate, Fractured rock, Soft Carbonate, and Lithic horizons. The Fractured rock was found within the Vaalbos soil form, while the Lithic occurred in the Glenrosa soil forms. Soft Carbonate was found in the Addo and Brandvlei soil forms, while Hard Carbonate was found in the Coega and Plooysburg soil forms. The Lithic horizon had a restricting layer at 300-1600 mm depths for the Glenrosa. Fractured rock was found at between 500 and 1000 mm. Soil depths not exceeding 700 mm were deemed not suitable for irrigation or vineyard cultivation. The chemical properties of the soils vary over the study area. The A and B horizons are chemically different with pH ranging from 5.7 to 7.4. The Orthic horizon of profile 36 is slightly acidic while the Red Apedal and Orthic horizons of profiles 75 and 88 were alkaline, all the other profiles had a relatively neutral pH.

Clay percentages range from very sandy to moderate. Most soils will have good drainage, but soil water holding capacity and fertility in some areas are low and would require good management. Since the soils are generally sandy, the soil depth would be the biggest contributing factor to drainage. The laboratory results indicate that the chemical parameters are manageable, it is expected that irrigation with high-quality irrigation water will leach some of the base-forming cations out of the soil profiles and thereby lower the pH. Salinity is of low risk within all areas except the Brandvlei soil area where salinity could be of risk. The ESP and EC for the rest of the areas are low and the soils have good drainage. The texture results show that in general, the soils do have sufficient drainage.

In terms of soil properties, the impact was rated low-moderate without mitigation and low with mitigation.

In terms of soil erosion, the impact was rated moderate without mitigation and reduced to low with mitigation and is dependent on soil and crop management.

In terms of soil pollution, the impact was rated low-moderate without mitigation and reduced to low with mitigation, which is to conduct soil management, irrigation scheduling, crop rotation, and proper planning of applying pesticides and fertilization. Incorrect applications could physically and biological change the soil composition which will ultimately impact the health of the area.

The land use of the property will not change but remain agricultural, however, the land capability will increase since farming will be more intensive. The impact is rated moderate-high without mitigation and reduced to very low with mitigation considering the geographical, physical, biological, socio-economic, and heritage aspects.

In terms of the flora, a vegetation report was completed by Dimela Eco-Consulting. Much of the vegetation on the site was in a good ecological condition, and due to its size and limited disturbances, rates high in its functional integrity and scores a medium Site Ecological Importance. Most of this vegetation also falls within CBAs, which should ideally remain in natural state. However, areas that were historically cleared and highly disturbed were rated as very low and low SEI. Also, most of the vegetation on the site is not unique and the Upper Nama Karoo vegetation is not considered threatened. Furthermore, no plant species of conservation concern were recorded or are expected to be present in these groups.

At the time of this assessment, only one (1) TOPS listed species were recorded within Site M. This species, *Harpagophytum procumbens* subsp *procumbens* (devil's claw) is listed as a Protected medicinal plant species and may not be traded. It is recommended that these species be replanted outside of the proposed clearing footprint. the national protected tree, *Boscia albitrunca*, occurred abundantly on the farm and specific Sites D, L, O, J and K, as well as around site A. These trees require a permit from the local Department of Environment, Forestry and Fisheries to be removed. The impact is rated low-moderate with or without mitigation.

In terms of the fauna, the highest impact will be at the construction phase, when the habitat is permanently removed and was rated low without mitigation and reduced to very low with mitigation considering the geographical, physical, biological, socio-economic, and heritage aspects.

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.

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.

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.

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.

In terms of the waste generated by this development, the impact was rated low without and reduced to very low with mitigation. The issue regarding waste management will mainly depend on the 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 very low impact with mitigation, since this type of farming is costumed to the surrounding area.

In terms of the impact on transport, the impact was rated low without mitigation and reduced to a very low with mitigation. 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, considering the geographical, physical, biological, socio-economic, and heritage aspects.

In terms of the heritage and archaeological aspects, the potential biggest impact will occur during the construction phase and was rated low significance, based on the findings of the heritage report. Dr. Rossouw indicated that surface limestones and geologically recent aeolian sand overburden in the region are generally not considered to be fossiliferous in the absence of intact (Neogene) terrace gravels, pans, springs, and pre-Holocene alluvial exposures. The farm is located within a wider region that has previously yielded ample archaeological evidence of prehistoric human occupation, but visible evidence of Stone Age/Prehistoric presence in two out of 16 areas is considered minor in terms of overall impact. A low-density, *ex situ* stone tool component observed in two areas on site has been mapped and recorded. All the areas are assigned an archaeological site rating of Generally Protected C (Low significance), but it is noted that the potential occurrence of isolated and unmarked graves, subsurface burial cairns or intact subsurface archaeological finds not observed during this survey can never be excluded.

CONCLUDING STATEMENT

From the above, it is concluded that the 406Ha recommended by the soil report be developed and that the remaining 98.7Ha be used as a nursery if plants are identified to be transplanted and conserved.

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 impacts.

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 at 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 into 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 Department.

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.

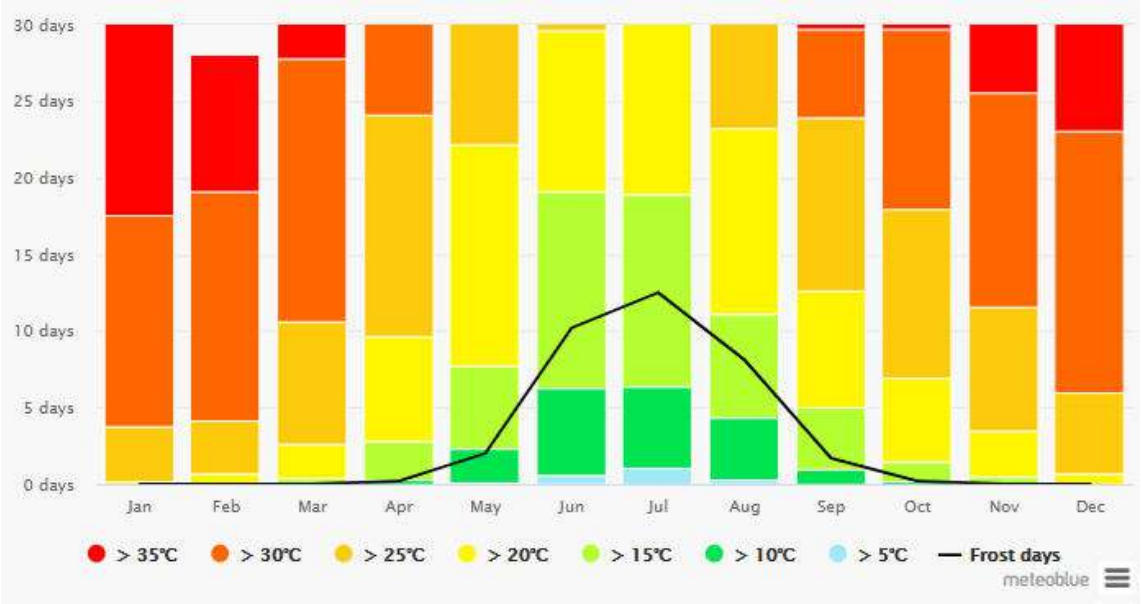
The study site falls within the Hot Desert Climatic (BWh) Region of South Africa, according to the Köppen Climate Classification System. Mild Desert Climate is characterised by warm to hot summers, high evaporation, and dry warm winters.

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)

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)



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

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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 will consider working out an irrigation scheduling to establish and maintain the crops.

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.

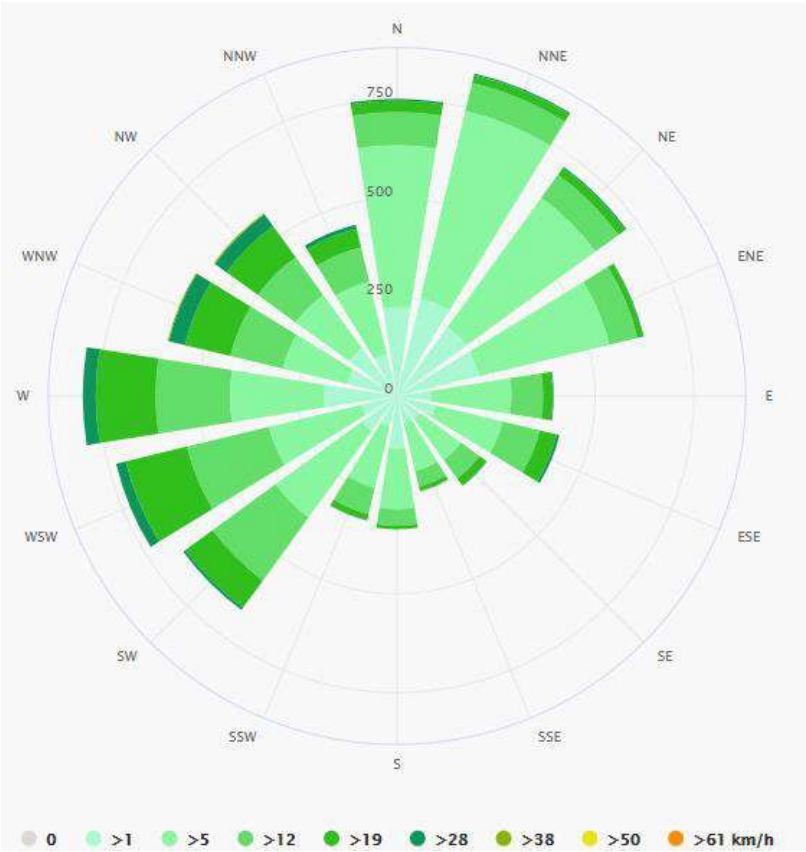
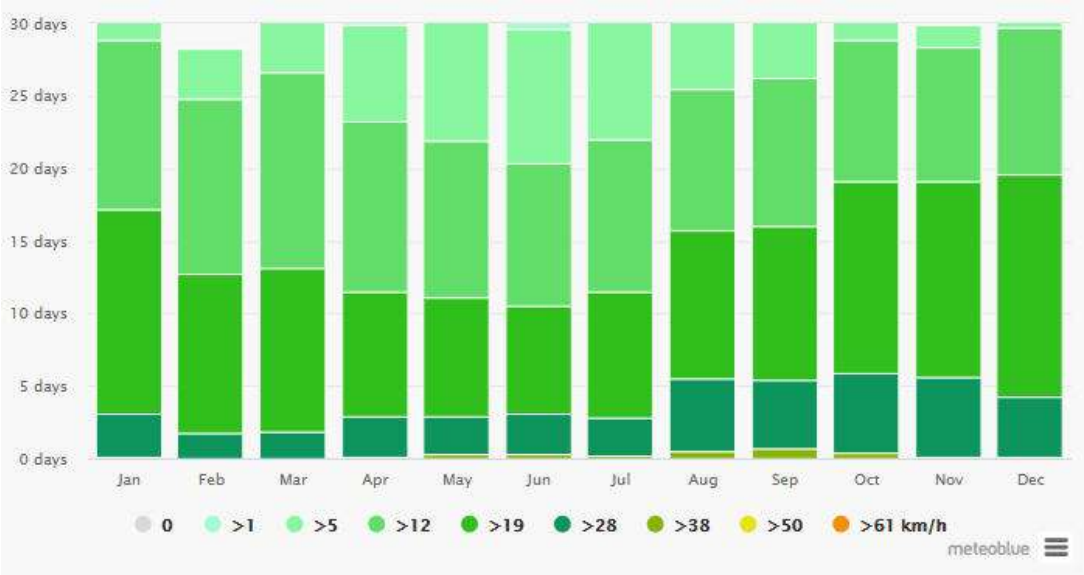


FIGURE 5: WIND ROSE OF PRIESKA AREA (SOURCE METEOBLUE)

TABLE 5: WINDSPEED OF PRIESKA AREA (SOURCE METEOBLUE)



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.

The topography of the area was flat with the majority of the area having a slope less than 0.8°. The area is situated in a valley and is surrounded by hills with slopes between 0.8 and 2.6°. Drainage would occur in a northern, direction leading to the orange river as it flows from the hills.

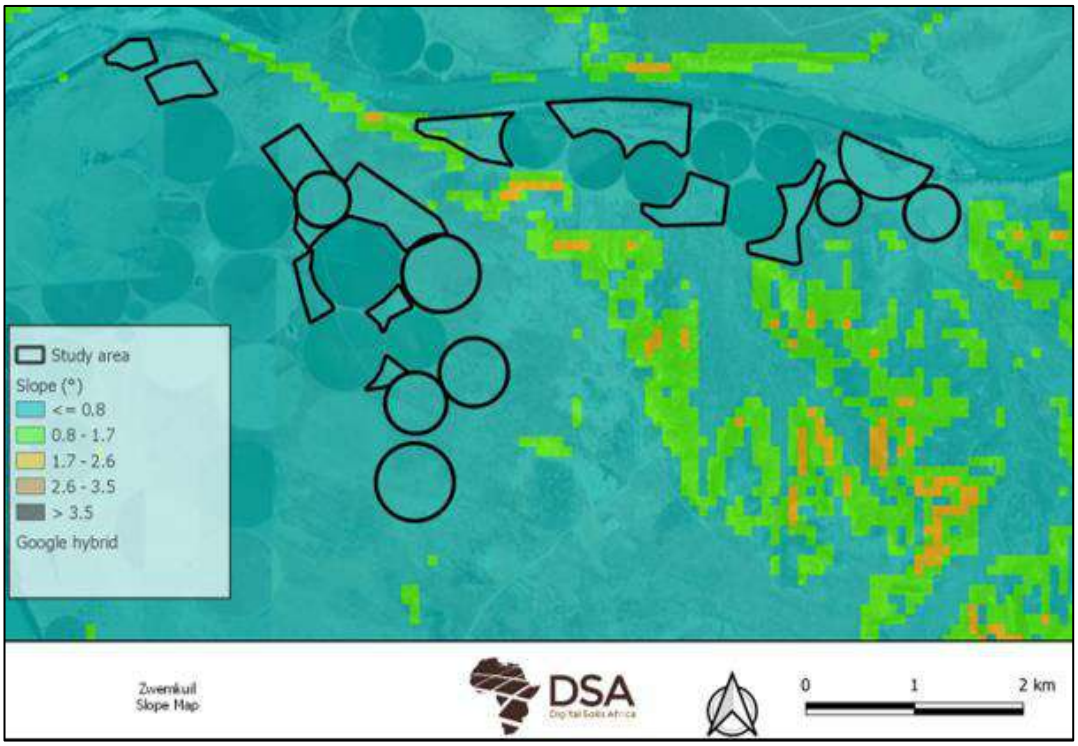


FIGURE 6: SLOPE OF THE STUDY AREA (SOIL REPORT, 2022)

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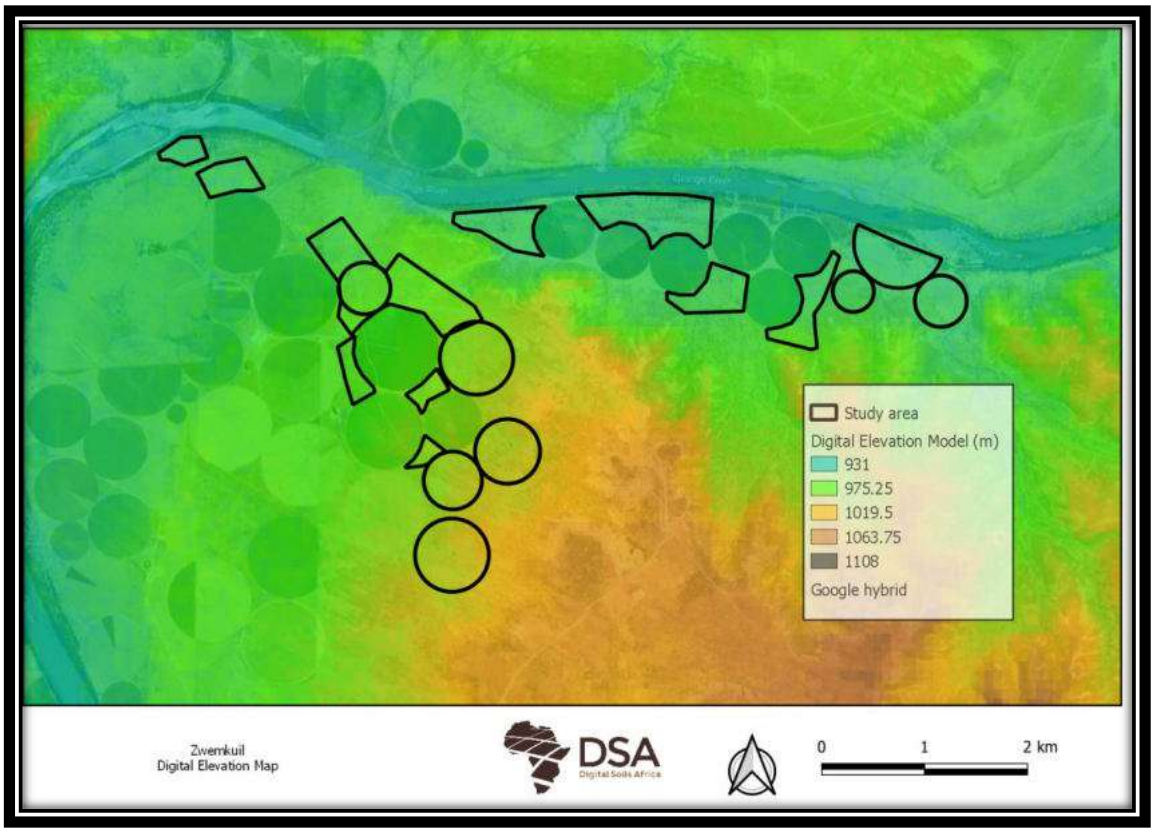

FIGURE 7: ELEVATION OF THE SITE(SOIL REPORT, 2022)

Direct Impacts on the topography

Construction Phase:

During the construction phase, clearance of vegetation and ploughing of topsoil will take place simultaneously. The construction phase will result in the clearing of natural veld on the allocated pivot areas according to the proposed site layout plan and preparing the soil.

The clearing of vegetation and preparation of the soil will not lead to the transformation of the topography of the sites. On the property, there are existing farm roads that will be used to gain access to the new pivot areas and croplands, 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 crops will be established, which will slightly elevate the perceived topography of the site, due to the height of the crops as it grows. Except for the pecan nut trees and vineyard, the crops are

seasonal. The limited height increase in the landscape will be absorbed since the establishment of crops fits in well with the surrounding area. 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 toilets (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 on 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. township development, solar farms, or wind turbine farms that will add to the cumulative impact on the topography of the area, however, there is a diamond mine on the farm that has caused an impact on the topography due to the nature of the mine diggings.

The proposed activity will increase the crop appearance of the area but the impact will remain low as it will fit in with the surrounding area due to the surrounding neighbouring farms. The mine diggings will contribute mainly to the cumulative impact but are governed by an Environmental Management Plan and the Department of Mineral Resources is responsible for regulating the site.

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 crops and managing the topsoil.

GEOLOGY & PALAEONTOLOGY

Geology

According to the 1: 250 000 scale geological map 2922 Prieska, the study area is underlain by glacially-related sediments of the Mbizane Formation (Dwyka Group, *C-Pd*), a largely heterolithic unit recognized in the upper part of the Dwyka Group of the Karoo Supergroup (Paleo Field Services, 2022). The mudstone and sandstone successions, tillites and conglomerates of the Mbizane Formation represents valley and inlet fill deposits that were laid down when Dwyka glaciers scoured out valleys and depressions in pre-Karoo rocks during the Permo-Carboniferous, *c*. 300 Ma years ago.

Small, isolated exposures of early Vaalian oolitic and stromatolitic platform carbonates are located to the northeast and well outside the boundary of the proposed development footprint (Beukes 1979). Superficial deposits are primarily represented by late Tertiary surface limestones (T-Qc), windblown Kalahari Group sand (Qs), surface gravels and alluvium.

TABLE 6: 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.

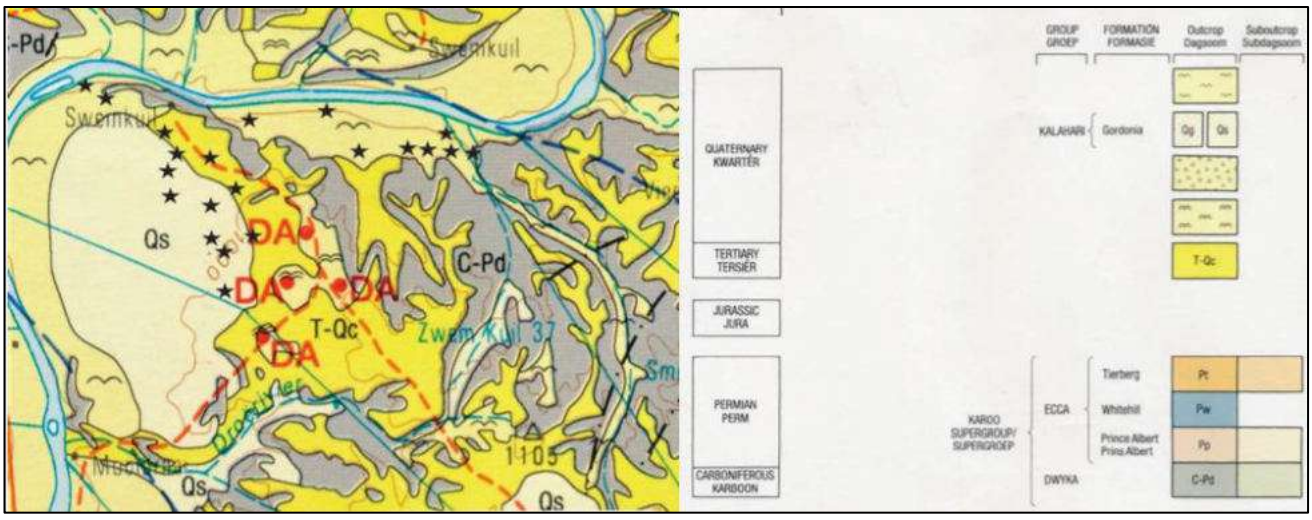

FIGURE 8: GEOLOGY ACCORDING TO THE 1:250 000 SCALE GEOLOGICAL MAP 2922 PRIESKA.

The clearing of vegetation and establishment of crops and pasture will largely impact geologically recent and well-developed superficial overburden but not the geological structure of the site.

Palaeontology

According to Dr. Rosouw from Palaeo Field Services, the potential occurrences: Ichnofossil assemblages and plant fossils associated with Dwyka Group sediments; Late Neogene vertebrate fossils associated with intact river terrace gravels; Quaternary vertebrate fossils associated with Pleistocene alluvial deposits.

Dr. Rosouw further cited that the Mbizane Formation is not considered to be highly fosilliferous, 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 mudrock facies. The Middle and Lower Gariep basin cut through a series of post-Karoo fluvial remnants. To the west of Prieska the landscape is dissected by the ancient Koa Valley, a Miocene relic with remnants of Cenozoic fluvial deposits that have produced fossil vertebrate bone as well as fossil wood. Southwards, the Koa Valley joins an extensive system of pans fossil where several Palaeogene and Neogene vertebrate fossil remains have been identified. No fossils have been explicitly reported from the late Neogene river terraces between Douglas and Prieska yet, but a variety of fossil fauna have been retrieved from gravel terraces along the Lower Vaal River basin. Here, gravel terraces between 21m and 30m above the present river level, contain frequent sandy lenses and have yielded vertebrate fauna such as the extinct proboscidian, *Mammuthus subplanifrons* that are estimated to be ranging in age from 4.5 to 3.5 million years old. Other fossil remains include extinct suids and more proboscidian taxa, notably *Elephas iolensis* . Except for a few bovid horn core remains found in limestone quarries, there are no records of Quaternary fossils from the immediate vicinity of Prieska. A fossilized horn core of an extinct alcelaphine was found along the Ongers River near Britstown, while Florisian type faunal remains have been excavated from an archaeological site at Bundu Farm Pan near Copperton.

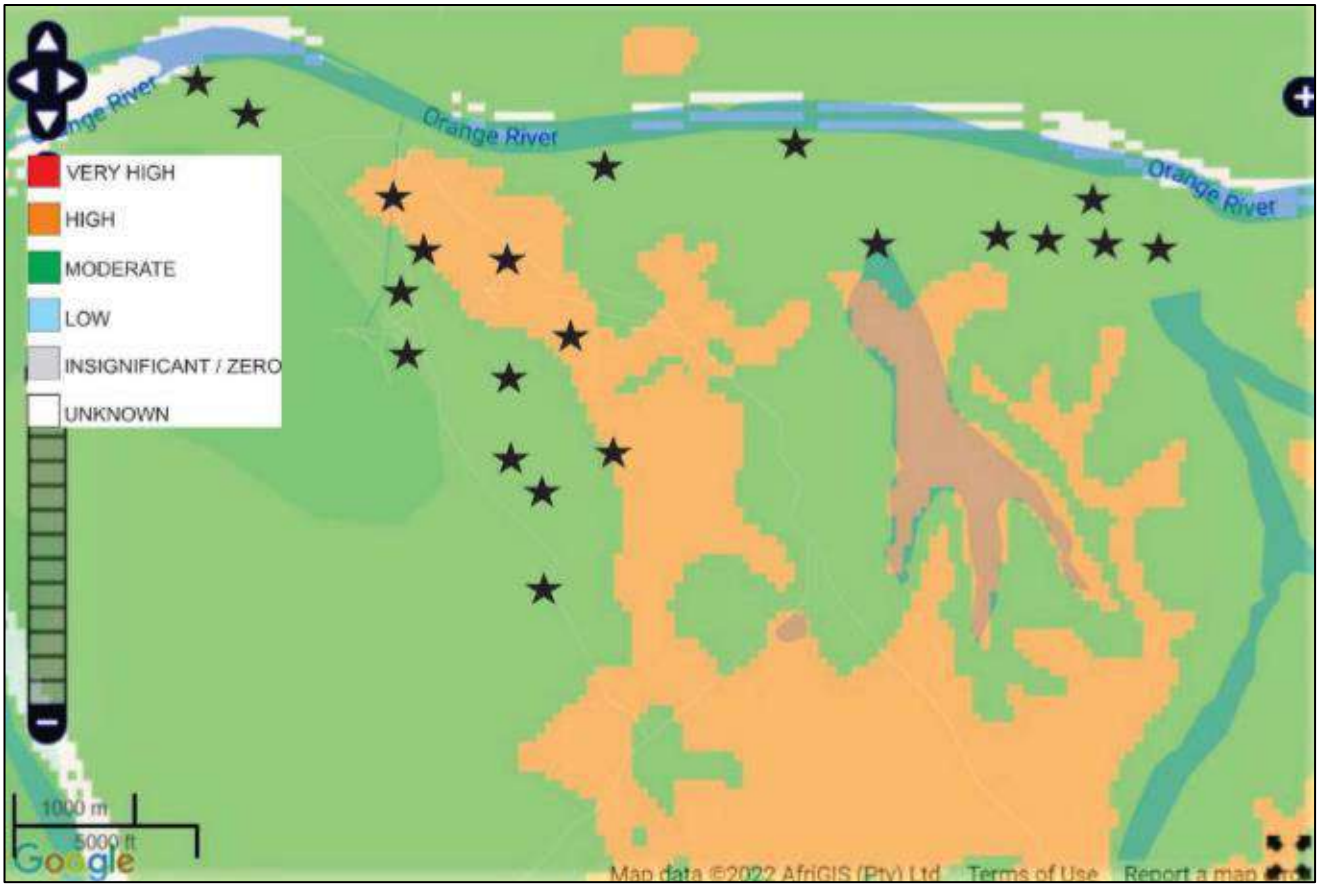

FIGURE 9: SAHRIS PALAEOSENSITIVITY MAP OF THE STUDY AREA (PAPAEO FIELD SERVICES, 2022).

According to Dr. Rossouw, surface limestones (*T-Qc*) and geologically recent aeolian sand overburden (Qs) in the region are generally not considered to be fossiliferous in the absence of intact (Neogene) terrace gravels, pans, springs, and pre-Holocene alluvial exposures. In his survey, he identified six areas that have been degraded by previous agricultural activities. The farm is located within a wider region that has previously yielded ample archaeological evidence of prehistoric human occupation. However, visible evidence of Stone Age/Prehistoric presence in two out of 16 areas is considered minor in terms of overall impact. The low-density, *ex situ* stone tool components observed in Areas 5 and 8 have been mapped and recorded. All the areas are assigned an archaeological site rating of Generally Protected C (Low significance), but it is noted that the potential occurrence of isolated and unmarked graves, subsurface burial cairns or intact subsurface archaeological finds not recorded during this survey can never be excluded. Therefore, it is advised that the relevant heritage authority (SAHRA) and a qualified archaeologist be informed immediately in the event of potential archaeological exposure during the construction phase of the proposed project.

The full report can be viewed in Appendix E.

SOILS

SOIL PROPERTIES:

Topsoil is a very precious, non-renewable resource with high conservation importance and is necessary for the production of grapes, pecan nuts and other crops 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 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.

A soil survey was conducted to determine whether the land would be suitable for irrigating the cultivation of crops. The soil forms found included: Augrabies (214 Ha) soil form is the dominant soil form in the study area. The Hutton soil form was found in the southern parts of the study area and covered 37 Ha. The Coega soil form (31.5 Ha) was found in the northern parts of the Southern Section and was characteristically shallow. The Addo soil form was found near the Augrabies soil forms in the Upper Eastern Section and covered approximately 36 Ha. The Glenrosa soil form (23.6 Ha) was found throughout the study area, while the Vaalbos soil form (25 Ha) was found near the Plooysburg soil form in the centre of the study area. The Prieska and Brandvlei soil form were only found in a small area of the study area and covered approximately 18 and 16 Ha of the study area (see Figure 10).

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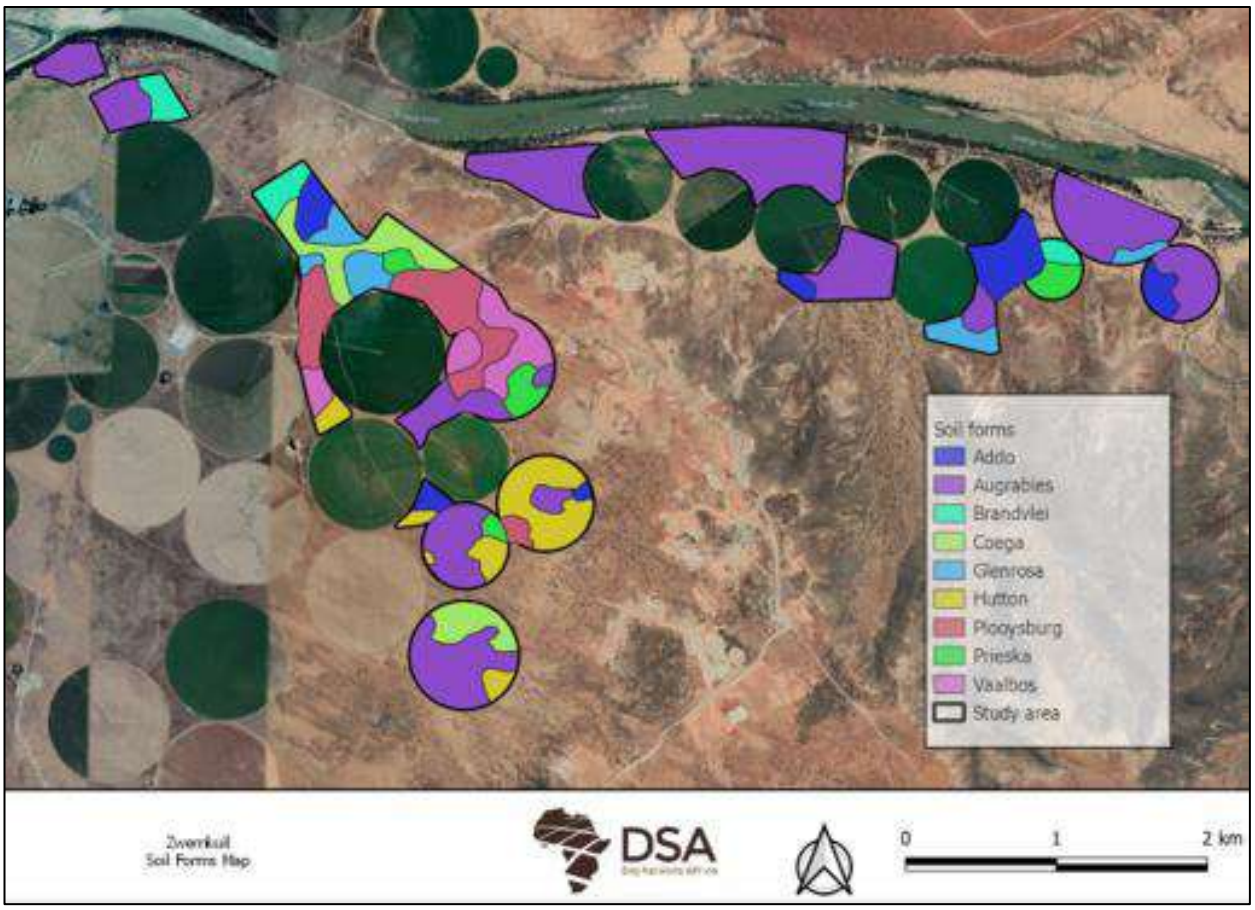

FIGURE 10: SOIL FORMS IN THE STUDY AREA (SOIL REPORT, 2022).

According to the soil report, the total and freely drainable soil depths of the study area are moderate to deep with most of the soils ranging from 1.51-2.00 mm in depth. A small portion of the area had depths shallower than 500 mm. The Coega and parts of the Glenrosa soils were associated with the 0-0.50 m soil depths. The restricting layers encountered were Hard Carbonate, Fractured rock, Soft Carbonate, and Lithic horizons. The Fractured rock was found within the Vaalbos soil form, while the Lithic occurred in the Glenrosa soil forms. Soft Carbonate was found in the Addo and Brandvlei soil forms, while Hard Carbonate was found in the Coega and Plooysburg soil forms. The Lithic horizon had a restricting layer at 300-1600 mm depths for the Glenrosa. Fractured rock was found at between 500 and 1000 mm. Soil depths not exceeding 700 mm were deemed not suitable for irrigation or vineyard cultivation.

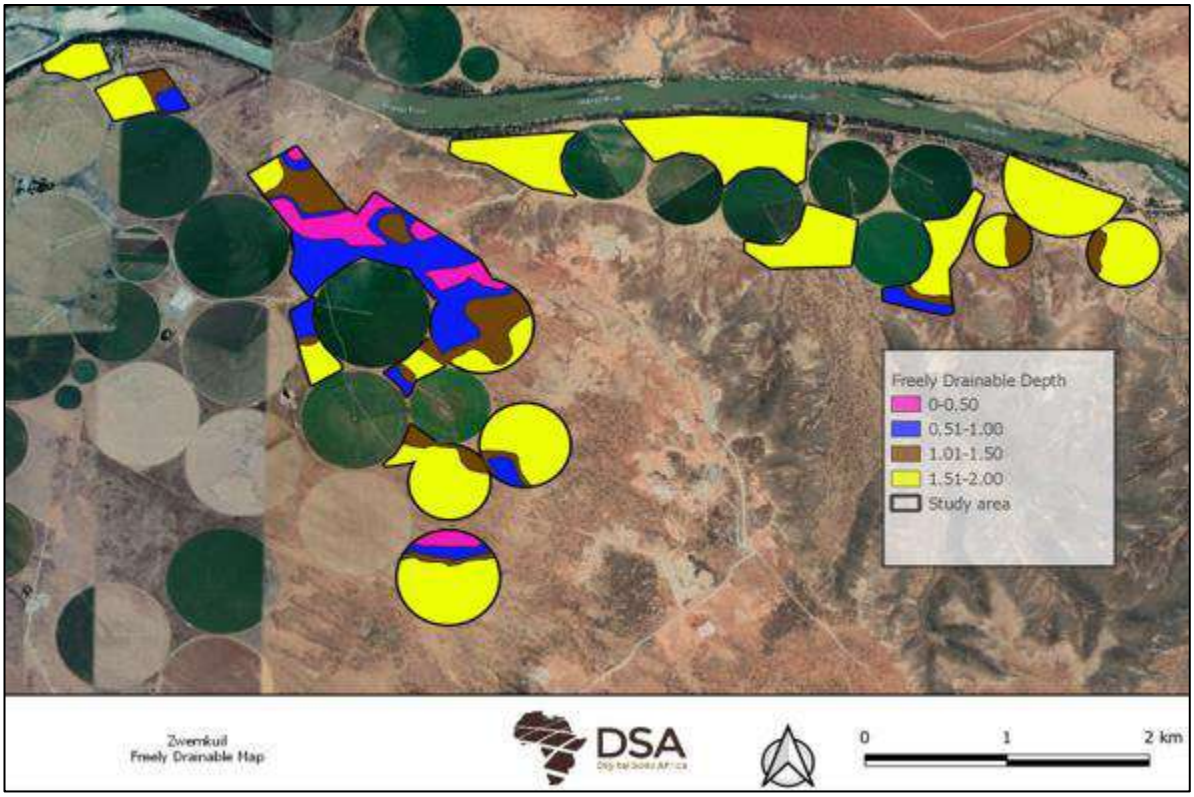

FIGURE 11: FREELY DRAINED DEPTH FOR STUDY AREA (SOIL REPORT, 2022).

Chemical analysis of the soil was done and the laboratory results indicate that the chemical parameters are manageable, it is expected that irrigation with high-quality irrigation water will leach some of the base-forming cations out of the soil profiles and thereby lower the pH. Salinity is of low risk within all areas except the Brandvlei soil area where salinity could be of risk. The exchangeable sodium percentage (ESP) and electrical conductivity (EC) for the rest of the areas are low and the soils have good drainage. The texture results show that in general, the soils do have sufficient drainage.

Clay percentages range from very sandy to moderate. Most soils will have good drainage, but soil water holding capacity and fertility in some areas are low and would require good management. Since the soils are generally sandy, the soil depth would be the biggest contributing factor to drainage.

Ultimately the soil report concluded that approximately 330 Ha of the survey area is suitable for irrigation. Soils with a freely drainable depth of 1000 mm, which included the Hutton, Augrabies, Prieska, Addo, and sections of the Plooysburg, Prieska, Glenrosa and Vaalbos soil forms were suitable for irrigation. The soil forms not suitable for irrigation (Sections of the Plooysburg, Vaalbos, Brandvlei, Prieska, and Glenrosa) were suitable for vineyards under drip irrigation as the soil could be mechanically altered to accommodate vineyards. The area for vineyard production was approximately 76 Ha. The areas not suitable for irrigation or vineyard production were the Coega and parts of the Glenrosa, Vaalbos, Plooysburg, and Brandvlei soil forms. Soil that had a freely drainable depth of <700 was unsuitable for irrigation and vineyard production.

It was recommended by the soil specialist that the pivot placement does not exceed more than 10% of unsuitable soil.

Direct Impacts on the soil

Construction Phase:

The construction phase is effectively the clearing of vegetation, plowing of soil, and planting of crops. The areas identified in the soil report as suitable areas are suitable for any crops (maize, wheat, lucerne, etc), however, the Applicant also wanted to investigate the possibility of planting vineyards and pecan nut trees. Therefore, the soil investigation included specific studies regarding these two crops.

General soil requirements for Vineyard Production

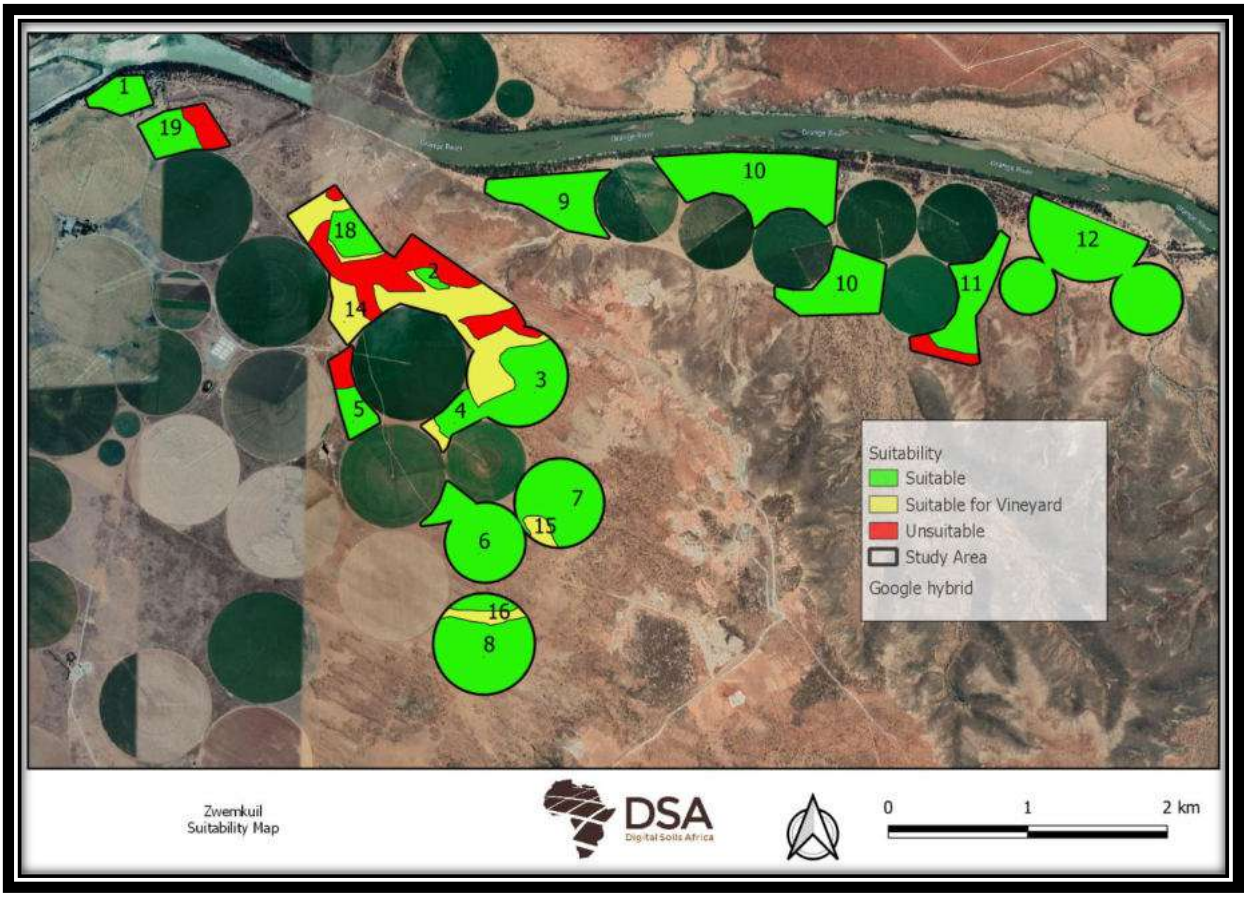

FIGURE 12: SUITABLE SOIL FOR VINEYARD (DSA SOIL REPORT, 2022)

Vineyards are best suitable for soil that has a pH between 5.5 and 6.5 and has required phosphorus between 40 to 50 ppm. Additionally, for vineyards to be successful a depth of between 600 mm and 800 mm is required. By breaking up the soil, deep ripping can allow roots to penetrate the soil and access water and nutrients. Soil texture is one of

the most important components of vineyards, a sandy soil will require intensive irrigation to achieve production goals, while clay soil struggles with cultivation and cracks that disrupts water and nutrient movement. (DSA Soil Report, 2022).

a. Soil depth

Vineyard production requires less soil depth than traditional agricultural produce. The area shown as suitable for the vineyard (Figure 12) has sufficient depth for vineyard roots to develop and is suitable for production. In the unsuitable area, vineyard roots will be restricted, and the available water and nutrients will be limited.

b. Soil texture

The soil texture is generally very sandy, with clay percentages generally under 20%. Dryland vineyards will not be suitable for these soil types as no water would be retained, while drip irrigation would be better suited for the soil type.

c. pH

The pH(KCl) of the soil samples is between 5.7 and 7.4. The more alkaline soils (Red apedal horizon of profiles 75 and Orthic of 88) require a reduction in pH, while the rest of the area has a suitable pH for vineyards. It is recommended that acidifying fertilizers be used on the soils to lower the pH. Liming is not required. Regular soil sampling will inform the farmer of best management practices concerning alkalinity/acidity.

d. Phosphorous

Calcuim carbonate (Found in Coega and Brandvlei and soils with Neocarbonate horizons) exerts a major influence on P fixation. The phosphorous within the soil (6-8 mg/kg) is below the required rate of 40 mg/kg and it is recommended phosphate be applied to prevent plant deficiencies. Phosphate availability is largely dependent on the pH. Soil pH values below 5.5 and between 7.5 and 8.5 limit phosphate availability to plants due to phosphorous being highly fixated at very low pH soils (pH 3-4) and moderately fixated at pH 7.5-9. Therefore, the more alkaline soils of Zwemkuil could experience P deficiency.

Conclusion

The soils indicated as suitable for vineyards in Figure 12 are generally suitable for vineyard production. The pH is not within the optimal range and acidic fertilization should be applied; it is also expected that soil pH will decrease with continued cultivation. The texture is suitable for vineyards under drip irrigation. It is recommended that phosphate be applied to prevent plant deficiencies.

General soil requirements for Pecan nut Production

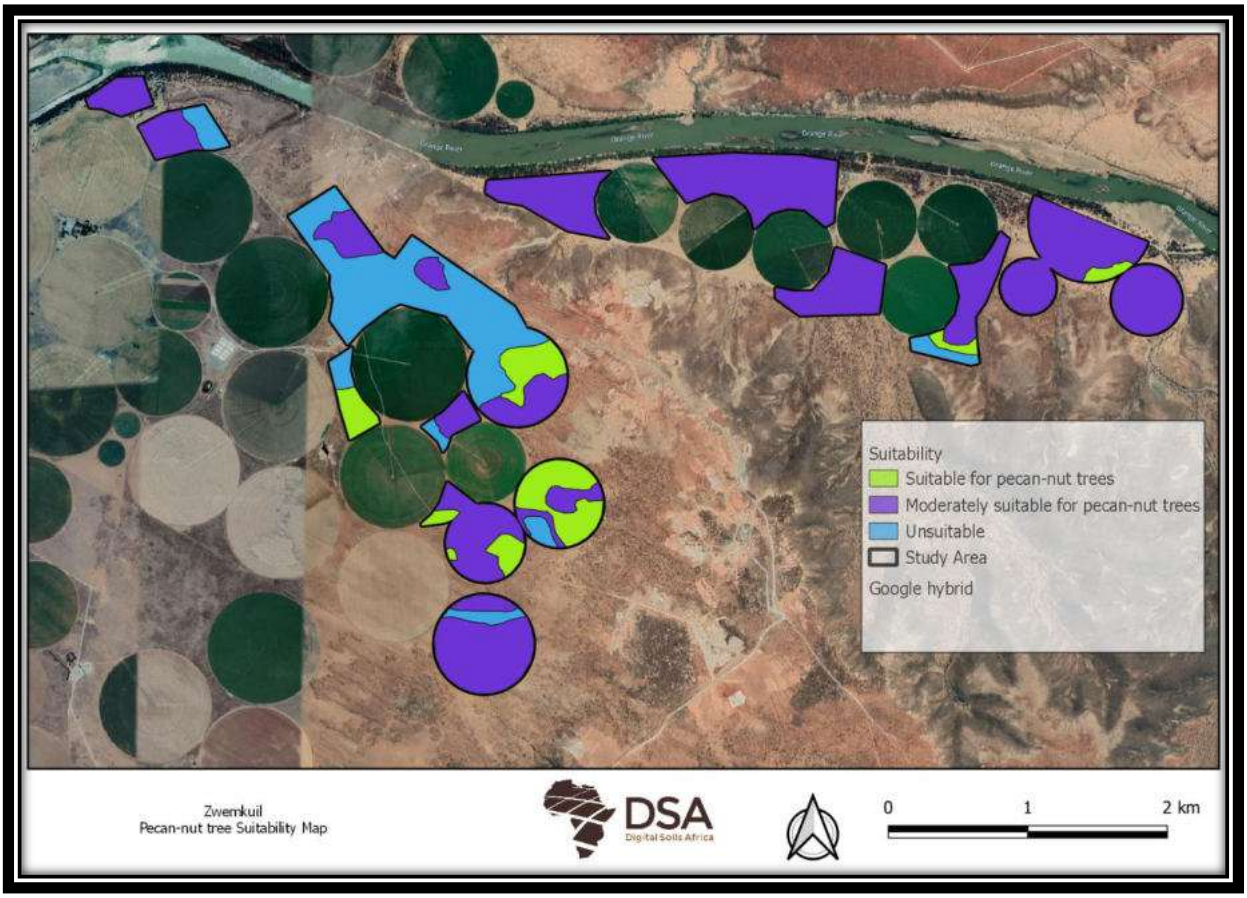

FIGURE 13: SUITABILITY FOR PECAN NUT TREES (DSA SOIL REPORT, 2022)

Pecan nut trees perform best in fertile, well- drained, deep soil which consists of a medium texture. The soil depth should at least be 2 m deep. The soil should not be calcareous as calcareous soil causes deficiencies in micro-nutrients, especially zinc. The pH recommendation for pecan-nut trees is 6.5 to 7. Suitability for pecan-nut trees was defined as suitable (depths of 1000 mm and non-calcareous) and moderately suitable (depths of 1000 mm and calcareous).

Soil depth

Soils with a freely drained depth >1000 mm were considered to have sufficient depth for pecans, which is a large portion of Zwemkuil farm

Soil texture

The soil texture is generally very sandy, with clay percentages under 20%. Pecan-nut trees prefer soil that is freely drained and has a sandy loam texture. All the soils meet the texture requirements.

pH

The pH(KCl) of the soil samples is between 5.7 and 7.4. More acidifying fertilizers should be applied in the alkaline soils (Red apedal of profile 75 and Orthic of profile 88). A slightly acidic pH was found for the rest of the area. Liming is not required on the alkaline soils as it is anticipated that the pH will lower with continued cultivation and irrigation. Soils that are more alkaline could lead to micro-nutrient deficiencies. Regular soil sampling will inform the farmer of best management practices concerning alkalinity/acidity.

Phosphorous

Calcuim carbonate exerts a major influence on P fixation as discussed with vineyard. The phosphorous within the soil (6-8 mg/kg) is low. The recommendations for pecan-nut tres are provided in the Soil Report.

Zinc

Zinc requirements within areas where pH is higher than 7 (Red apedal of profile 75 and Orthic of Profile 88) are especially at risk for zinc deficiencies. The pH can be decreased and thereby increasing zinc uptake in the roots or apply the zinc for foliage uptake. It is recommended to pursue lowing the pH, since the good drainage of the soils allows leaching which, with chemical amendments, can lower pH effectively.

Conclusion

The soils indicated as suitable for pecan-nut trees in Figure 13 are both physically (depth and texture) and chemically suitable for Pecan-nut trees production. The pH is not within the optimal range and acidic fertilization as well as Zn should be applied; it is also expected that soil pH will decrease with continued cultivation.

Based on the findings of the soil report the Applicant must portion the areas allocated for vineyard pecan nut trees and other crops, such as maize, wheat, lucerne, etc., clear the site, and plant the relevant crops. With the recommendations of the soil scientist, the direct impact on the soil properties will decrease to very low. The clearing of vegetation and establishing of the crops will continue into the operational phase on a crop rotation basis (applicable to the maize, wheat and lucerne fields).

Operational Phase:

The operational phase is the phase where soil management and regular soil sampling must take place and will inform the farmer of best management practices concerning alkalinity/acidity of the soil.

The areas producing crops will continue to produce a harvest and must not lead to degradation of the soil or soil on abutting farm areas. After about 2-5 years after the commencement of the project, all the areas applied for should be cleared and the various crop production should be established.

The soil will be managed and maintained by the farmer and will be a permanent establishment. In addition, 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. Without mitigation, the impact is rated low-moderate.

Indirect Impacts on the soil

Construction and Operational Phase:

The soil pH values will impact the phosphorous and zinc availability to plants which can lead to micro-nutrient deficiencies and 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 ultimately lead to 2) the loss of employment.

Thus the only possible indirect impact would be on the site specifically. It is thus clear that the indirect impact has a negative socio-economic impact and soil management and soil management is very important to prevent financial loss to the Applicant 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, the majority of the study area is flanked by pivot areas of the applicant. According to the soil report, drainage will occur in a northern, direction leading to the Orange River as it flows from the hills. Due to the drainage properties of the soil, it is not expected that irrigation and drainage will cumulatively contribute to water accumulating on any of the suitable soils.

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	Medium	4	Low-Medium	3
Probability	Likely	3	Probable	2	Likely	3	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**	**27**	**Low**	**21**
Extent to which impacts can be reversed	Negative impacts can be mitigated through proper soil management, which will include 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 crop and pasture. 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.

According to the soil report, the Augrabies and the Coega soil forms have medium potential for wind and water erosion, and the Plooysburg soil form has a low potential for wind and medium potential for water erosion.

The types of erosion can include:

- Sheet erosion (water erosion), is almost invisible.
- Wind erosion is highly visible and generally much more severe.
- Rill erosion occurs during heavy rains when small rills form over areas making farming difficult.
- Gully erosion makes gullies, sometimes impossible to cross with farm machinery.

- Ephemeral erosion occurs in a natural depression and differs from gully erosion in that the area can be crossed by farm machinery.

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, thus the predicted soil loss is considered very low.

Soil loss due to water erosion reduces crop yields. Managing soil and water resources is the best practice to prevent soil from being washed away. Bare soils are very vulnerable to water erosion, and steep slopes and long, uninterrupted slopes are especially prone to water erosion. Silty soils, soils with low organic matter, and soils with an impermeable subsoil layer are also more susceptible to water erosion.

At the site, the slopes are fairly flat, but sandy however fairly deep. Thus soil management and irrigation scheduling will be important to mitigate potential erosion. In terms of soil moisture management, crop rotation (maize and wheat will be planted, rotating with lucerne the following year and so forth) and moisture conservation practices can reduce drought risks. Since crops differ in their nutrient requirements and their abilities to extract nutrients from the soil. The benefit of rotating maize with lucerne will increase soil nitrogen and carbon content in the soil (Huynh, *et al*. 2019), which will increase the organic matter in the soil, but also reduce the application of fertilizers and reduce the potential impact on water resources.

Due to the unusually high rainfall this region experienced over the past few months, there were erosion dongas noted on the day of the assessment. Soil management would therefore be important to prevent further erosion as a result of this development.

FIGURE 14: EROSION GULLIES AS A RESULT OF UNUSUAL HIGH RAINFALL

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 to 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 the soil.

Factors affecting the extent of wind erosion are wind speed and the soil texture and structure. 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. According to Roose (1996), loamy sand, rich in particles between 10 and 100 microns in size, is the most vulnerable soil. More clayey soil is much stickier, better-structured, and hence more resistant. Coarse sand and gravelly or rocky soils are also more resistant since the particles are too heavy to be removed by wind erosion. The optimum size for wind erosion is about 80 microns.

In terms of the soil structure, Roose (1996) indicated that the less structure-improving matter a soil has on the surface (organic matter, iron and free aluminium, lime), the more fragile it will be, while the presence of sodium or salt often leads to the formation of a layer of dust on the surface, which fosters wind erosion. If the soil surface is stony, forming a "pavement", the risks of wind erosion are lower. Wind erosion also decreases if the surface is rough, due to tillage or ridges perpendicular to the prevailing wind, which slows down the wind at ground level, thus reducing saltation (Roose, 1996). Stubble and crop residues after harvest will also curb wind speed at ground level and soil moisture will temporarily prevent wind erosion since it increases the cohesion of sand and loam.

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 clearing of vegetation and crops.

Direct Impacts on the soil erosion

Construction & Operational Phase:

Crop fields are more vulnerable to soil erosion during the construction phase (clearing of natural vegetation) or immediately after harvest (operational Phase). During the construction phase, the clearance of vegetation will take place but will not cause depressions or change in natural topography and will follow the natural incline of the area,

which will reduce the erosion impact since the site is already relatively flat but considering the sandy texture of the soil, there is a risk of erosion.

Wind erosion control is carried out on two fronts: reducing wind speed at ground level, and increasing soil cohesion, thus improving soil resistance to wind. There are a few mitigation measures, according to Roose (1996) that can be implemented to prevent wind erosion and these include:

- Increase soil cohesion through:
  - Applying organic matter to the surface horizons will improve soil structure.
  - Supplementary irrigation to allow favourable tillage conditions and establish plant cover before windy seasons.
- Increase the roughness of the soil surface:
  - Cropping techniques that leave large clods on the soil surface or ridges perpendicular to the direction of the prevailing wind - although ridges must not be more than 40 cm high or the wind will lop off their tops, thus speeding up erosion.
  - Leaving crop residues in the fields.
- Increase plant cover:
  - Wind-speed can also be cut by increasing plant density. Since this is not easy in arid and semi-arid zones, it is particularly important to ensure sound crop residue management.
- Windbreaks:
  - Their role is twofold: they cut wind speed to reduce both evaporation and wind erosion. Shade cloth or tree stands can be established. The effect of cutting wind speed by 20% is operative over an area 10 to 12 times the height of the barrier before and behind it.
  - This protection depends on the permeability of the wind-break, for relative impermeability reduced speed more, but over a smaller area. According to Heusch (1988), if the speed is cut too much by very close planting, the temperature rises, and crops are scorched along the windbreak. It would be better to regenerate a stand of about 40 adult trees to cut the wind speed more regularly.
  - In principle; wind-breaks reduce evapotranspiration by up to 20% (although the water consumption of the wind-break itself can offset this positive effect), hence the attraction of windbreaks around irrigated crops.
  - The best arrangement would be two rows of tall trees surrounded by two rows of low trees, making up a 10-meter strip, half of which is logged at a time. The cropped area between windbreaks can be as wide as 100 meters if the tall trees are over 5 meters. Root competition is reduced by breaking the young horizontal roots of the trees from the first year onwards by raking the tillage furrow. It is particularly important to repair breaches in a hedge to keep the wind from pouring through at these points (the Venturi effect) and considerably reduce effectiveness.

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

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 falling 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, however, the quality was not tested. 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 crops, it is concluded that no confident assessment can be made of whether the dust will or will not have an impact on harvest yields.

High dust levels can however introduce harmful fungus and mould and can cause mass infection and crop 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, mould or mites, requires costly pesticides and can compromise crop quality. Also, if dust becomes problematic, is that while crops suffer the weeds thrive, which further exacerbates the problem of delayed or stunted growth.

From an environmental point of view, an indirect impact can be the siltation of streams. During the clearing of vegetation or harvesting of crops, the possible impact of wind erosion and resulting dust generation will be the highest risk due to the clearance of vegetation. With the predominant winds in summer being north-easterlies and westerlies, there is limited chance of silt being deposited into the Orange River system during summer periods when the harvest is completed and the irrigation areas are ploughed. Fact that the areas between the site and the Orange River are well vegetated, it is likely that dust will be dispursed and very limited, if any, silt will be deposited into the stream.

Regarding the possible use of pesticides to control fungus, mould, 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 mitigate the impact, genetically manipulated crops are planted, which have significantly reduced the risk of fungus, mould, and mites and thus reduced the use of pesticides.

The indirect impact is rated low-moderate without mitigation, but can be reduced to low with mitigation.

<u>Cumulative Impacts on the soil erosion</u>

During the site visit, erosion was noted on the site along the drainage lines, especially Block N. 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.

The cumulative impact on wind erosion and effectively dust fallout will depend on the harvest seasons and crops. If areas on neighbouring 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 crop area will contribute to the increased cumulative dust fall impact on abutting areas and is rated low-moderate 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	Short Term	1	Short Term	1	Medium Term	2	Short Term	1
Intensity	Medium	4	Low	2	Medium-High	5	Medium	4
Probability	Likely	3	Probable	2	Definite	4	Likely	3
Cumulative Impact	Low		Low		High		Low-Moderate	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low**	**18**	**Very Low**	**8**	**Moderate**	**32**	**Low**	**18**
Extent to which impacts can be reversed	All negative impacts can be successfully mitigated and reversed through soil management and irrigation scheduling.							

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, and 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 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 if lateral drainage occurs. 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 to be onsite during the construction phase (9 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. Ultimately the waste production will be very limited at the site and the impact on soils and surroundings is rated very low with mitigation.

Operational Phase:

During harvest time, the number of workers on site will increase to about 20-300 people (depending on the vineyard and pecan nut crops). 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, one toilet for every 10 people must be provided for the workers during the harvest time and can be removed from the site once the harvest season is over.

As previously discussed, the exchangeable sodium percentage (ESP) values are low and the pH values indicate that salinity is not a major risk. The study area (excluding the Brandvlei soil areas) is of low risk to salinization, with low ESP and EC together with good drainage. A fertilization plan on soils with low CEC should be implemented to ensure maximum crop production.

In terms of pesticides and the vineyard, 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 costs.

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 a portion of the pesticide misses the vine canopy and falls 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 (and can be used as a baseline for the application of pesticides to other crops as well):

- 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, since the Orange River are in the direct path of this wind. The label instructions must always be followed.

Temperature and relative humidity also influence 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 15**Error! Reference source not found.**). 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.

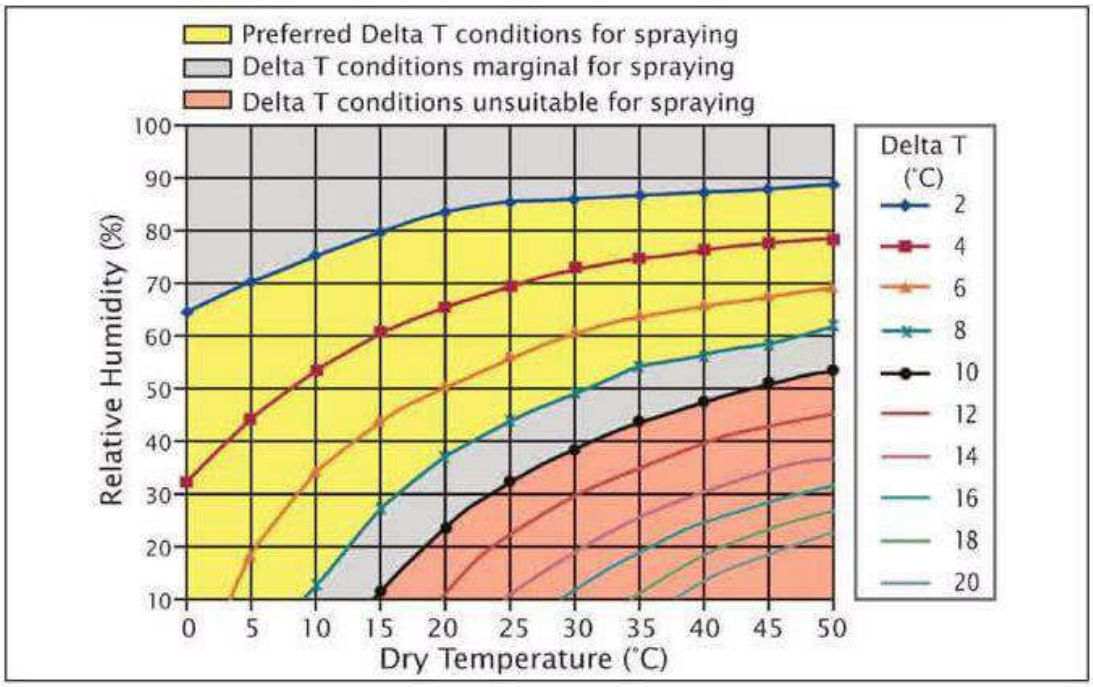

Photo (by Nufarm): Delta T chart to avoid evaporation of droplets when spraying vineyards.

FIGURE 15: 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 pesticide application are the most important factors to consider in choosing which pesticide to use.

In terms of pesticides for maize, stalkborer (*Busseola fusca*) can lead to 80% crop damage. By changing to genetically modified crops the stalkborer infestation can be significantly reduced to 2-3% damage to the entire maize crops, thus the use of pesticides can decreased considerably.

Pathogens generally occur during wet years (usually once every 5 years and what has been recently been experienced) and may include *Fusarium* fungus in the lower-lying areas of the wheat crop area. The *Fusarium* fungus grows on the dead residue from the maize crops and favours moist and warm conditions which then affects the wheat crop that is planted during winter. The fungus is effective to control via chemical control, however, the farm predominately does not battle with fungus or bacteria due to the dry climate.

As a general rule, rotating crop plants not related botanically will help ensure that non-host crops are being used. Some pests problems have such a wide host range or can survive in the soil for such long periods that other methods of control need to be considered. The type and application of pesticides are crucial for two main reasons, financial- and environmental costs.

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. Without mitigation, the impact is rated moderate-high, with mitigation the impact is reduced to low-moderate, considering the limited chances of pesticide application.

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 to 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, diarrhoea, 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 crops.

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 losses 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 other croplands. This region along the Orange River is valuable irrigation land and it is guaranteed that fertilizers and pesticides have been applied to surrounding farms. Many pesticides have been measured 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. Fortunately, the site is fairly far from the Orange River, and with the use of genetically modified crops, the application of pesticides is reduced significantly.

The serious health risks associated with certain pesticides are not only 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).

Except for the past few months of unpredictably high rainfall, 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 such as using genetically modified crops and crop rotation will be applied for this project. For this specific site, if pesticides are used it should not be applied during southerlies at the risk of drift spray towards the Oranje Rivier, 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.

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	Short Term	1	Short Term	1	Short Term	1	Short Term	1
Intensity	Low-Medium	3	Low	2	Medium-High	5	Low-Medium	3
Probability	Likely	3	Probable	2	Likely	3	Likely	3
Cumulative Impact	Very Low		Very Low		Low-Medium		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Very Low**	**15**	**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, irrigation scheduling, crop rotation, and proper planning of applying pesticides.							

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. . The AGIS figure below is outdated as areas in the Southern and Upper Eastern Sections are used for commercial irrigation. Overall the study area itself can be mostly described as an area with a mix of shrubland, low fynbos, thicket, bushland and high fynbos.

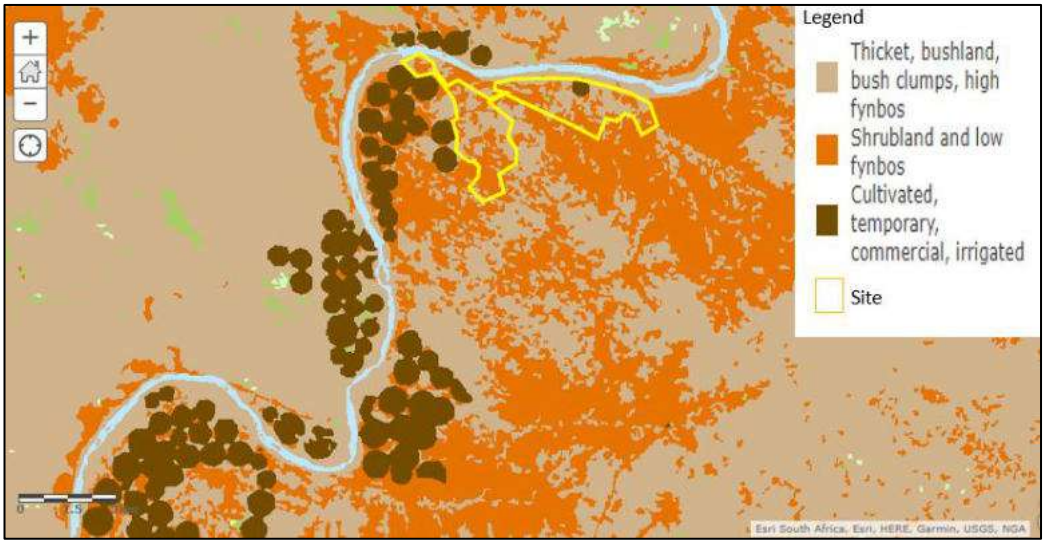

FIGURE 16: LAND COVER CLASSIFICATION ACCORDING TO AGIS

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 is 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.

In comparison with livestock production in South Africa, only 70% of agricultural land in South Africa can be utilized 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 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 were not available, but considering the lower rainfall and the fact that during winter, stock farmers must provide supplements for livestock, indicates that both crop produce and livestock farming can have advantages and disadvantages.

At the Zwemkuil farm, there are camps where the farmer has game and the land between the commercially cultivated lands are grazed by small stock. Thus, from the above, game and livestock farming will continue, but more focus will be given to commercially cultivated produce.

In terms of maize and wheat, they are important field crops in South Africa, serving as the staple food for the majority of its population, particularly for low-income households (Ala-Kokko, 2021). Maize is also the major feed grain for the animal feed industry.

Although fluctuating, there has been a general increase in the contribution of the maize industry to the gross value of South African agricultural production (GVP) from 2006 of about 10 billion rands to 2016 of just under 30 billion Rands. The Northern Cape contributes to 9% of maize production in South Africa. In terms of wheat, the Northern Cape produces about 262 800 tons per year (DAFF, 2016).

Considering the current medium to the low ecological importance 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 crops. The clearing of natural vegetation to establish the crops 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 natural grazing to crop production would also not compromise the needs and the well-being of future generations.

Direct Impacts on Land use

Construction Phase:

The stripping of topsoil and clearing of the vegetation, establishing the irrigation system, vine floor design and the planting of maize/wheat/lucerne/vineyard/pecan nuts (depending on the season after approval) 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 in agricultural use. The change in agricultural activities will, however, be

offset against the net profits of the raisin and pecan nut production within two-seven years, which the landowner had weighed up against the current GDP produced by the grazing unit. The GDP for raisins and pecan nuts will be substantially larger than those generated by the current natural grazing capacity of the site.

If the crop establishment is however unsuccessful, it could be rehabilitated back to a grazing unit and no loss in this regard is anticipated. In addition, as a contribution 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 the areas around the pivot areas that will not be cleared (98.7 Ha).

To mitigate this potential impact during the construction phase, the planning of the irrigated areas 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 land use.

Operational Phase

Once the vineyard and pecan nut orchards are 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 crops. If mitigation is however not implemented and the vineyard and orchard are unsuccessful after a few years, the land use will remain agriculture.

In terms of the areas set out for maize/wheat/lucerne, there will be no impact on the land use if the soil is managed correctly to prevent soil degradation and ultimately failure of the crops. If mitigation is however not implemented and the crops fail, the land use will remain agricultural and rehabilitated back to grazing. After 5 years there is a possibility that the natural dormant seed bank could be lost and it will be difficult and very costly to rehabilitate the site into a functional grazing unit, but it will not be impossible.

Considering the low conservation status of the property, the proposed establishment of crops would not detrimentally affect the ecological value of any property concerned, but would rather increase the economical value of the property. 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 completely mismanaged and soil degradation is the result and failure of the crops, the indirect impacts are most economically and to a lesser extent environmentally.

From an economical point of view, the expected R5 million annual income, the 30 employment opportunities during the construction phase, and the 20 employment opportunities during the operational phase of which 100% will be for previously disadvantaged people, will be lost. It is clear that if the crops are 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 reduced to moderate (negative) without mitigation and the result of failed crops.

From an environmental point of view, about 406Ha of natural veld will be disturbed and transformed into irrigated areas. In the vegetation report completed by Dimela Eco Consulting, it was found that most of the vegetation on the site is not unique and the Upper Nama Karoo vegetation is not considered threatened. Furthermore, no plant species of conservation concern were recorded or are expected to be present in these groups. Dimela Eco Consulting had no objection to the clearing of the proposed sites, provided that mitigation measures as listed in the report be adhered to as a minimum.

Therefore the transformation of this unit into irrigation land will not lead to the degradation of a protected or endangered ecosystem, but if approved the removal of *Boscia albitrunca*, would require a permit for removal. From an environmental point of view, the impact is rated low with mitigation but increases to moderate without mitigation.

<u>Cumulative Impact on the land use</u>

Cumulatively, if crops are established, it would increase the total area under cultivation in this region by about 406Ha, 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 crops are related to incorrect soil management and the 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).

The site, according to Mucina and Rutherford (2006), hosts two vegetation types, namely the Upper Gariep Alluvial vegetation (AZa) and the Northern Upper Karoo (NKu3). However, Dimela Eco Consulting did a vegetation survey of the area. Below are extractions from her report:

The site visit found that the vegetation on the sites ranged from modified to natural vegetation. The grass layer displayed a patchy dominance of grass species (*Eragrostis, Enneapogon* and *Stipagrostis* species), while the tree layer was mostly dominated by *Senegalia melifera* (swart haak), except along the Orange River, where *Vachellia karroo* (sweet thorn) dominated. The dominance of species varied depending on soil substrate (e.g. sandy, red sandy and

pebbly soils). Several ephemeral and dry drainage lines were recorded, characterised by a higher number of tree species.

Please refer to the Final Scoping Report and Dimela Eco Consulting Report for a more comprehensive photographic record of the vegetation representation of the site.

Vegetation was broadly delineated and discussed as per below:

1. Modified land
    a. Impacted land
    b. *Tribulus terrestris* veld
    c. *Eragrostis lehmanniana – Enneapogon cenchroides* veld
2. *Rhigozum trichotomum Eragrostis lehmanniana* veld
3. *Senegalia mellifera veld*
    a. *Senegalia melifera- Enneapogon cenchroides* veld
    b. *Searsia burchellii-Eragrostis lehmanniana* veld
4. Ephemeral drainage- and dry drainage lines
5. *Vachellia karroo* riparian woodland

The vegetation is shortly discussed below and geographically represented in Figure 17. The plant species identified in walked transects are listed in the report (Appendix E).

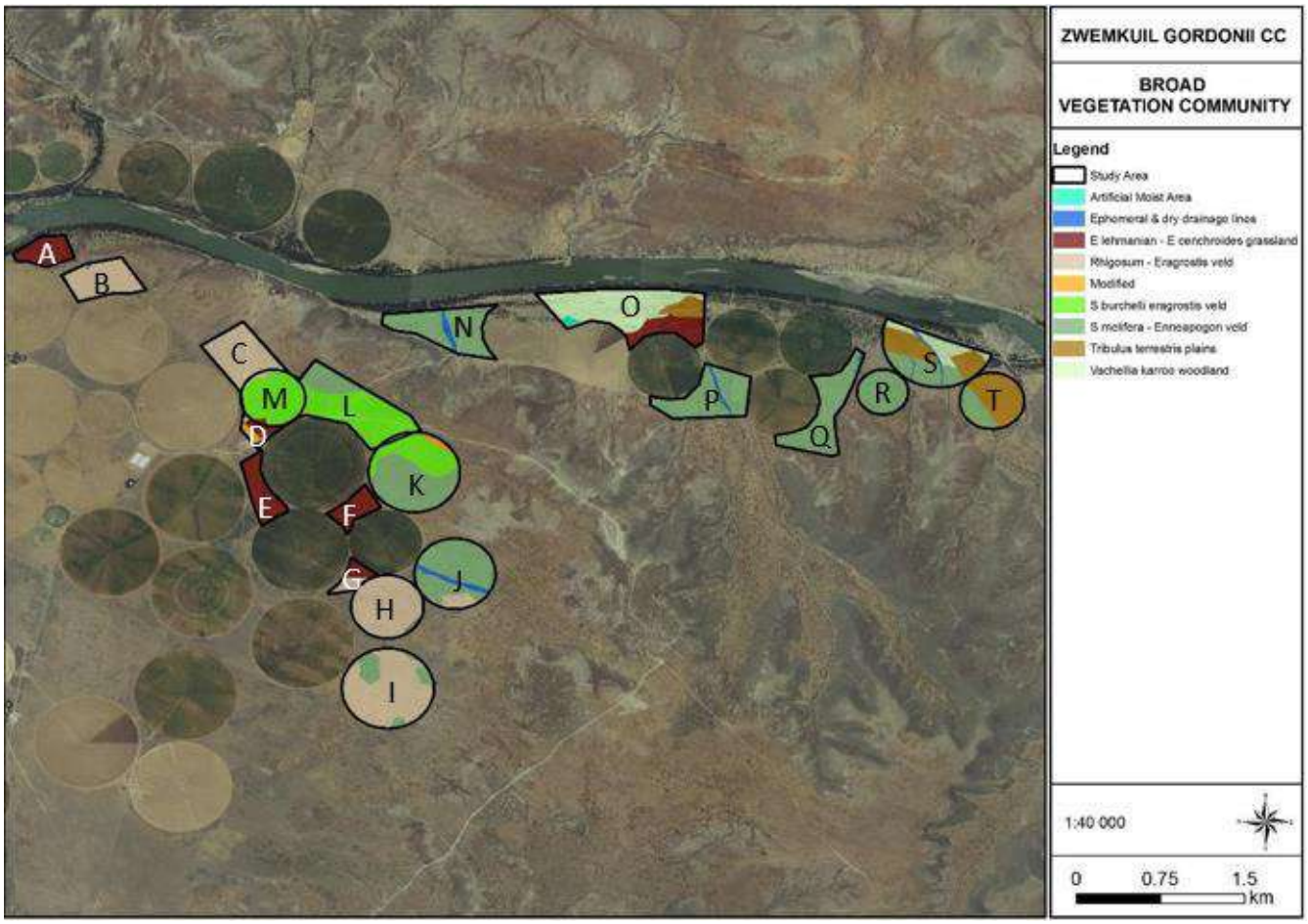

FIGURE 17: BROAD VEGETATION DELINEATION FOR THE AREA UNDER APPLICATION (DIMELA ECO CONSULTING, 2022)

Modified Land

Modified vegetation refers to an ecological condition class in which the ecosystem has been modified, with an almost complete loss of composition and structure. Much of the ecosystem function has been destroyed and the changes may be irreversible. Such land is usually in poor ecological condition and can range from irreversibly modified to moderately modified.

Mine and Agricultural Impacted Land

Mining has destroyed some vegetation to the east of Site K. At the time of the site visit, the area was cleared of vegetation. East of the farm workshop area, the vegetation has also been historically impacted and comprised compacted soils with limited natural vegetation (the western portion of Site D).

FIGURE 18: CLEARED VEGETATION (MINING-RELATED) ON THE EASTERN EXTENT OF SITE K (DIMELA ECO CONSULTING, 2022)

Tribulus terrestris Plains

Historically cultivated land along the northern sites were dominated by the weedy *Tribulus terrestris* as (common devil's thorn / dubbeltjie), especially at Blocks T & S.

FIGURE 19: *TRIBULUS TERRESTRIS* FOUND AT THE SITE

The vegetation ranged from compacted and bare soils with only *T terresris* and some hardy pioneer species noted. Aerial imagery indicates that these areas were not recently cultivated and are remaining in a pioneer state. No natural succession is expected due to the degraded and compacted nature of the soils. The species diversity is low with weedy species such as *Dyspania (Chenopodium) carinata* (green goosefoot), *Xanthium spinosum* (spiny cocklebur) and the grass *Tragus berteronianus* (carrot seed grass). The opportunist tree *Senegalia melifera* (black thorn) and shrub *Lycium* species (Krie doring) were also noted. No plant species of conservation concern were recorded or are expected to be present in this group.

Eragrostis lehmanniana Enneapogon cenchroides Grasslands

Historically cultivated land along the Orange River (e.g., Sites A and O), as well as areas continuously impacted by surrounding cultivation (Sites D, E, F, & G) were found to be dominated by the grasses *Eragrostis lehmanniana* (Lehmann's grass) and dense patches of *Enneapogon cenchroides* (nine-awned grass)

Hardy forbs such as *Tribulus terrestris* (dubbeltjie), *Indigofera alternans* (skaap-ertjie), *Seasamum capense, Hermbstaedtia fleckii, Cucumis zeyheri* and patches of *Gisekia africana var africana* were recorded. The shrub *Lycium cinereum* (krie doring) was also common. No plant species of conservation concern were recorded or are expected to be present in this group.

FIGURE 20: *ERAGROSTIS – ENNEAPOGON* DOMINATED GRASSLANDS

Artificial Moist Area

Site O includes an artificial moist area, likely seepage from the pivot system. However, this must be confirmed by a soil specialist. Here the vegetation was modified as it comprised vegetation associated with most conditions that do not correspond to the Upper Gariep Alluvial Vegetation expected here. The vegetation comprised a dominance of the grass *Chloris virgata, Eragrostis rotifer* and dense, almost impenetrable patches of *Setaria verticulata*. The tree *Ziziphus mucronata* was recorded.

Rhigozum trichotomum Eragrostis lehmanniana veld

Various sites, comprising largely of sandy soils, were dominated by the grass *Eragrostis lehmanniana* Lehmann's grass with dense patches shrub *Rhigozum trichotomum* (three thorn Rhigozum). These areas comprised open grasslands with patches of *Rhigozum* that can also be distinguished from historical aerial imagery.

The grass layer included *Enneapogon cenchroides*, *Stipagrostis obtusa* (bushman grass), *Aristida congesta* (tassel three-awn) and *Schmidtia pappophoroides* (sand quick). The shrubs *Lycium cinereum* (Krie doring), *Helichrysum luciliodes* (bergkerriebos) and *Gnidia polycephalus* (Jannuariebos) were recorded, as well as small individuals of the tree *Senegalia mellifera* and larger *Ziziphus mucronata* to the south of Block C. The forb diversity included *Pentzia* species, *Indigofera daleoides* and *Osteospermum leptolobum*. No plant species of conservation concern were recorded or are expected to be present in this group.

FIGURE 21: *RHIGOZUM TRICHOTOMUM ERAGROSTIS LEHMANNIANA* VELD

Senegalia mellifera veld

Many of the sites were dominated by the tree *Senegalia mellifera*, which is typical of the Northern Upper Karoo. However, this tree forms dense, almost impenetrable stands in many areas on the sites. This is likely indicative of bush encroachment due to a combination of historic land uses, grazing, climatic changes, and elevated atmospheric carbon dioxide. The *Senegalia mellifera* veld were further divided into two variants based on the dominant grass species (*Senegalia mellifera – Enneapogon* species veld), as well as the presence of the discriminant species *Searsia burchelii* (Karoo kuni bush) (*Searsia burchelii-Eragrostis lehmanniana* veld).

Senegalia mellifera – Enneapogon species veld

The grass layer was dominated by grasses of the *Enneapogon* genus and varied depending on grazing and sandiness. Sites grazed by goats were dominated by *E devauxii* (eight-day grass) and *Aristida congestus*. Other sites included dense patches of *E. cenchroides* (nine-awned grass) interspersed with *Eragrotis lehmanniana, Stipagrostis obtusa*,

Eragrostis cilianensis (stink love grass), *E porosa* (besembiesie) and *Schmidtia pappophoroides*. Other than *S melifera,* the nationally protected tree *Boscia albitrunca* (witgat) was recorded, as well as *Ziziphus mucronata* (buffalo-thorn).

The forb diversity varied depending on the grass densities and dominance. Areas covered by *E cenchroides* were low in forb species diversity. Forbs and shrubs recorded included *Pentzia* species, *Gnidia polycephalus*, *Helichrysum luciliodes*, *Indigofera alternans, Roepera (Zygophyllum) lichtensteinianum* (skildpadbos) and *Lycium cinerea.*

Other than the protected tree, *Boscia albitrunca*, no other plant species of conservation concern were recorded. Bulbous species and succulents may be present; however, it may have been dormant or obscured by dense stands of *S meliifera* and *E cenchroides.*

FIGURE 22: *BOSCIA ALBITRUNCA*

Searsia burchelli - Eragrostis lehamnniana veld

This variant had a patchy dominance of the grass *Eragrostis lehamnniana* (particularly the eastern portion of Block L). However, to the south (Block K), the dominant patches of *Enneapogon cenchroides* were prevalent. *Senegalia mellifera* dominated, however, the small tree *Searsia burchelli* was only recorded in this variant. Also, this vegetation included a bulbous species that was becoming dormant (assumed to be an *Ammocharis* species), the shrub *Asparagus* cf *glaucus*, as well as the succulent *Aloe claviflora.* This variant also included a high frequency of the national protected tree, *Boscia albitrunca*.

No plant species of conservation concern were recorded. However, this area is the most likely to support such species.

FIGURE 23: GRAZED *SENEGALIA MELIFERA- ENNEAPOGON DEVAUXII* VELD

Ephemeral and Dry Drainage Lines

A network of drainage lines flows through some of the sites, all of which were dry at the time of this assessment. The tree diversity was higher along these drainage lines with species such as *Ziziphus mucronata* (buffalo-thorn), *Searsia lancea* (karee), *Vachellia karroo* (sweet thorn) and *Lycium oxycarpum* (Karoo honey-thorn). Sandy banks were dominated by the grasses *Cenchrus ciliaris* (foxtail buffalo grass), *Chloris virgata*, *Eragrostis rotifer* (pearly love grass) and *Setaria verticulata*. Forbs and small shrubs that were recorded included *Salsola aphylla* (rivierganna), *Plinthus karooicus* (Karooganna) and *Roepera lichtensteinianum*. No plant species of conservation concern were recorded or were expected to be present.

FIGURE 24: EXAMPLE OF SOME OF THE NETWORK OF DRAINAGE LINES THAT FLOWS THROUGH THE STUDY AREA.

Vachellia karoo woodland

None of the sites proposes to clear riparian vegetation along the Orange River. However, Blocks O and S do impact the associated *Vachellia karoo* woodland along the riparian area.

The areas that will be impacted were historically disturbed. Other tree species recorded included *Diospyros lycioides* (blueish), *Searsia lancea, Ziziphus mucronata*, and *Gymnosporia buxifolia*. The most prominent grass species were *Setaria verticulata* (burr bristle grass), *Chloris virgata* (feather-top Chloris), *Eragrostis cilianensis* and *Cenchrus ciliaris* (foxtail buffalo grass).

No plant species of conservation concern were recorded or were expected to be present.

FIGURE 25: *VACHELLIA KARROO* WOODLAND

The full vegetation report can be viewed in the Appendix E.

The National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA) provides for the listing of plant and animal species as threatened or protected. If a species is listed as threatened, it must be further classified as Critically Endangered, Endangered or Vulnerable. These species are commonly referred to as TOPS listed (Dimela Eco Consulting, 2022). At the time of this assessment, only one (1) TOPS listed species were recorded within Block D. This species, *Harpagophytum procumbens* subsp *procumbens* (devil's claw) is listed as a Protected medicinal plant species and may not be traded. It is recommended that these species be replanted outside of the proposed clearing footprint.

In terms of the provincially protected plants by the Northern Cape Nature Conservation Act No.9 of 2009, at the time of the vegetation assessment, only *Ammocharis carinica* (bulb almost dormant and was assumed to be *Ammocharis*) and the tree *Boscia albitrunca* were recorded. A denser grass layer likely obscured the smaller succulent species. Where such species are encountered, they should be relocated outside of the proposed development footprint. However, the tree *Boscia albitrunca* will require a permit for removal from the Department of Agriculture, Land Reform and Rural Development.

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 irrigated areas for crop production, thus the removal of natural vegetation will be permanent and to the extent of about 406Ha. Once the crop areas are operational, the impacts are likely to be contained to the cleared areas with minimum edge effects (Dimela Eco Consulting, 2022). The following impacts are expected, but can be mitigated:

1. Destruction of natural vegetation
2. Destruction of protected tree and plant species
3. Potential increase in invasive vegetation
4. Degradation of remaining natural vegetation
5. Bush densification
6. Potential pollution of the soil and water

The main mitigation measure to consider is to ensure that open, naturally vegetated areas remain through the cleared areas as ecological corridors while clustering the cleared as is proposed. This could assist the movement of pollinators and the continuation of ecological processes.

According to Dimela Eco Consulting, one species, listed as Rare, has a likelihood of occurring: *Tridentia virescens* and the likelihood of occurring is considered medium to low. Below is an image of this species which should be relocated if found during clearing. No further plant species of conservation concern assessments are thought to be needed.

FIGURE 26: *TRIDENTIA VIRESCENS*

The area of 98.7 Ha around the irrigated areas will not be cleared and if for whatever reason, the crops are not successful, the probability of the site being rehabilitated to represent natural vegetation will be difficult but possible The success of rehabilitation will however not be passive, but active planting and irrigation of species representative of the Upper Gariep Alluvial vegetation and the Northern Upper Karoo vegetation and alien vegetation control will ensure successful rehabilitation.

It is however not the intent of the Applicant for the crops to be unsuccessful, therefore the direct impact on the flora is permanent, the intensity is between high and low, due to the fairly large portion of the area to be disturbed and the probability will be definite. Since the vegetation will be removed permanently the biggest impact will be

experienced during the construction phase, but with conservation or offset plan to transfer the rare and protected species, obtain the permits that need to be obtained, and the alien eradication plan, the significance level is rated moderate, with the mitigation, but increase to high without mitigation. Once in operation, the impact is reduced to low.

ALIEN VEGETATION CONTROL

In terms of alien vegetation, the seed of alien invasive plant species that occur in and in the vicinity of the areas to be cleared could spread into the disturbed and stockpiled soil. Also, the vehicles and equipment that will be sued were likely used on various other sites and could introduce alien invasive plant seeds or indigenous plants not belonging to this vegetation unit to the site. Areas disturbed by edge effects could be infested by alien invasive plant species.

According to Dimela Eco Consulting, the vegetation in the study area is prone to bush densification whereby open veld, in the absence of good veld management, becomes denser and dominated by stands of encroacher species e.g. "stands of plants of the kinds specified in Table 4 of Regulation 16 (CARA), where individual plants are closer to each other than three times the mean crown diameter". Plants in this group are not alien plants, but indigenous plants that tend to become abnormally abundant when the area is degraded. The plants themselves are thus not the problem, but their increased abundance or encroachment into vegetation serves as an indicator of poor land management practices. Several species occurring on the site could become encroachers e.g. *Lycium species, Rhigozum trichotomum, Senegalia mellifera* and *V karroo*. Clearing edge effects and operational disturbances can result in the densification of such species, a change in vegetation composition, and a loss of species diversity, particularly grass and forb species.

The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. On 18 September 2020, the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 43726 of 2020). The Alien and Invasive Species Regulations were published in the Government Gazette No. 43735, 25 September 2020. The legislation calls for the removal and / or control of alien invasive plant species (Category 1 species). In addition, unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within close proximity to a watercourse. Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

> Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
>
> Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.

Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

The alien plant species identified on the study site are listed in the specialist report in Appendix E. Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

(a) notify the competent authority in writing
(b) take steps to manage the listed invasive species in compliance with
    (i) section 75 of the Act;
    (ii) the relevant invasive species management programme developed in terms of regulation 4; and
    (iii) any directive issued in terms of section 73(3) of the Act.

The following category 1b plants were observed within the site:

Argemone mexicana
Eucalyptus camaldulensis
Opuntia ficus-indica
Salsola kalii
Xanthium spinosum

See the Environmental Management Plan in Appendix D for specific control measures for the above-listed species.

Indirect impact due to the removal of vegetation

Construction & Operational Phase

An indirect impact 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 impact 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.

Finally, the removal of vegetation can lead to the degradation of the remaining natural vegetation. It could change the fire regime (if any) on the site, as well as the presence and activity of herbivores, small mammals, and pollinators within the Northern Upper Karoo, with mitigation the moderate indirect impact is reduced to low (Dimela Eco Consulting, 2022).

Cumulative Impact on the Flora

According to Dimela Eco Consulting, the cumulative impacts are limited. The area that the site is situated in is located south of the Orange River. Several pivot systems, as well as mining, are taking place along and around the river. Thus, clearing of additional vegetation on the sites will reduce the remaining Northern Upper Karoo vegetation in this area. however, currently, this vegetation is not threatened. The cumulative impact on the 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	High	6	Medium	4	Low-Medium	3	Low	2
Probability	Definite	4	Definite	4	Definite	4	Definite	4
Cumulative Impact	Low		Low		Very Low		Very Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Moderate-High**	**44**	**Moderate**	**36**	**Low-Moderate**	**32**	**Low-Moderate**	**28**
Extent to which impacts can be reversed	Impacts on vegetation are compensated as the adjacent area hosts similar habitats. The impacted vegetation can be mitigated to some degree through a conservation plan/offset plan by transplanting some plants to the remaining 98.7 Ha area between the irrigated areas and controlling 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 concentration of species at a certain location.

FIGURE 27: SENSITIVE MAMMAL SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

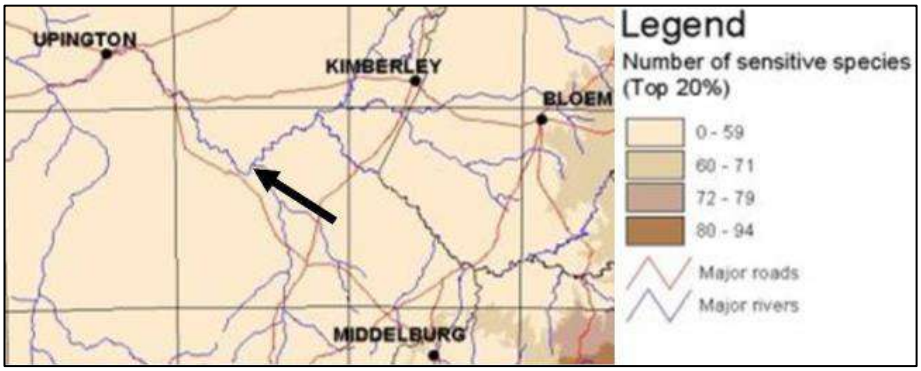

FIGURE 28: SENSITIVE BIRD SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

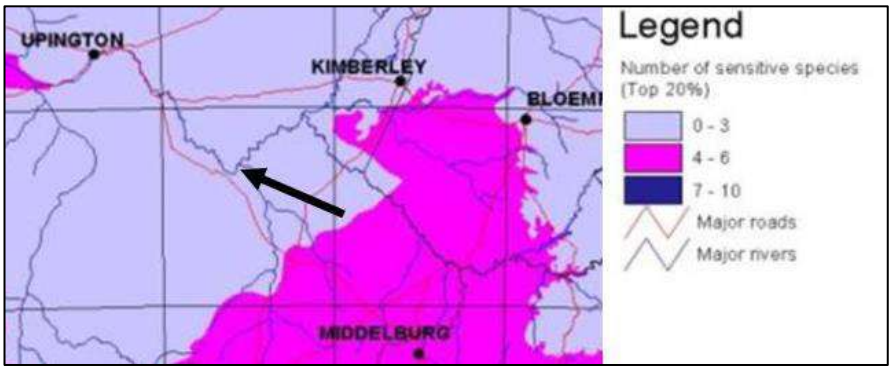

FIGURE 29: SENSITIVE REPTILE SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

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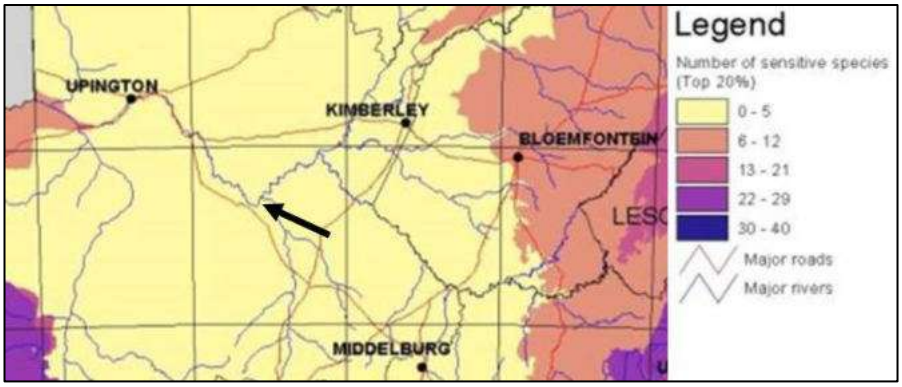

FIGURE 30: SENSITIVE BUTTERFLY SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

The occurrence of faunal species within the proposed area is likely, however, it is farm properties and generally fenced-in camps, which will hinder 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, and others. From 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 birds 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, kudu (*Tragelaphus strepsiceros*), blesbok (*Damaliscus pygargus phillipsi*), gemsbok (*Oryx gazella*) springbok (*Antidorcas marsupialis*), ground squirrel (*Xerus inauris*), guineafowls, falcons, finches, the northern black korhaan (*Afrotis afraoides*) and vervet monkeys (*Chlorocebus pygerythrus*) was within the abutting crop fields, mongoose (*Herpestidae*), and various common birds. A few burrows were noted and diggings out of old termite hills, which could indicate the presence of aardvark (*Orycteropus afer*).

Due to the heavy rains this region received, huge swarms of brown locust (*Locustana pardalina*) have been spotted in the region, and on the day of site inspection, many locusts in nymph stage were noted. They are considered a pest for agricultural activities and can cause huge financial losses if crop fields are devoured by adults.

FIGURE 31: BROWN LOCUST SPOTTED ON THE FARM

The clearing of vegetation would be restricted to limited areas and the fairly slow clearance rate would provide adequate time for migration of any animals remaining on-site to be sustained in similar adjoining habitats. Also, noise generated by vehicles will cause most animals to vacate the site temporarily. If certain species were to be affected they would simply vacate the proposed cleared areas during the day and return during the night. Since adequate buffer zones will be maintained from drainage lines, the clearing of vegetation will not impact amphibian species.

Direct Impacts on the fauna

Construction Phase:

During the construction phase, the clearing of vegetation will destroy habitat and put animals at risk of being killed, and nesting places being destroyed will have a direct impact on animals living in the study area. Once clearing of natural vegetation has occurred the impact on the habitat had occurred and during the operational phase of planting and harvesting crops, the impact on the habitat will be negligible as the same area will be disturbed and replanted. Crops might provide food for animals, but not a shelter, except perhaps the pecan nut trees.

The clearing of vegetation would be restricted to limited areas and the fairly slow clearance rate would provide adequate time for migration of any animals remaining on-site to be sustained in similar adjoining habitats. Also, noise generated by vehicles will cause most animals to vacate the site temporarily. If certain species were to be affected they would simply vacate the proposed cleared areas during the day and return during the night. Since there are no water features onsite, the clearing of vegetation will not impact amphibian species.

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 south and south-east is still in a natural condition, however, the farm has fenced camps and the Orange River runs north of the study area. Thus in terms of connectivity, although the site is also directly abutting cultivated areas, the south and southeastern area and the Orange River system with drainage lines on the farm area will provide a corridor for migration.

Overall, the study area, in its current status, is moderately restrictive in terms of 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 a 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, would be restricted to aquatic environments, and since the clearing of vegetation and establishment of irrigated land will not take place in drainage lines, these animals or their movement will not be impacted.

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 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 the clearing of vegetation 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, and 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 pivot area 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, the 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-moderate. If certain species were to be affected they would simply vacate the proposed cleared areas during the day and return during the night.

Operational Phase

As indicated above, once the natural habitat has been destroyed to establish the irrigation areas, the impact is done. Future cultivation and harvesting will not increase the impact unless pivot/irrigation areas are extended. Thus the impact during the operation phase on the fauna is rated very low with mitigation.

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 the farm staff. Strict control measures will be put in place and severe penalties will be applicable if any animal on site is poached.

Another potential indirect impact on fauna, during the operational phase, is the potential risk of insects and pathogens. It is important to discuss the potential impact since not all insects are environmentally or economically beneficial for the farm. For example, bees pollinate certain crops, which is essential for crop production, while certain moths species lay eggs in stems that can ruin crops. Crop rotation has been used as a method to prevent, curb and/or decrease possible insect pests and pathogens from spreading.

In terms of pathogens such as fungi, nematodes, and a few bacteria, they can inhabit soil and can persist for many years in the absence of a susceptible crop. Although the populations of these types of pathogens may not decline with crop rotation, the rotation can prevent the populations from increasing or reduce the rate of increase (Seminis, 2020). Some pathogens have wide host ranges that can include crops in different rotational groups, thus care must be taken when designing rotational sequences to manage such pathogens. In addition, crop rotation will not be effective against pathogens that primarily enter fields on air currents, by vectors (e.g. insects), or on the seed.

The length of time between similar crops also requires management concerning the pathogen. Some pathogens remain viable in the soil or infested crop debris for a short time, thus rotating away from a susceptible host for 1-2 years is adequate for reducing populations of the pathogens.

It must be noted that crop rotation will not be a successful tool in fighting or reducing pathogens levels in the soil if plants that belong to the same family are rotated, because the same family often share the same pest problems.

Another factor that needs to be considered in crop rotation, is that it is not very effective on pathogens that have a wide host range, such as *Rhizoctoinia solani*, and *Pythium* species. It is very difficult to find a suitable crop to rotate with and crop rotations need to be especially carefully selected to reduce pathogens such as these.

In terms of insect pests, there are a few that can cause much damage to maize crops. According to Bell (2016):

- The maize stalkborer (*Busseola fusca*), is the most serious insect pest of maize in South Africa and has caused enormous crop losses (estimated at more than 10% of the national crop). The use of pheromone moth traps has greatly enhanced timeous spraying against this pest.
- The cutworm (*Euxoa* and *Agrotis* species) is the second most important maize pest in South Africa. It is a general feeder, and attacks almost any kind of succulent young plant, causing the most damage in spring.
- The black maize beetle,(*Heteronychus arator)*, affects a wide variety of crops, including maize, sorghum, wheat, ryegrass and oats. Symptoms are sometimes confused with cutworm damage. Although it occurs virtually throughout S.A., there are certain areas in which it assumes plague proportions. It seems to favour cooler areas and sandy soils.
- The common name, maize snout beetle, refers to several kinds of closely-related weevils which feed on the leaves of young maize plants. Four different species cause the most loss and others that are occasionally troublesome. The four major species are *Tanymecus destructor, Systates exaptus, Mesoleurus dentipes* and *Protostrophus* spp. None of these fly. Once land is infested trouble can be expected year after year.
- The spotted maize beetle, *Astylus atromaculatus*, is also known as the Astylus beetle or the pollen beetle. The adult feeds on pollen, but will also attack the soft, young kernels of maize cobs when the silks are wilting off. Larvae can reduce seedling stands drastically. Larvae are also known to drill into maize pips, preventing their germination.
- The American bollworm, *Heliothis armigera*, derives its common name from the fact that it is one of the worst pests of cotton in the United States. Where it attacks maize cobs it is commonly called the cobworm.

- The maize chafer beetle,*Adoretus cribrosus*, attacks tender growth at night, causing damage to the leaves. It is easily controlled with insecticides, but spraying is seldom necessary.
- Various members of the family Aphididae suck the sap from young leaves. Spraying is seldom necessary.
- The maize rootworm, *Buphonella murina*, is becoming a significant pest in parts of South Africa. A granular systemic insecticide is registered for use against maize rootworms.
- Leafhoppers belonging to the family Jassidae transmit streak virus in maize. Systemic insecticides are registered for use against these leafhoppers.
- Wireworms (Elateridae) and false wireworms (Tenebrionidae) are sporadic but potentially serious pests, and it is occasionally necessary to treat these pests.

In terms of insects on wheat, according to the ARC, 2014 the following insects can cause damage to the crops:

- The greater false wireworm (*Somaticus* spp.) They are controlled through cultural practices supporting germination and rapid seedling development, which will shorten the vulnerable 'damage period' of the plant thus limiting seedling loss and retaining plant densities. Targeting the larval stage in the soil through seed treatments can also be used with the best effect where seedlings grow actively under moist soil conditions.
- The lesser false wireworm (*Gonocephalum* spp.). They are controlled through cultural practices supporting germination and rapid seedling development which will shorten the 'damage period' of the plant thus limiting seedling loss and retaining plant densities. Targeting the larval stage in the soil through seed treatments can also be used with the best effect where seedlings grow actively under moist soil conditions.
- The black maize beetle (*Heteronychus arator*). Cultural practices supporting germination and rapid seedling development will shorten the 'damage period' of the plant thus limiting seedling loss and retaining plant densities. Chemical seed treatments are registered as pre-plant approach toward control of adult beetles.
- The Russian wheat aphid (*Diuraphis noxia*). The best control option for RWA is the use of resistant cultivars.
- The greenbug (*Schizaphis graminum*). Infestations during hot, dry conditions seem more injurious. Chemical interventions can be considered when 30-40% of the tillers are infested with 10 or more aphids per tiller.
- The oat aphid (*Rhopalosiphum padi*). The oat aphid is less harmful than RWA. Population increase generally occurs after the flag leaf stage and chemical control can be considered when 50% of the tillers are infested with 10 or more aphids per tiller.
- The maize aphid (*Rhopalosiphum maidis*). Mixed populations of Maize Aphid, Brown Ear Aphid and Oat Aphid do occur and should be controlled when 50% of the tillers are infested with 10 or more aphids per tiller.
- The brown wheat mite (*Petrobia latens*). In South Africa, two systemic insecticides are registered against the Brown Wheat Mite on wheat. Rainfall of more than 12 mm will destroy mite populations.

All of these insects can be controlled by applying insecticides (in the correct manner). However, by understanding the life cycles of these insects and by disrupting their habitat through ploughing and crop rotation, insects can be managed. Unfortunately, for crop rotation to control an insect pest effectively, the insect must live in one crop to the beginning of the next in a stage with low mobility and must have a restricted range of host plants, of which not many insects fit this pattern. Most adult insects can travel easily across at least a single farm and emerge from their overwintering stage in the spring, so crop rotation from one year to the next will not affect them. But by growing a

crop that is not a host plant for that pathogen or insect could lead to the pest dying out and its population levels lowering.

For example, the hibernating larva is the weak link in the stalkborer life-cycle, and ploughing can reduce the stalkborer threat (Bell, 2016). Likewise, winter ploughing before August destroys winter weeds and the cutworm larvae exposed on the soil surface might be damaged or taken by birds. Frost also kills cutworm larvae and the destruction of winter weeds prevents the larvae from feeding and also denies the moth a site for oviposition.

Cultivation can be used to control the black maize beetle, because the larval stage is very sensitive to disturbance. Partial suppression of insect numbers might be obtained by cultivating during September and October. While the American bollworm can be controlled if the maize lands are kept free of weeds.

In terms of pathogens, during wet years (usually once every 5 years, or as recently experienced) the *Fusarium* fungus could potentially become a problem in the lower-lying areas. The *Fusarium* fungus grows on the dead residue from the maize crops and favours moist and warm conditions which then affects the wheat crop that is planted during winter. The fungus is effective to control via chemical control, however, the farm predominately does not battle with fungus or bacteria due to the dry climate.

Chauhan *et al* (2008) suggested that seed treatment or pre-sowing soil drench with carbendazim or carboxin could be used to reduce seedling mortality of cotton due to an individual or combined infections of *Fusarium, Macrophomina* and *Rhizoctonia* spp. Singh *et al* (2016) reported that carbendazim is a major pollutant detectable in food, soil and water. Carbendazim's extensive and repeated use induces acute and delayed toxic effects on humans, invertebrates, aquatic life forms, and soil microorganisms. The acceptable daily intake (ADI) of carbendazim is 0.03 mg/kg/day in India (Sharma, 2007). However, Devi *et al*. (2015) found that the foliar use of 12% carbendazim and 63% mancozeb combination on mango fruits were found to be safe for both crop and consumer health.

At the end of the day, any chemical used to treat fungus infections will have an impact on the environment. Considering that the farm predominately does not battle with fungus or bacteria due to the dry climate, the limited times used (possibly once every 5 years) will reduce this impact to very low.

As a general rule, rotating crop plants not related botanically will help ensure that non-host crops are being used. Some pests problems have such a wide host range or can survive in the soil for such long periods that other methods of control need to be considered. Crop rotation is still one of the better, more widely practised, and cost-effective methods of disease prevention.

Vineyard

In terms of fungus and pests on vine trees, high dust levels can introduce harmful fungus and mould and can cause mass infection and fruit rot, which will lead to harvest loss and loss of income, as discussed under the heading ‘Soil’.

In terms of pests, grapes are frequently attacked by grape berry moths, whose larvae feed on grapes (DAFF, 2012). To control diseases resistant cultivars are used, vines are regularly pruned and only when necessary fungicides are used. Sanitation is also important. The following diseases, according to the DAFF (2012) are common when rainfall, humidity and temperatures are high:

Powdery Mildew

Any part of the plant (leaves, blossoms, fruit and young leaves) can become affected. This is more important from the viewpoint of the export of fresh grapes. The disease leaves blemishes on the affected berries and results in deformation. As the name suggests, the first symptom is the appearance of a white powdery (ash-like) substance on the leaves, young shoots and immature berries. The disease is common under warm and dry conditions.

To control powdery mildew, sulfur-containing organic fungicide is recommended as both a preventative and treatment for existing infections (Hagen, 2022). Affected leaves, stems, buds, and fruit can be trimmed and pruned and discarded, however, do not compost any damaged or diseased foliage as the spores can spread and persist in the composted material. Disinfect pruners and all the tools after using on infected plants (Hagen, 2022).

Downy Mildew

According to the DAFF (2012), the disease is caused by light and continuous rain or heavy dew that is associated with high humidity; or low temperature also favours the development of the disease. It attacks the leaves, flowers, clusters, and young fruit. The first symptoms are light-yellow spots on the upper surface of the mature leaves corresponding with white spots on the lower side. The affected leaves turn brown and cannot support bunch development due to reduced photosynthetic activity.

To control downy mildew, it is important to maintain plant vigour by ensuring that the soils are well-drained and fertilised according to the soil test information (Missouri Botanical Garden). Remove fallen leaves which are the source of overwintering inoculum and prune out the ends of infected shoots. Fungicides are an important control measure, especially on susceptible cultivars. They should be applied just before bloom, 7 to 10 days later (usually at the end of bloom), 10 to 14 days after that, and finally, 3 weeks after the third application. For cultivars very susceptible to downy mildew or where the disease was severe the previous season, an additional application is suggested about 2 weeks before the first blossom opens. Only use pesticides registered for use but preferably select and plant resistant cultivars (Missouri Botanical Garden).

Bacterial leaf spot

The disease is more frequent when the temperature is 25°C to 30°C and humidity is 80-90%. The first symptoms appear on young growing shoots. This disease infects leaves, shoots and berries. On the leaf, it appears as minute water-soaked spots on the lower surface of the leaves along the main and lateral veins. The spots coalesce later to form larger patches and brown-black lesions on the berries which become small and shrivelled. Since it spreads rapidly, treatment needs to happen immediately, delaying treatment could lead to the death of the entire vine.

To control Bacterial leaf spot the first preventative measure is to plant disease-resistant seeds. Since Bacterial leaf spot lives in the soil for years, rotating crops is essential and since water on the foliage encourages the spread of the bacteria, watering the vines at the base is essential. If the bacteria live in the soil and water from a sprinkler splashes it onto the plants it can become infected, therefore drip irrigation is recommended (Hayes, 2022).

Always lay a thick layer of mulch under the vineyard trees to cover the soil as it can stop water from splashing soil onto the leaves and preventing infection (Hayes, 2022). Pruning is an important step in preventing bacterial leaf spot and it improves air circulation around the vines. Infected plant debris must be removed. Never use as compost plants that are infected with diseases, as they will infect the entire compost. Always disinfect pruning equipment after each cut to prevent spreading the bacteria.

Black rot

The disease occurs more frequently in areas with a warm and moist climate and extended periods of rain and cloudy weather, therefore highly unlikely to occur in the Northern Cape. However, with the recent high rainfall events, it is a small possibility. The disease attacks the leaves, stems, flowers and berries. All the new growth will likely be attacked during the growing season. The symptoms are usually reddish-brown spots on the leaves and a black scab on the berries.

Black rot can be very difficult to control and there is no one method, including the use of fungicides, that will control it alone. An integrated disease control program that uses some very important cultural practices combined with the application of effective fungicides must be used. Fungicides alone will not provide complete control without the use of cultural practices.

Sanitation is extremely important. Destroy mummies, remove diseased tendrils from the wires, and select fruiting canes without lesions. It is very important not to leave mummies attached to the vine. Research has shown that mummies on the ground release most or all of their ascospores before the end of bloom. Mummies left up in the trellis can produce ascospores and conidia throughout the growing season, thus making control of this disease much more difficult. If only a few leaf lesions appear in the spring, remove these infected leaves (Ellis).

Black rot is generally controlled very effectively in commercial grape vineyards largely because several very effective fungicides are readily available to commercial growers.

Pecan Nuts

Scab

In terms of diseases and pests on pecan nut crops, scab is caused by a fungus and is the most important disease in pecan nuts in South Africa (DA, 2000). Early symptoms are the appearance of numerous small, brown to black spots, especially on the underside of the leaves. The spots become larger and merge until the entire leaf turns black.

Immature leaves drop off. Similar spots are visible on the shuck of the nut. Such nuts suffer from delayed development and they are misshapen. Immature nuts may drop off and have no commercial value.

The fungus winters on branches and old shucks that have dropped. Fungal spores rapidly develop in spring and are spread by wind and rain. New spring growth on the trees is infected when the leaf surfaces are wet, especially after rain. Susceptibility for the disease varies in different cultivars. Ukulinga, Shoshoni, Moore and Barton are regarded as highly tolerant, while Mohawk, Wichita and Chocktaw are susceptible.

To control scab, fungicides can be used, but it is better to select resistant cultivars and use good cultural practices, such as involving ways of getting the air moving around the trees to keep it dry. This can be accomplished by pruning and thinning the trees to encourage air and sunshine to enter the canopy, helping to dry the branches. In the planning phases, the planting of trees can also be spaced optimally to allow for air moving.

Pecan Nut Stem Borer

In terms of pests on pecan nut crops, the pecan nut stem borer is sporadically observed on pecan nut trees. The first sign of an infestation is red-brown granular excretions around the base of the trunk. This discharge comes from the pink coloured larvae which have burrowed into the trunk and branches of the trees (DA, 2000). The tunnels vary in size according to the age of the larvae and can be as much as pencil thickness. Numerous tunnels occur in a single tree trunk. Young larvae hatch from the middle of December until the end of February. The larvae reach their maximum size of approximately 40 mm during spring and early summer. At this stage, the larvae become inactive and change into pupae in the tunnels. The pupal stage lasts approximately 6 weeks and it appears that only 1 generation occurs per year. The larvae remain in the trunk for about 11 months.

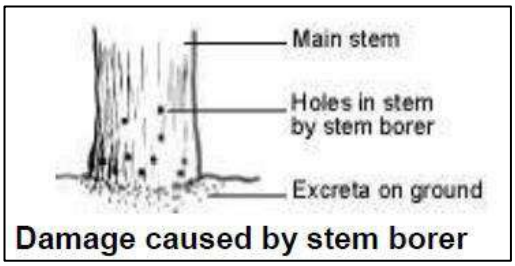

FIGURE 32: ILLUSTRATION OF DAMAGE CAUSED BY THE STEM BORER (DA, 2000)

In terms of control, good chemical control of the larvae in the tunnels can be obtained. By removing larval excreta around the stem just after spraying, the producer can later determine whether some of the tunnels were skipped during spraying.

In young trees, a piece of soft wire can be used to kill the larvae in the tunnels. This method, although primitive, is very effective and must be undertaken during winter when the tunnels and the excreta are more noticeable around the stem of the tree.

Bark borer

The bark borer is another pest of the pecan nut crop and the larvae of the bark borer feed on the living bark of pecan nut trees, especially in young plantings. They later bore into the hardwood. Penetration is usually where branches are formed and can occur in branches of any thickness. The holes in the branches that serve as shelter for the larvae are about 70 mm long and 5 mm in diameter when the larvae reach maximum size. Feeding marks on the bark are covered with larval excreta spun together with threads in such a way that the larvae can move freely underneath the threads. As the larva feeds, this "house" of spun threads and excreta becomes bigger and could be found around a branch. Although infected trees do not die, the branch is ring-barked and it could die back.

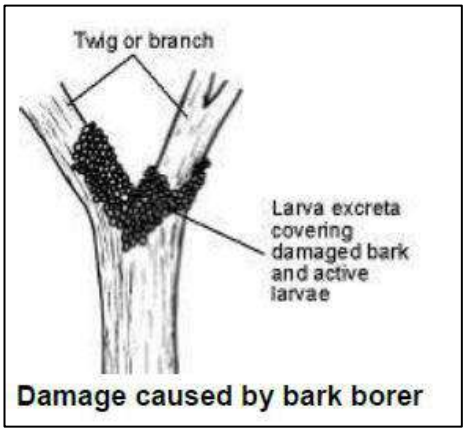

FIGURE 33: ILLUSTRATION OF DAMAGE CAUSED BY BARK BORER (DA, 2000).

Good control can be achieved with a registered chemical, even if only the lesions on the branches are treated. It is not necessary to remove the excreta from the branches before spraying. Spraying of the entire tree is not recommended.

Tapinanthus spp.

Parasitic plants in pecan-nut trees such as *Tapinanthus* spp. (bird-lime), occur in most pecan-nut producing areas of South Africa (DA, 2000). These plants have no root system and parasitise the host plant. They debilitate the tree and reduce the bearing area. The plants, with their red and yellow flowers, are easily seen on the tops of pecan trees, especially during winter and September.

There is no chemical control method for these parasitic plants. The only way is to prune the parasitic plants. The branch on which the bird-lime grows must be cut off and removed from the orchard.

Another indirect 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 in crop fields, 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 behaviour and impact 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 behaviours, 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.

If the applicant will apply pesticides, 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 406Ha will be transformed within this region.

Considering the location of the study site, the abutting area south and south-east host similar habitats and due to the topography will not be transformed into croplands. If certain species were to be affected by the proposed development of crops, they would simply vacate the proposed area and find shelter in the area north of the site or they would simply vacate the site during the day and return during the night.

Also, the impact on faunal movement on the property is existing and the proposed development will not contribute to additional impediments to 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	Local	2	Local	2	Local	2	Local	2
Duration	Long Term	3	Short Term	1	Long Term	3	Short Term	1
Intensity	High	6	Medium-High	5	Low-Medium	3	Low	2
Probability	Definite	4	Likely	3	Probable	2	Probable	2
Cumulative Impact	Low-Medium		Low		Low-Medium		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Moderate-High**	**44**	**Low-Moderate**	**24**	**Low**	**16**	**Very Low**	**10**
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 19.5km south and about 30km southeast of the proposed site.

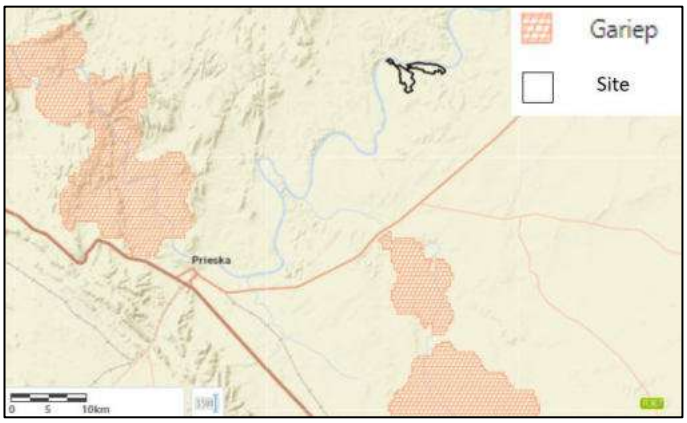

FIGURE 34: THE NATIONAL PROTECTED AREAS EXPANSION STRATEGY (NPAES) INDICATES THAT THE GARIEP FOCUS AREA, IS SITUATED MORE THAN 10KM FROM THE SITE.

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.

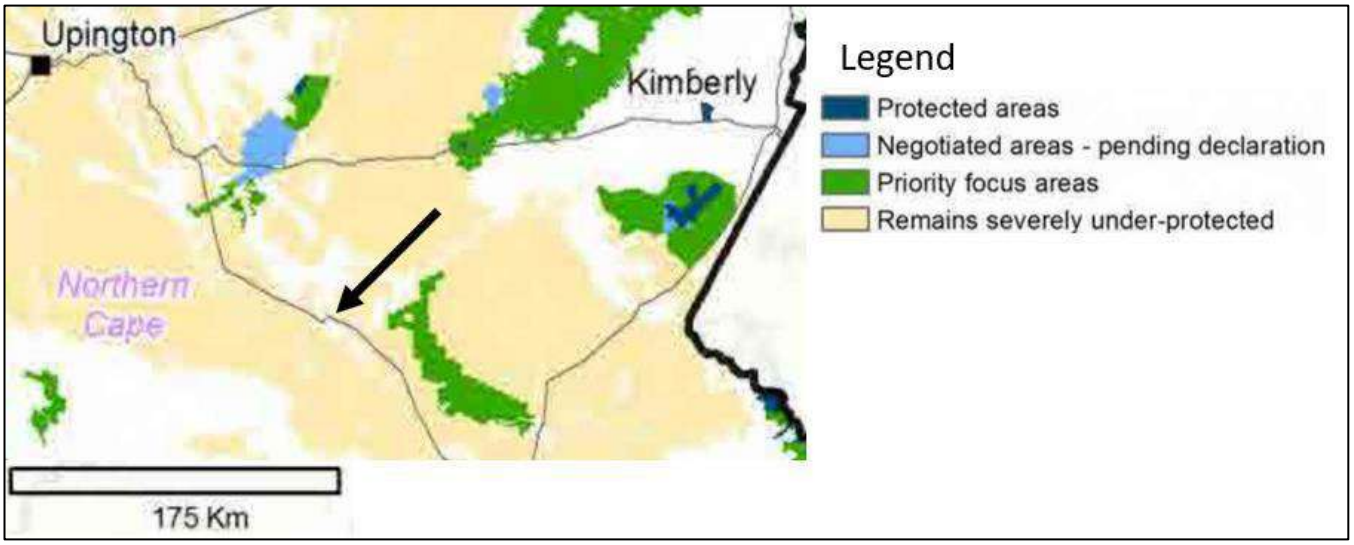

FIGURE 35: PRIORITY AREAS FOR THE PROTECTED AREA EXPANSION IN THE NORTHERN CAPE (BELFOUR ET AL, 2016).

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 36: THE SITE FALLS WITHIN 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. 2010).

TABLE 7: 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. • These are areas with low irreplaceability with respect to biodiversity pattern targets only.
ONA (Other Natural Areas) and Transformed	Production landscapes: manage land to optimize sustainable utilization of nature.

According to the Spatial Development Framework, the key issue in the Siyathemba Municipality is the long-term sustainability of all land development practices which is the key factor in the environmental and economic future of this predominantly agricultural region. In terms of land conservation, there are various areas along the Orange River that are well suited for tourism and agricultural development alike. These areas are however sensitive to overutilization and pollution and will have to be protected and conserved to ensure long-term benefits thereof.

The SDF identified amongst others mixed agriculture (livestock & crops), with the following impacts associated with such activities:

- The destruction of biodiversity;
- Indigenous flora being substituted with exotic species;
- The loss of herbaceous annuals;
- Exposure of bare soil and subsequent erosion;
- Areas are homogenized and ecosystem functioning on cultivated land is essentially simplified to the production of bio-mass;
- Depletion and degradation of soils may lead to unproductive soils; or

The Siyathemba Municipality has mapped the environmental sensitivity of the municipal area in the SDF. The sensitivity is rated from 0-6 (0 being no sensitivity, 1 being low sensitivity, 6 being high sensitivity). 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 2 and thus low sensitivity (see Figure 37).

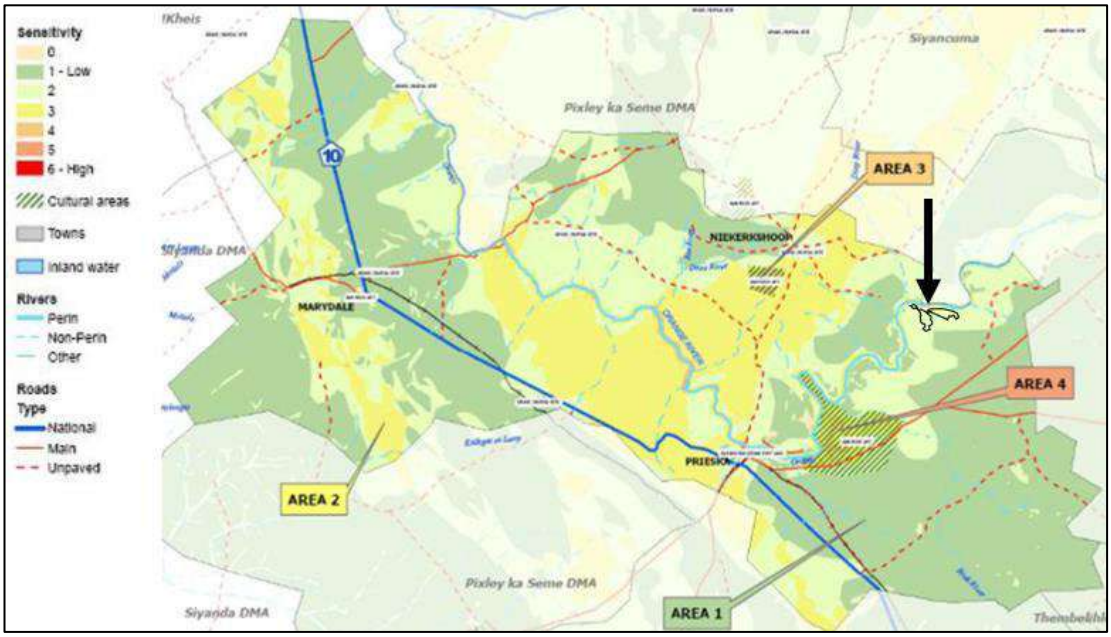

FIGURE 37: SDF OF THE SIYATHEMBA MUNICIPALITY, THE BLACK ARROW INDICATE THE POSITION OF THE SITE.

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. While most of these plans are broad-based, regional/national plans are wide-scale plans and do not consider the land-use of the area and surround or site-specific features and locations. Others are more regionally specific like the Siyathemba Municipality SDF is a localised plan. Thus broad-based, regional/national plans might indicate that a site is not sensitive, but localised plans might indicate otherwise, or *vice versa*.

To assess the sensitivity of the environment onsite verification is therefore essential. The Site Ecological Importance (SEI) is discussed in detail in the report submitted by Dimela Eco Consulting. Much of the vegetation on the sites were in a good ecological condition, and due to its size and limited disturbances, rates high in its functional integrity and scores a medium SEI (see Figure 4). Most of this vegetation also falls within CBAs, which should ideally remain in a natural state. However, areas that were historically cleared and highly disturbed were rated as very low and low SEI. Also, most of the vegetation on the site is not unique and the Upper Nama Karoo vegetation is not considered threatened.

Dimela Eco Consulting identified five (5) species that were short-listed to have a possibility of occurring, and for which the habitat assessment was undertaken. None of these species was recorded in walked transects on the sites and the habitat assessment agrees with the screening tool report which indicates much of the site as being of low plant species sensitivity. Only one species, listed as Rare, has a likelihood of occurring: *Tridentia virescens*. Dimela Eco Consulting indicated that no further plant species of conservation concern assessments are thought to be needed.

Chapter 4, Part 2 of the National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA) provides for the listing of plant and animal species as threatened or protected. If a species is listed as threatened, it must be further classified as Critically Endangered, Endangered or Vulnerable. These species are commonly referred to as TOPS listed. The Act defines these classes as follows:

- Critically endangered species: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- Endangered species: any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- Vulnerable species: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category will include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known as 'Restricted Activities', are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the act are keeping, moving, having in possession, importing and exporting, and selling. The first list of threatened and protected species published under NEMBA was published in the government gazette on the 23rd of February 2007 along with the Regulations on Threatened or Protected Species. At the time of Dimela Eco Consulting's assessment, only one (1) TOPS listed species was recorded within Block D. As previously discussed, this species, *Harpagophytum procumbens* subsp *procumbens* (devil's claw) is listed as a Protected medicinal plant species and may not be traded.

Dimela Eco Consulting further indicated that several plants are provincially protected by the Northern Cape Nature Conservation Act No.9 of 2009. The removal or pruning of these plants will require a permit from the Northern Cape Department of Environment and Nature Conservation.

At the time of the assessment, only *Ammocharis carinica* (bulb almost dormant and was assumed to be *Ammocharis*) and the tree *Boscia albitrunca* were recorded. Where such species are encountered, they should be relocated outside of the proposed development footprint, however, the tree *Boscia albitrunca* will require a permit for removal. The *Boscia albitrunca* (witgat / shepherd's tree), occurred abundantly on the farm and specific Blocks D, L, O, J and K, as well as around Block A (Dimela Eco Consulting, 2022).

Since the clearing of vegetation and essentially destroying about 406 Ha of habitat will be permanently replaced with crops, the only mitigation measure will be to provide a biodiversity offset plan. The principal approach to biodiversity

offsets is to provide a '*like for like or better*' area to compensate for the area which will be negatively affected. Offsets that do not involve securing and managing habitat but include funding research, education, staffing, etc. are generally believed to be unacceptable for impacts on biodiversity. Biodiversity offsets are to be used in cases where the EIA process identifies negative residual impacts of 'medium' or 'high' significance on biodiversity. Activities resulting in impacts of 'low' significance may not require an offset. In other words, biodiversity offsets can provide a mechanism to compensate for significant residual impacts on biodiversity. It refers to measures over and above rehabilitation to compensate for the residual negative effects on biodiversity, after every effort has been made to minimise and then rehabilitate impacts.

Direct Impact on sensitive areas

Construction Phase & Operational:

The clearance of vegetation will take place over 5 years from the commencement of the project and irrigation systems will be installed and the site prepared for the planting of crops. Thus from a flora perspective, two protected species were found, one TOPS listed species and one rare listed species, but no red data species were found. No endangered or protected ecosystems were found, and the area has a connection to other environments with natural conditions that represent the Upper Nama Karoo.

From a fauna perspective, the fauna in this region is relatively species-poor but there are a few endemics such as the Visagia's golden mole (*Chrusochloris visagiei*), the Grant's rock mouse (*Aethomys granti*), the Shortridge's rat (*Thallomys shortridgei*), the riverine rabbit (*Bunolagus monticularis*), *Gerbillurus vallinus* and *Petromyscus monticularis* (Hilton-Taylor 2000). The most vulnerable of vertebrates is the riverine rabbit (*Bunolagus monticularis*), classified as "Endangered" in the South African Red Data Book because of habitat destruction by agriculture (Smithers 1986). The important bird and reptile species were listed above.

On the day of site inspection, the following animal species were noted at the site, kudu (*Tragelaphus strepsiceros*), blesbok (*Damaliscus pygargus phillipsi*), gemsbok (*Oryx gazella*) springbok (*Antidorcas marsupialis*), ground squirrel (*Xerus inauris*), guineafowls, falcons, finches, the northern black korhaan (*Afrotis afraoides*) and vervet monkeys (*Chlorocebus pygerythrus*) was within the abutting crop fields, mongoose (*Herpestidae*), and various common birds. A few burrows were noted and diggings out of old termite hills, which could indicate the presence of aardvark (*Orycteropus afer*).

From a movement perspective, the movement of faunal species within the proposed area is likely, however, it is farm properties and generally fenced-in camps, which hinder the mobility of some of the larger wildlife that cannot jump a fence or the smaller wildlife that cannot borrow. Ultimately the migration patterns of animals and to a large extent species diversity within abutting areas will be restored after hours as some animal species have turned nocturnal due to farming and other anthropogenic activities. The proposed study area is just over 100m south of the Orange River, with a few non-perennial drainage lines between the proposed irrigated areas. Animals can therefore use the riparian zone of the river and drainage lines to relocate to other areas of the proposed study area that is intact and considered ecological support areas.

Although the status of the conservation at the site is low, farming has already impacted the biodiversity (or sensitivity) of the site. If an offset plan can be implemented to compensate for the area that will be negatively affected, the impact can be reduced from moderate-high to moderate.

As a biodiversity offset plan, the remaining 98.7 Ha between the irrigated areas will be used as a nursery for the transplant of the geophytes species and control of alien vegetation.

Indirect Impact on sensitive sites

Construction & Operational Phase:

One of the indirect impacts of replacing natural habitats with crop fields and subsequent loss of biodiversity is the potential segmentation of corridors and disruption of the movement of migrating animals or even plant species. On the other hand, studies have shown that some endemic faunal species prefer transformed lands which could have a positive impact on such species' populations. The study area is mostly surrounded by cultivated land and if developed it will seem like a continuation of abutting sites. As indicated above, the fences in the study area have already impacted the possible movement of terrestrial animals, however, the drainage lines provide corridor movement. Thus this indirect impact is rated low.

Another indirect impact is the possible loss of tourism interest at a site if there is a special fauna or flora attraction to a site. Or potential research opportunities are lost if a habitat is destroyed that hosts a specific endemic species (whether it be fauna or flora species). Since the site does not host any endemic micro-habitat to attract a certain type of special species or is a tourism destination, it is unlikely that this potential indirect impact would exist.

Cumulative impact on sensitive sites

In terms of the cumulative impact, one has to consider not only the cumulative impact of agriculture, but also the mining practices in the region, and anthropogenic infrastructures such as Eskom power lines, wind turbines, dams, roads, towns, etc.

In terms of agricultural practices, this region will have a much higher impact on migratory routes of animals and fish cumulative, than individually. The single biggest cause of biodiversity loss in South Africa is the loss of natural habitat due to urban development, agriculture, and plantation forestry. Infestation by invasive alien species is a second major cause. Agricultural activities not only destroy natural vegetation areas for crop production but also impact water sources either due to abstraction or pollution (e.g. topsoil loss due to ploughing of lands causing erosion and/or silt transport to water systems, or due to fertilizing causing organic pollution of water systems). The only means of reducing the potential impact of agriculture is to emphasize the importance of sound management of farmland and river catchments in ensuring water flows, which is the responsibility of the government and farmers.

In terms of the negative impacts created by Eskom power lines or wind turbines will also contribute to the cumulative impact on avian- and possible bat species as well as visual impacts. Two of the most common problems normally associated with power lines and wind turbines and birds or bats are the animals colliding with the power lines and

then being electrocuted or with the wind turbine and being killed. Subsequent problems are the disturbance/habitat destruction during construction and maintenance activities and social impacts as a result of electrical faults caused by bird excreta when roosting or breeding on the electricity infrastructure. There are power lines along the R3112 and no wind turbine farms close to the site. All the Eskom servitudes approved in the area are governed by environmental authorization and mitigation measures should be implemented/ followed to reduce the cumulative impact.

Mining activities, such as the diamond mine on the farm, human settlements, etc., will also contribute to the cumulative impact on the biodiversity of the region since such activities generally also involve the destruction of habitat. With mining, there are supposed to be rehabilitation plans in place and are governed by environmental authorisations, to mitigate the cumulative impact. Local municipalities should identify areas in and around towns for conservation to mitigate the cumulative impact. At the end of the day, a balance must be reached to satisfy the socio-economic need of a region as well as the conservation responsibility we have towards protecting our environment.

The proposed crop development will contribute 406 Ha of destroying natural habitat to the cumulative impact, but if the off-set plan is implemented, the soil is managed, and mitigation measures listed in the Environmental Management Plan are followed, the conclusion is that the cumulative impacts on the biodiversity and ecosystem function on the site would be of medium significance. It is unlikely that the faunal community structure will be significantly affected once the crops are established.

Impact on the Sensitivity of the site

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Local	2	Local	2	Local	2	Local	2
Duration	Permanent	4	Permanent	4	Permanent	4	Permanent	4
Intensity	Medium-High	5	Low-Medium	3	Medium-High	5	Low-Medium	3
Probability	Definite	4	Definite	4	Definite	4	Definite	4
Cumulative Impact	High-Medium		Medium		High-Medium		Medium	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Moderate-High**	**44**	**Moderate**	**36**	**Moderate-High**	**44**	**Moderate**	**36**

Extent to which impacts can be reversed	Impacts on sensitivity are compensated through a conservation plan/offset plan by transplanting some plants to the 98.7 Ha between pivot areas and controlling alien vegetation.

WATER

Surface Water

The proposed site falls within the Orange River Catchment area. The Orange River originates in the Lesotho Highlands and flows in a westerly direction 2 200 km to the west coast where the river discharges into the Atlantic Ocean (ORASECOM, 2007). The Orange River basin is one of the largest river basins south of the Zambezi with a catchment area of approximately 1 million km^2.

It has been estimated that the natural runoff of the Orange River basin is in the order of 11 300 million m^3/a of which approximately 4 000 million m^3/a originates in the Lesotho Highlands and approximately 800 million m^3/a from the contributing catchment downstream of the Orange/Vaal confluence which includes a small portion in Botswana feeding the Nossob and Molopo rivers. The remaining 6 500 million m^3/a originates from the areas contributing to the Vaal, Caledon, Kraai and Middle Orange rivers

The Northern Cape is divided into the following four Water Management Areas:

- Lower Orange;
- Upper Orange;
- Olifants/Droon; and
- Lower Vaal.

More specifically the proposed site falls within Lower Orange Water Management Area, in the D71D. The National Freshwater Ecosystems Priority Areas (NFEPA) identifies important catchments based on the presence of important biota or the degree of riverine degradation.

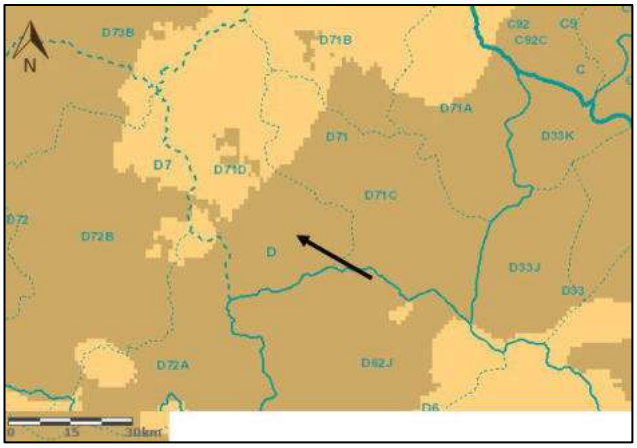

FIGURE 38: QUATERNARY CATCHMENT OF THE SITE IS D71D

TABLE 8: PRESENT ECOLOGICAL STATE CATEGORIES USED TO DESCRIBE THE CURRENT AND DESIRED FUTURE CONDITION OF SOUTH AFRICAN RIVERS, FOR NFEPA, RIVERS IN AN A OR B CATEGORY WERE REGARDED AS BEING IN GOOD CONDITION.

Ecological category	Description
A	Unmodified, natural
B	Largely natural
C	Moderately modified
D	Largely modified
E	Seriously modified
F	Critically/Extremely modified

Fish sanctuaries in a good condition (A or B ecological category) were identified as FEPAs, and the whole associated sub-quaternary catchment is shown in dark green. The remaining fish sanctuaries in lower than an A or B ecological condition were identified as Fish Support Areas, and the associated sub-quaternary catchment is shown in medium green. Fish Support Areas also include sub-quaternary catchments that are important for the migration of threatened or near-threatened fish species – these are not marked with a fish symbol.

The site is located within a Fish Support Area of the *Barbus anoplus*. The back fish symbol on the map (see Figure 39) indicates the presence of vulnerable or near-threatened fish populations. If it was a red fish symbol, it would have indicated that there is at least one 13 population of a critically endangered or endangered fish species within that sub-quaternary catchment. Some fish sanctuaries are FEPAs, with their associated sub-quaternary catchments shown in dark green; others are Fish Support Areas, with their associated sub-quaternary catchments shown in medium green, such as the proposed site.

A goal of NFEPA is to keep further freshwater species from becoming threatened and to prevent those fish species that are already threatened from going extinct. To achieve this, there should be no further deterioration in river

condition in fish sanctuaries and no new permits should be issued for stocking invasive alien fish in farm dams in the associated sub-quaternary catchment. Since there are drainage lines or perennial stream on the site and the Orange river are situated more than 100m from some of the proposed pivot areas, there is a small possibility of an impact on the *Barbus anoplus* fish sanctuary.

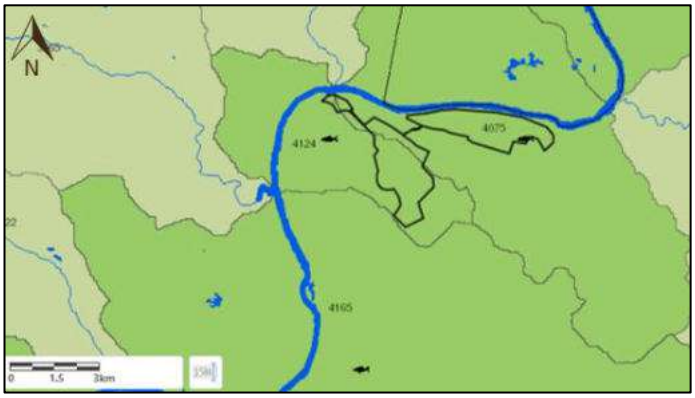

FIGURE 39: THE SITE FALLS WITHIN A FISH SUPPORT AREA

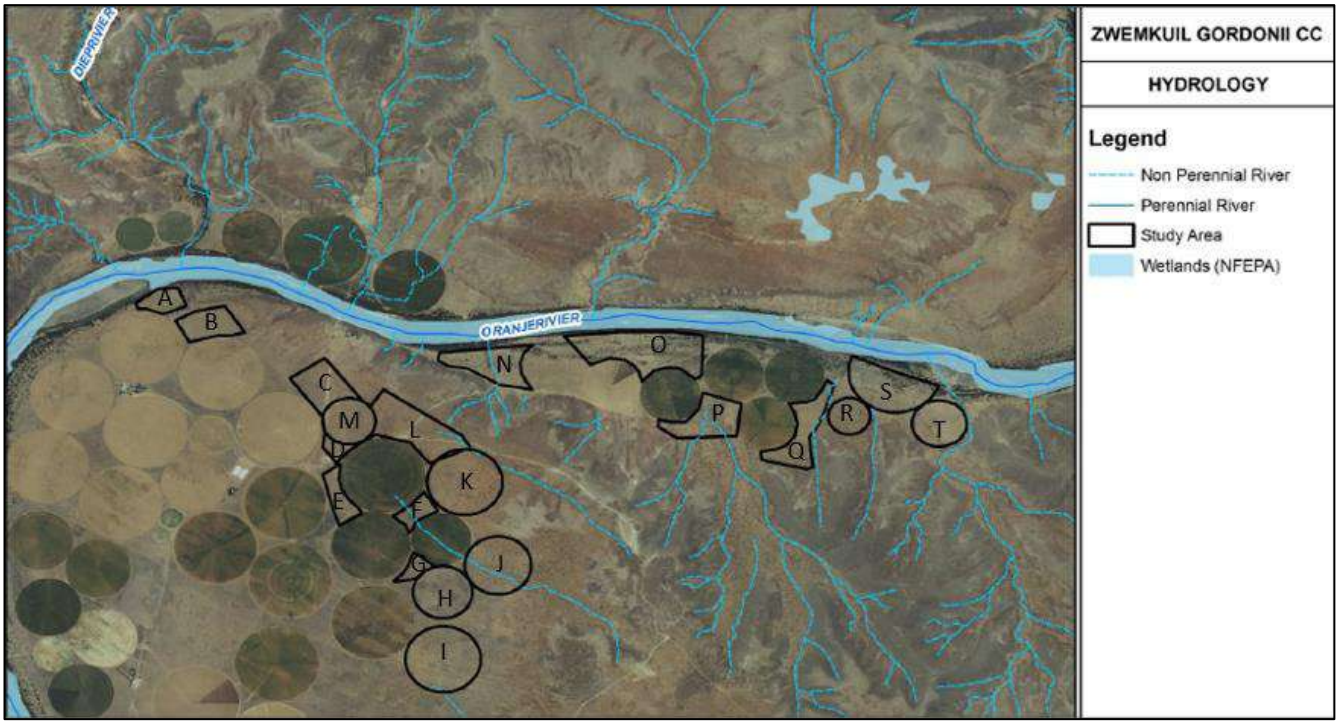

FIGURE 40: HYDROLOGY OF THE SITE AS PER THE NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS (NFEPA), 2014 (DIMELA ECO CONSULTING, 2022).

The Application already has a Water Use Right, therefore water abstraction has already been accounted for.

Blocks A, N, O & P will be situated further than 100m from the Orange River, therefore Section 21 (c) & (i) of the NWA will not be applicable. From the above figure, there is one drainage line that runs through Blocks J & F, but it would appear that existing pivots between the two blocks already transversed this drainage line and has no impact on the crops. The reason might be found in the activities associated with the diamond mine, southeast of Block J. From the above figure, it is clear that the drainage line originates in the mining area, which has been excavated. Such excavations most likely have diverted or impeded this section of the drainage line and negatively impacted its function further along.

Considering the existing pivots and the mining area, it can be determined that the functionality of this drainage line has been completed compromised and cut off to Block F and partly to Block J. The assumption is that if Block J is developed the existing impact on this drainage line will be extended and possibly diverted to the north (thus adding to a cumulative impact), but the impact will be limited due to the very low rainfall in this region, the flat slope and limited area (thus very limited catchment of this section of the drainage line).

More significant drainage lines run through Blocks N & P and along the eastern boundary of Block T. It is recommended that a minimum of 32m boundary be kept from clearing vegetation along the drainage lines in Blocks N, P and T.

Direct Impact on the watercourses

Construction and Operational Phase:

During the construction phase, the natural vegetation will be removed from 406Ha over 5 years and topsoil will be ploughed, and during the operational phase, the harvesting of annual crops and establishing of new crops (maize/wheat/lucerne) will result in similar impacts as the construction phase. Vineyards and pecan nut orchards will be permanent.

It could lead to 1) the possible transport of silt and/or 2) drainage problems, which could potentially impact the water quality of the area, or specifically the Orange River.

In terms of the possible transport of silt, during the establishment of the crops, for a time a portion of land will be bare which will expose it to wind erosion, which can increase dust and transport of silt. As crops are planted and allowed to grow, the soil remains vulnerable in terms of erosion while the ground cover is insufficient to intercept rainfall before it reaches the bare soil.

The same principle applied to the vine trees and pecan nut trees. As it is planted, the soil remains vulnerable in terms of erosion potential, since many non-bearing vineyards and orchards are maintained with clean tillage between rows, and the small trees have not yet developed a large canopy to intercept rainfall before it reaches the bare soil.

With the runoff generated in the bare areas, there is always a concern that the water quality can be affected by an increase in suspended and dissolved solids. As discussed above the Orange River is more than 100m from the study

area but there are existing drainage lines in certain Blocks. The general drainage of the area is towards the north, into the Orange River. A buffer zone of 32m will be kept from all drainage lines, except for Block J & F, which drainage line has already been compromised. With the buffer zones, the silt transport that is expected due to the clearing of vegetation and ploughing of topsoil will simply be absorbed by the plants before the runoff eventually reaches the Orange River. It is unlikely that any TSS (Total Suspended Solids) and TDS (Total Dissolved Solids) increase will be experienced, considering the sandy soil with easy drainage and the low rainfall this area generally receives. In the past few months the 1:50 year high rainfall was experienced, and undoubtedly has increased TSS and TDS. These are natural cycles, but not expected to be experienced in the near future.

As the vineyard floor plan and pecan nut orchard are established the bare areas under the trees (or areas between the rows) will decrease and ultimately this potential will decrease (operational phase).

Drainage

As discussed in detail under the heading 'Soil', vineyards require a soil depth of between 600 mm and 800 mm. By breaking up the soil, deep ripping can allow roots to penetrate the soil and access water and nutrients. Soil texture is one of the most important components of vineyards, a sandy soil will require intensive irrigation to achieve production goals, while clay soil struggles with cultivation and cracks that disrupts water and nutrient movement. (DSA Soil Report, 2022). In the areas suitable for the vineyard (Figure 12), the soil depth is between 0.5-1m deep and the soil texture is generally very sandy, with clay percentages generally under 20%. Therefore dryland vineyards will not be suitable for these soil types as no water would be retained, while drip irrigation would be better suited for the soil type. Drip irrigation will also mitigate the spreading of certain plant diseases.

Soils with a freely drained depth >1000 mm were considered to have sufficient depth for pecans, which is a large portion of Zwemkuil farm. Pecan-nut trees prefer soil that is freely drained and has a sandy loam texture. All the soils meet the texture requirements.

The laboratory results indicate that the chemical parameters are manageable, it is expected that irrigation with high-quality irrigation water will leach some of the base-forming cations out of the soil profiles and thereby lower the pH. Salinity is of low risk within all areas except the Brandvlei soil area where salinity could be of risk. The ESP and EC for the rest of the areas are low and the soils have good drainage. The texture results show that in general, the soils do have sufficient drainage.

Based on the findings of the soil report the Applicant must portion the areas allocated for vineyard pecan nut trees and other crops, such as maize, wheat, lucerne, etc. The management of the drainage structures, irrigation scheduling, and vineyard/pecan nut floor plan will mitigate the potential impact further.

As the crops are established the bare areas will decrease and ultimately this potential will decrease, until harvest time (operational phase). With mitigation measures, the direct impact on the water quality during the construction & operational phase is low.

During the operational phase the following will also be applicable:

Sewage Facilities

Potentially, the toilet facilities (especially during harvest time) could cause coliform contamination of surface runoff but since the system (chemical toilet) is a closed system, will cause this impact to be of very low significance.

Hydrocarbons

Fuel will not be stored on-site and only emergency servicing of vehicles would be performed, therefore hydrocarbon spills should the very limited, in addition, the use of appropriate receptacles such as drip pans will cause this impact to be negligible. The impact is rated very low.

Waste

Very limited amounts of domestic or industrial waste would be generated and therefore management facilities would be restricted to waste bins and skips on the farm.

Indirect Impact on the watercourses

Construction & Operational Phase:

Reduction in the ecological reserve for water is always a potential indirect impact if croplands are established. The Orange River system has reached its limit and the Department of Water and Sanitation in the Northern Cape has indicated that no new water use rights will be issued for irrigation on this water system. The applicant already has a Water Use Right, therefore water abstraction has already been accounted for.

Excessive amounts of dissolved salt in water can ultimately affect agriculture, drinking water supplies, and ecosystem health. In terms of agriculture, besides the obvious reduction in crop yields by impairing the growth and health of salt intolerant crops, excessive amounts of dissolved salt in water can also cause corrosion of machinery and infrastructure such as pipes, valves, and fences, roads, bridges, etc.

In terms of the ecosystem, it can lead to poor health or death of native vegetation and ultimately a decline in biodiversity through the dominance of salt-resistant species and potentially altering ecosystem structures. Reduced ground cover can also increase erosion risk, which can lead to increased sediment transport into aquatic systems and the loss of valuable topsoil. If pesticides or/and fertilizers have been applied, then eroded soil can pollute water threatening aquatic ecosystems, the plant and animal species they support, and the safety of water for both human and animal consumption.

Another indirect impact caused by salinization of water is the financial cost of the loss of crops, or the additional need for water treatment, and/or the more frequent maintenance or replacement of corroded civil and agricultural infrastructure.

Considering the salinity is of low risk within all areas except the Brandvlei soil area (which will not be cultivated), the impact is rated very low but can increase to low-moderate without mitigation.

Cumulative Impact on the watercourses

The Orange River basin is an important resource for South Africa, especially in arid areas. It is highly developed and the use of water for irrigation is one of the highest. A major problem along the Orange River is the unlawful water abstraction for irrigation use. The applicant already has a Water Use Right, therefore no contribution towards illegal abstraction will be made due to this project.

In terms of chemicals and fertilizers, a study completed by Bucas (2006) indicated that the results of the water chemistry of the Orange River were controlled naturally by chemical weathering of siliceous sediment, intrusive igneous rocks, and metamorphic rocks, and unnaturally from agricultural and urban activities.

This region along the Orange River is valuable irrigation land, and in terms of water chemistry, it is guaranteed that fertilizers and pesticides are applied on surrounding farms (cumulative impact). Pesticides in the aquatic environment have the potential to affect all end-users, including both humans and wildlife. This cumulative impact was discussed in full detail under the heading 'Soil' and will not be repeated in this section.

Furthermore, the study completed by Bucas (2006) also found that:

- There was an increase from 1986-2006, in the concentration of cations and anion from the colder wetter climate to the drier hotter climate region along the Orange River, which was severely influenced by the stream runoff due to agricultural and urban input;
- Variation of the annual runoff affects the percentage of pollution, especially in the lower Orange River. Pollution shows a strong increase when the annual runoff is <2000 m^3 or around 10 000 m^3;
- At the time of the study, eutrophication of the Orange River was not a problem, however, the increase in phosphate input from agricultural and urban activities into the lower Orange River may lead to a potential eutrophication threat.

It is thus clear that cumulatively anthropogenic activities (e.g. agriculture, urban development, mining, dams, weirs, etc.) are placing increasing strain on the lower Orange River as a natural resource and it is clear that the river has been modified and is impacted.

The proposed development of croplands on 406 Ha will contribute to this potential cumulative impact if no mitigation measures are implemented. With the prescribed mitigation measures the potential cumulative impact on the surface water quality will be substantially reduced.

In addition, any possible groundwater pollution, as a result of pesticides, will not reach the groundwater table due to the vertical impeding of drainage. The lateral movement of drainage will however drain towards the drainage lines before it will drain toward the Orange River, which will reduce the possible cumulative impact.

Impact on the surface water

	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	Medium	4	Medium	4	Medium	4	Medium	4
Probability	Definite	4	Likely	3	Definite	4	Likely	3
Cumulative Impact	Low-Medium		Low		Low-Medium		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low-Moderate**	**24**	**Low**	**18**	**Low-Moderate**	**24**	**Low**	**18**
Extent to which impacts can be reversed	All negative impacts can be successfully mitigated and reversed through soil management and irrigation scheduling, protection.							

AIR QUALITY

The air quality of the immediate surroundings is good due to its rural status. During windy periods a limited amount of dust will be deposited into the atmosphere causing a slight rise in air pollution levels during the clearing of vegetation or harvesting. Since the property involved is still zoned agricultural and rural, it would cause tolerable ambient levels to be higher than those for residential areas.

Exhaust emissions are caused by a fair amount of vehicles entering and exiting the site at regular intervals. Vehicular emissions during the project will be related to approximately one bulldozer during the construction phase, and a few trucks/bakkies, which is hardly an amount that will cause excessive exhaust emissions. The closest receptor is the applicant's farmhouse about 330m north of Block L and the neighbour's residence which is about 680m south-west of Block B, separated by pivot and natural veld area. The distance to people and the very limited amount of exhaust emissions generated will preclude any detrimental impact on people and the impact is negligible.

In terms of smoke generation, the workforce will not reside on the property, therefore no cooking fires will be permitted and no burning of waste generates harmful smoke. To control alien trees, a fire might be a method as part of an integrated management plan but will be controlled and limited. No odours should be generated by the farming operation.

The amount of dust generated on a site is directly linked to the type of material that is extracted, mechanical processes involved, traffic volumes, wind speed and soil moisture content. The finer the material (more easily airborne) and the higher the clay and silt concentrations, the more severe the impact is. Mechanical processes that will generate dust will be the clearing of vegetation, harvesting, and ploughing.

The potential dust generation source will mainly be during the clearing of vegetation until the crops are established, this will include harvest times, as mechanical processes will continue into the operational phase since summer crops will be alternated with winter crops or lucerne for the 'rest years'. It will be restricted to the clearing of vegetation and ploughing, since ploughing is currently taking place on abutting farming sites, the dust generation would remain similar to what is currently being experienced. During normal climatic conditions, a very low impact is anticipated.

In terms of the potential dust generation source at the vineyard and pecan nut plantation, it will mainly be during the clearing of vegetation until the vineyard and plantation are established, thus during the operation phase dust should be limited.

The impact of dust was discussed in full detail under the heading 'Soil' (sub-heading: 'Soil Erosion') and would therefore not be repeated in this section. The impact on air quality due to the impact of dust generation is rated low (calm days) to low-moderate (windy days).

Impact on air quality due to dust generation

	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	Medium	4	Medium	4	Medium	4	Medium	4
Probability	Definite	4	Likely	3	Definite	4	Likely	3
Cumulative Impact	Low-Medium		Low		Low-Medium		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	

Significance	**Low-Moderate**	**24**	**Low**	**18**	**Low-Moderate**	**24**	**Low**	**18**
Extent to which impacts can be reversed	All negative impacts can be successfully mitigated and reversed through soil management, and irrigation scheduling, protection.							

Another potential impact on air quality is during the application of pesticides, which can have health impacts on workers and abutting farms if the application is applied incorrectly. The impact of the application of pesticides was discussed in full detail under the heading 'Soil' (sub-heading: 'Soil Pollution') and would therefore not be repeated in this section. Ultimately, the impact on air quality due to the impact of pesticides being used is rated to be low-moderate with mitigation and can increase to moderate-high without mitigation. Although pesticides will most likely not be applied regularly (but rather seasonal or when needed), the occurrence will be less compared to the occurrence of dust, but since pesticides have a higher risk of pollution and environmental impact if used incorrectly, the intensity and extent of the impact is more.

Impact on air quality due to the use of pesticides

	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, irrigation scheduling, and proper planning of applying pesticides.							

NOISE

The impact of noise levels generated by farming activities is determined by the type of activity, the time of day, the consistency thereof, distance to people, whether it is a low or high-pitched noise and whether beneficiation is taking place. Noise levels are more intense in the morning and evening than during the rest of the day and are more irritating if it is high-pitched. The more continuous the noise is the higher the impact. In terms of SABS standards, noise levels for rural residential areas are 45dB during the day, 40dB in the early evening, and 35dB at night. Noise impact is rated against the following: 1) The average dB will result in no or sporadic complaints from communities whilst an increase between 5-10dB will result in widespread complaints, 3) An intruding noise is defined by National Noise Regulations as disturbing if it causes the ambient noise levels at the border of the property from which it emanates to increase with 7dB, 4) An average person will perceive such an increase in the ambient noise levels as a doubling of noise levels and very strong response will be expected from communities/residents.

The rural setting of the study area and the extensive agricultural activities characteristics of the area would, under normal circumstances, probably result in the ambient noise levels being between 40 and 45dB during the day. Since the site is 12km from the R375, cumulative impact concerning provincial roads will not be a factor. There is a small diamond mine on the property and trucks might cause an intermittently increase in noise levels to approximately 65-70dB along the gravel road. Since there are no receptors it is not anticipated that the proposed development will impact the tranquillity of the area, but rather fit in with the surrounding area.

Noises generated during the construction and operational phase (clearing of vegetation and crops) will generally be low-pitched if earth-moving machinery is well maintained. There is one exception and that is the reverse sirens which produce a high-pitched, irritating noise and could cause some irritation to the applicant's home residence early in the morning or later at night. In terms of neighbours, the closest resident is more than 2.5km from the site, very low to no impact is expected. Since the fitting of sirens is a requirement of the OHS Act, there is no mitigation possible.

No campsite would be established in the study area, therefore no noise would be generated at night that could become a nuisance.

Management of the human impact during the day could be achieved via the environmental awareness programme. Also, staff and contractors should be sensitized not to engage in unnecessary hooting, shouting, flapping of tailgates, and use of exhaust brakes during operational hours. Maintaining speeds below 40km/h would assist in curbing noise impact. Thus, noise impact is already experienced and it is not anticipated that the proposed agricultural activities will result in a cumulative impact.

<u>Direct Impact of Noise</u>

<u>Construction and Operational Phase:</u>

During the construction phase, the possible placing of farm signs, fences, and disposable infrastructure (chemical toilet) will not cause any spike in noise levels.

Earthmoving machinery to strip the natural vegetation, harvesting, and ploughing the land will generate noise during the construction and operational phase, but it will be low-pitched if earth-moving machinery is well maintained. There is one exception and that is the reverse sirens which produce a high-pitched, irritating noise and could cause some irritation, but since the closest resident (receptor) is 330m from Block L and is the Applicant, and the neighbour is 680m from Block B, separated with existing pivots, it is unlikely that it will cause any disturbance or nuisance to the neighbouring farmhouse, as they are accustomed to agricultural practices. Since the fitting of sirens is a requirement of the OHS Act, there is no mitigation possible.

A dozer will be used to clear the vegetation or harvest machines and the metal on the surface will generate noise levels between 60 & 75dB at the source. Ploughing of topsoil will generate similar noise levels. Noise levels will decrease as the distance to receptors increases. Within 10m from dozer/harvest machine, noise levels will abate to approximately 63dB, within 20m noise levels will abate to approximately 57dB, within 60m, to approximately 47dB, and within 150m to approximately 39dB, which is below the ambient noise levels. Thus the nearest public entity (neighbours farmhouse) is more than 600m southwest of Block B and thus the noise levels raised through the bulldozer, trucks, and harvest machine at the site will not cause any impact and no complaints are expected.

During the harvest season, a few tractors, bakkies, and trucks will enter or exit the farm at any given time, and the impact is rated very low since the surrounding farming areas are used to harvest time activities and have become accustomed to this.

Maintenance of equipment where steel on steel action is involved will also not be heard by any resident due to the far distance from the site and considering this is an operational farm, maintenance on equipment will not be a new activity. In addition, the workforce will not be housed on the site therefore no noise generation at night would be applicable. The Applicant will however sensitize his staff and contractors through an environmental awareness programme and instructing them not to engage in unnecessary hooting, shouting, flapping of tailgates, and use of exhaust brakes, regardless of the impact. Maintaining speeds between 20-30km/h would assist in further curbing noise impact.

No campsite would be established in the study area, therefore no noise would be generated at night that could become a nuisance.

Overall the direct impact of noise is rated low with mitigation.

Indirect Impacts of Noise

Construction & Operational Phase:

Excessive noise can potentially impact wildlife and they would flee from the site, however, this impact was discussed in detail under the heading ‘Fauna’ and will not be repeated.

In terms of human receptors, noise pollution depends on how an individual is actually distracted or stressed by the noise. The effect of noise and its 'nuisance-rating' depends on the noise characteristics, the timing of the noise, and the general context, but also individual characteristics. According to Naguib (2013), the effects of noise on cognitive performance depend on personality. Introverts are similar to or better than extroverts in performing cognitive tasks in silence, whereas extroverts outperform introverts under noisy conditions. Any general personality-dependent effect of noise as an environmental stressor can, thus, also affect communication between individuals (Naguib, 2013). Since there are no close human receptors to the noise that will be generated at the site and the area is sparsely populated, any indirect impact on humans is rated insignificant.

The site and area are not a tourist attraction site but a farm and it is not anticipated that the proposed development will impact the tranquillity of the area, but rather fit in with the surrounding area.

There are no other indirect impacts associated with noise generation.

Cumulative Impact of noise

Except for the diamond mine, there are no other activities such as wind turbines, factories, processing plants, etc. in the immediate or within a 1km radius of the farm. Thus the cumulative source of noise is existing farming activities and the mine which will include excavation and heavy vehicle movement.

This farming operation can add to the noise impact experience through the combined surrounding farming and mining activities and trafficking but since this is in line with abutting land-use practices, the sparse receptors and the fact that people have become accustomed, the cumulative impact is thus rated low.

Impact on Noise Pollution

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Local	2	Local	2	Local	2	Local	2
Duration	Short Term	1	Short Term	1	Short Term	1	Short Term	1
Intensity	Low-Medium	3	Low	2	Low-Medium	3	Low	2
Probability	Likely	3	Likely	3	Likely	3	Likely	3
Cumulative Impact	Low		Low		Low		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low**	**18**	**Very Low**	**15**	**Low**	**18**	**Very Low**	**15**

Extent to which impacts can be reversed	Maintaining equipment to a good standard and restricting operations to normal working hours will effectively mitigate any impact.

WASTE GENERATION

Direct Impacts due to waste generation

Construction Phase:

During the construction phase, there will be about 30 people involved in the clearing of vegetation to prepare the site for crops that will produce a very small volume of domestic waste (food, bottles, plastic bags, paper, clothing, rags, etc) and must be deposited in small containers provided in the earth moving vehicles. It can be emptied once a day in a refuse bin at the farmhouse/workshop and the refuse bin should be marked and placed in strategic areas to encourage workers to use them.

In terms of the system structure, poles (made from wood or reinforced concrete), galvanized steel cables, and possible plastic nets/covering. Wooden poles are fixed on the ground, while concrete poles have a small foundation. The galvanized steel cables are fixed by anchors in the soil. The irrigation system that is installed could be made of plastic pipe with drippers, a possible plastic water storage tank, and an electrical pump. All of the above have to potential to become waste due to offcuts of products, broken fixtures, etc.

A skip can be placed at the Blocks that are developed to dispose of system structure waste and once full, it can be emptied at a legal waste disposal facility. Due to the limited number of people anticipated on-site, the limited waste stream will have very low impacts on soils, water vegetation, air quality, and humans.

In terms of clearing of vegetation, the geology of the area restricts the type of residue to possible small rocks and root mass. The rocks could be removed from the site and the root mass can be worked into the topsoil as organic matter. The cumulative impact on soils, water quality, vegetation, and aesthetics, is expected to be rated of very low significance.

In terms of sewage, a chemical toilet must be provided. At least 1 chemical toilet per 10 people must be provided on-site during the construction phase. The effluent stream will be limited to approximately 0,1 m^3 per month and no impacts on soils, groundwater, surface water, air, and humans are anticipated if it is maintained/serviced properly.

When machinery is involved, hydrocarbon spills are possible. At the site, no hydrocarbon storage will take place. Servicing of equipment and vehicles would be done off-site at the farm workshop therefore no hydrocarbon waste such as used oil, lubricants and hydrocarbon-contaminated filters will be generated. Any such material generated during emergency repairs will be removed from the site immediately. No-wash bay or oil trap will be constructed as

vehicles will be washed off-site and all hydrocarbon spills will be contained within large drip pans. The impact is anticipated to be very low.

Operational Phase:

Once all the Blocks have been established with crops over 5 years, it will be harvested (maize, wheat) or cleared (lucerne). All of the waste mentioned above will be generated during the operational phase, but it is not expected that the waste stream will increase dramatically. Due to the overlapping of construction with the operational phase, all of the waste mentioned above will be generated during the operational phase, but it is not expected that the waste stream will increase dramatically.

Provision should however be made for the increase of workers during the harvest time in terms of chemical toilet provision (one toilet for every 10 workers) and easily accessible containers for the domestic waste deposits.

Once the vineyard and pecan nut orchard is established, the waste generated will be related to the general maintenance of the system structure, such as tying vines to the wire, replacing poles, steel cables or irrigation systems, etc. Waste must not be left in the field, but be removed from the site, and deposited in a refuse bin at the farmhouse/workshop after the day's work.

In addition, the pecan nut trees and vine require pruning, flower cluster thinning, leaf removal, etc. If for whatever reason the plant material is damaged and must be removed, or the drying of grapes results in rotting, it will be regarded as waste. All vegetation waste can be worked into the rows between the vines and trees, and into the topsoil as organic matter, except if such debris is infected with a plant disease. In such a case the material must be discarded or burnt.

During the operational phase for the maize/wheat/lucerne fields, the pivot areas will either be under crop production or resting. In terms of crop residue that will be produced after harvest, cattle will feed on it and the root mass can be worked into the topsoil as organic matter as the soil is prepared for rest. Likewise, once the resting year is done, lucerne residue can be worked into the topsoil as organic matter as the soil is ploughed and prepared for the next season's crops, and so forth the cycle will continue.

In terms of fertilizing, to reduce the wastage of fertilizers or over-fertilizing it is important to only fertilize the vineyard if a soil test or leaf tissue analysis indicates deficiencies.

The waste generated during the operational phase will mostly depend on the management of the site. With mitigation, the impact is rated very low, without mitigation the impact can increase to low.

Indirect Impacts due to waste generation

Construction and Operational Phase:

Poor control over waste handling could lead to littering the site and abutting properties and must be avoided since it could lead to livestock mortality or impacts on aquatic fauna. If the farm is managed correctly, there will be a limited waste stream and if removed regularly the impact on soils, water, air quality, animals, and humans is rated very low.

Cumulative Impact

The site is surrounded by a farming community and agricultural land. The proposed site and abutting farm area are clean and neat and have not become prone to illegal dumping. There are no other activities, such as a factory, processing plants, human settlements, abattoir, etc. in the immediate vicinity that could cumulatively contribute to the waste impact of the area. The mine area was not inspected, but from the bypass road no waste was seen and it appears neat.

If waste is collected and controlled as outlined in the Environmental Management Plan, then the proposed activity will contribute negligible amounts of waste to the greater area.

Impact of Waste on the Environment

	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	Short Term	1	Short Term	1
Intensity	Low-Medium	3	Low-Medium	3	Medium	4	Medium	4
Probability	Likely	3	Probable	2	Likely	3	Probable	2
Cumulative Impact	Low		Very Low		Low		Very Low	
Status	Negative		Neutral		Negative		Neutral	
Confidence	High		High		High		High	
Significance	**Very Low**	**15**	**Very Low**	**10**	**Low**	**18**	**Very Low**	**12**
Extent to which impacts can be reversed	Good farm managing and maintaining equipment to a good standard, and regularly removing waste to appropriate waste disposal sites will mitigate the impact							

VISUAL IMPACT AND AESTHETIC ACCEPTABILITY

Originally, the landscape would have been described as very attractive and of high aesthetic quality because of the meandering status of the river and the unique riverine environment. However, due to the anthropogenic impacts such as the establishment of cultivation areas, Eskom servitudes, a diamond mine, and road infrastructure, the current surrounding landscape can be viewed as impacted, but with a moderate-high aesthetic quality, due to the location of the site (fairly close to the Orange River) and the tranquillity that farming generally provides to areas.

The landscape itself does not provide valleys and ridges to add to the visual character of the area, and roads, bridges, telephone and power lines, and residences on farms, farm buildings, etc. further reduced the aesthetic value of the surroundings. Onsite assessment of immediate landscapes revealed that the majority of the Southern-, Upper Western- and Upper Eastern Sections are transformed due to past and present agricultural activities, while the southern parts of the Southern Section are more intact, but borders the diamond mining area.

With the removal of vegetation and establishment of crops, the anthropogenic impact will be evident, but it will be site-specific, since it is not visible from any public area, and since it will be directly abutting existing pivot areas, it would seem like a continuation of the same activity and therefore reduce the perceived aesthetic impact.

Direct Impact on the Visuals and Aesthetic appearance of the site

Construction Phase & Operational Phase:

During the construction phase fences might be erected, mobile toilets, possible containers, signage, etc. This topographical interference will be very low to negligible and will be similar to the impacts that farm residences and associated infrastructure pose in the landscape.

The clearing of vegetation will temporarily change the texture (vegetated/rough to bare/smooth) and colour (green/brown to red/brown) of the cleared out areas and will increase onsite visibility, but as the crops are established the onsite visuals will be absorbed into the landscape and will fit in with the surrounding land use. This will be a continued impact during the operational phase, as summer and winter crops are planted or lucerne for alternating years.

In terms of the areas allocated for vineyards and pecan nuts, once established the onsite visuals will be absorbed into the landscape and will fit in with the surrounding land use.

The clearing of vegetation/crops and ploughing of topsoil will generate some dust volume that will increase on windy days. This will result in a dust column appearing above the cleared-out area, which could attract more visual focus to the area. With good soil management, the mentioned impact will mostly be eliminated and will cause the landscape to comfortably fit into the surrounding landscape. This will guarantee an acceptable visual impact and aesthetic appearance. Considering the abutting farming activities and no complaints were received could further indicate that residents and landowners have grown accustomed to such activities. This impact is rated low-moderate

at the start of the re-vegetation phase but once maturity has been reached, the impact would be reduced significantly.

Indirect Impacts

Construction & Operational Phase:

A visual impact is a change to a scenic attribute of the landscape brought by the introduction of visual contrasts and the associated changes in the human visual experience of the landscape. The clearing of land to establish crops is not an introduction of new activity in the area, and although the proposed development will cause a temporary visual contrast to the landscape during the construction phase, it is not regarded as a change that will negatively impact the human visual experience of the landscape.

In the immediate surrounding area, and to the knowledge of the author, there are no other tourist attractions or businesses, such as e.g. hiking trails, nature reserves, Khoisan rock art, etc. within a 5km radius of the site, that would be indirectly impacted if 406Ha of the natural veld is cleared to establish crops. There is no other indirect visual impact identified for this development.

Cumulative Visual Impact

Activities that cumulatively could negatively impact the surrounding area would be structures such as wind turbines, Eskom lines, mining, factories with the constant release of emissions, clearing of land, construction of buildings into the skyline, erection of billboards, light pollution at night, etc.

Mining is taking place southeast of the site and has contributed to the visual impact of the farm. It is supposed to be regulated by an Environmental Management Plan that has a rehabilitation plan and technically should rehabilitate areas that have been mined out, reducing the cumulative impact. Thus, the cumulative impact will increase during the clearing of vegetation or crops but once the crops or lucerne is established it would be readily absorbed into the surroundings. Thus the cumulative impact is rated low.

Visual Impact Assessment

	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	Short Term	1	Short Term	1
Intensity	High	6	Medium-High	5	High	6	Medium-High	5

Probability	Likely	3	Probable	2	Likely	3	Probable	2
Cumulative Impact	Low		Very Low		Low		Very Low	
Status	Negative		Neutral		Negative		Neutral	
Confidence	High		High		High		High	
Significance	**Low-Moderate**	**24**	**Very Low**	**14**	**Low-Moderate**	**24**	**Very Low**	**14**
Extent to which impacts can be reversed	Through establishing crops the site will fit in with the surrounding land uses and the visual impact can be mitigated.							

TRANSPORT IMPACT

The existing access roads on the farm and the R357 will be used. During the construction phase (vegetation clearing) a bulldozer will be at the site and will not add heavy vehicle traffic to the national and provincial road system. It is not anticipated that there will be any impact on the farm road infrastructure.

Once operational, the R357 will be used to transport harvest crops, dried fruit and nuts to the relevant markets. It is anticipated that during the harvest time, heavy vehicles will add to the traffic count on the R357, but since this road is built for heavy vehicles, the impact is anticipated to be low.

Direct Impact

Construction & Operational Phase:

It will be required that heavy vehicle signs should be erected on both sides of the gravel road (Muishoek road) that leads to the R357 near the entrance to the Zwem Kuil farm, as per the specifications of the District Roads Engineer to increase safety standards, especially during harvest season.

The maintenance of the farm roads will be the responsibility of the Applicant and mining company, as per the agreement in the past and since no complaint during the public participation was received it is presumed that there are no objections regarding the use of the farm road.

The Muishoek road leading to the R357 as well as the R357 are provincial roads and will be used to transport harvest crops to the relevant markets. The Muishoek road showed signs of erosion and will require maintenance. Since this is the responsibility of the government, the Department of Roads were consulted during the Scoping Phase but had

no objections or feedback. Likewise, no other neighbour or farmer using the gravel road responded during the Scoping Phase's public participation and it is presumed that none have objections.

The R357 is suitable for all vehicles and constructed to carry frequent traffic and heavily loaded vehicles. It is anticipated that during the harvest time, heavy vehicles will add to the traffic count on the R357, but since this road is built for heavy vehicles, the impact is anticipated to be a very low impact.

During periods of high hauling rates which could occur during the harvest time, a flagman should secure access. The line of visibility on both sides of the junction is good and therefore poses no direct threat to the road users abiding by the speed limit. Making other motorists aware of the possibility of heavy vehicles on the road will create more awareness and caution the drivers. The overall impact on traffic and road infrastructure during the operational phase is rated low impact.

Indirect Impact

Construction & Operational Phase:

Road safety for motorists is always a priority and of importance. Truck drivers should be informed accordingly and be sensitized towards displaying proper road etiquette. Despite the quality of the roads, the safety risks for motorists, cyclists, and pedestrians could increase due to human error, since heavy vehicles will slow down vehicles or reckless driving could cause accidents. Therefore all truck drivers will be sensitized on the matter and provided with the necessary transport training.

Furthermore, harvest material should be carted from the property from 07:00 to 17:00 during the week (winter) and 6:00 to 19:00 (summer) but this may result in the need to cart crops on Saturday mornings, this will reduce the small impact on being restrained to daylight, furthering increasing visibility, since visibility is better in the day than at night time. The impact is expected to be low with mitigation.

Cumulative Impact

The current traffic volume on the Muishoek road or the R357 road is not known, however, they are provincial roads, and thus it is expected to carry sufficient volumes of traffic. Activities such as farming, mining and schools can cumulatively contribute to the vehicle load on the Muishoek road leading to the R357. Some of these activities will add heavy vehicle loads only during harvest time, thus there is a small possibility that the cumulative impact on the structural integrity of the road will increase if this site is approved. Considering the annual harvest, the possible cumulative impact is rated low-moderate to low.

Traffic Impact Assessment

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Sub Regional	3	Sub Regional	3	Sub Regional	3	Sub Regional	3
Duration	Short Term	1	Short Term	1	Short Term	1	Short Term	1
Intensity	Low-Medium	3	Low	2	Low-Medium	3	Low	2
Probability	Likely	3	Probable	2	Likely	3	Probable	2
Cumulative Impact	Low		Very Low		Low-Moderate		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low**	**21**	**Very Low**	**12**	**Low**	**21**	**Very Low**	**12**
Extent to which impacts can be reversed	Impacts cannot be reversed but can be mitigated through adhering to traffic regulations and mitigations stipulated in the EMP.							

SOCIO-ECONOMIC IMPACT

It is very important for any development to consider the social impacts, whether it is beneficial or harmful to the surrounding community.

During the construction phase, the development will provide permanent and casual work for a number of people, whether it is renting a bulldozer from a local company, employing workers to 1) remove the vegetation, 2) remove stones, 3) construct the irrigation infrastructure, or 4) fencing/moving fencing the camps, etc. Once in operation and the crops are harvested, it will create job opportunities for harvesters, transport companies, etc. and must be seen as a positive contributor to upliftment of inhabitants of the Siyathemba Municipal area.

Once in operation and the crops are harvested, the vineyard starts producing fruit, and the pecan nut plantation starts producing nuts, an annual raisin production/nut harvesting and crops harvesting will create job opportunities for harvesters, transport companies, etc. and must be seen as a positive contributor to upliftment of inhabitants of the Siyathemba Municipal area.

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.

It is thus clear that raisin production, pecan nut production, and maize/wheat/lucerne crops, 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 about 50 permanent staff and 300 seasonal staff to be employed during the operational phase of the vineyard and pecan nut harvesting, thus assisting the low-income households that will assist in poverty alleviation.

In terms of the negative impacts, it could potentially pose some social impacts on residents in terms of safety and security issues, nuisance factors such as dust & noise generation. However, the Applicant is a farmer and has a close relationship with the local community. Most of the families employed on the farm will be from families that have been on the farm for generations, which is the basis of their mutual trust in each other. The Applicant will therefore employ local community members known to the farming community, which is in line with current farming practices.

Direct Impact

Construction Phase:

During the construction phase, the development will provide 30 employment opportunities (10 will be for skilled employment and 20 for un-skilled), whether it is renting a bulldozer from a local company, employing workers to remove the vegetation, 2) planting new vine trees/pecan nut trees, 3) constructing the irrigation infrastructure, or 4) fencing the camps, etc. It is expected that the value of the employment opportunities during the construction phase will be about R5 00 000/year. The clearing of 406Ha will continue into the operational phase as the entire site will not be developed in one phase but over 5 years, thus the above employment will continue to benefit until the entire site is developed.

Establishing the vineyard and pecan nut orchard will also result in some downstream employment and other spin-offs, such as construction companies renting out the bulldozer/earth moving equipment, hardware stores, or Farm Co-ops selling fences, irrigation equipment, pesticides, signage, the chemical toilet rental companies, nurseries, etc. which should provide more upliftment opportunities than just the agriculture activities and is a small positive impact. Overall the impact during the construction phase is rated very low (positive).

Operational Phase:

Once in operation, it is expected that the annual income generated by the crops will be about R15 million. During the operational phase 20 permanent employment opportunities will be created, of which 100% will be for previously disadvantaged people. Over 300 seasonal employment during harvest time. It is clear that if the crops are

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.

Additional downstream employment and other spin-offs, such as harvesters, transport companies, packaging companies, distributors, etc. should also add to the overall economic impact and are regarded as a positive impact.

The establishment of the vineyard/orchard and other crops will have a very limited impact on agricultural activities, as was discussed previously under the heading 'Land use' and is from an economical point of view considered to be a better option than livestock farming. Any minor losses that might be experienced with the loss of grazing units, will be offset against the net profits of the crop production, which are substantially larger than those generated by current farming. Therefore no net losses will occur to the landowner and this is seen as a positive attribute.

Any economic benefit will also improve social benefits since households might afford better education for the children, better health services, lifestyles might improve, etc. Most of the families employed on the farm will be from families that have been on the farm for generations, which is the basis of their mutual trust in each other. The applicant will therefore employ local community members known to the farming community, which is in line with current farming practices. There is no need for relocation of people, therefore, no impact is expected in this regard

In terms of the negative impacts, it could potentially pose some social impacts on residents in terms of cattle theft, and nuisance factors such as dust and noise generation, but with the mitigation measures described elsewhere, these impacts could be reduced to acceptable levels.

In terms of safety and security, the impact could likely increase during the harvest time with the influx of labour. It is very important and is a current topic in South Africa, and could potentially have a negative, indirect social impact if a farm attack occurs. Most farmers already have security measures in place, but having good relationships with your neighbours is important to have immediate access to help and assistance, and farmers should have scheduled training days.

Another integral part of security is for farmers to have a good relationship with farmworkers, as they will also be able to assist and help secure the property. Unfortunately, most farmers are isolated and the impact is a possibility. The only possible mitigation is for the applicant to ensure that the influx of people during harvest time is from the local community, so the workers know each other and they have been registered with the farm to be employed as contract workers. Open communication should be established, if a neighbour or farmworker notices any strangers in the area, especially those who ask questions, should be reported. Farmworkers and community members could also be rewarded if the information is provided that prevents theft or attack.

Technology plays a very important and increasing role in preventing crime, and applications such as WhatsApp, Telegram, etc. should form an integral part of security as communication is key in an emergency, since you can reach an entire community in one message.

Permanent farmworkers do have premisses on the farm to live in, contract workers will commute to the farm when contracted, thus no form of squatting is anticipated.

Overall, the impact is rated low-moderate (positive) with mitigation, but reduced to low (positive) without mitigation.

Indirect Impact

Construction & Operational Phase:

Currently, the site is not near any tourist destinations or next to any public road. Thus from a tourism point of view, there is no potential socio-economic impact. Furthermore, the site is not visible along the Muishoek road, and as discussed under the heading 'Visual Impact' will not cause any significant and permanent impact on the tranquillity of the area and the impact is rated insignificant.

Cumulative Impact

From an environmental point of view, there are no cumulative impacts that cannot be mitigated or prevented to ensure that there is no negative environmental cumulative impact this proposed activity will have on abutting residents or other members of the public.

From an economical point of view, the proposed crops will generate permanent and casual work for a few additional people, thus creating the opportunity to employ more local people; this is a cumulative positive impact.

In terms of competing land uses nearby: there are abutting crops next to the site, but the South African farming industry is under pressure to provide a secure food supply due to the growing population and the exodus of many farmers from this country. Therefore the agricultural sector is poised for a significant expansion in the next few years and this application will be in line with this projection. Having abutting farms could also result in farmers sharing resources and it is not expected that the proposed development will lead to a loss in clientele for the abutting farms.

Considering the above from a socio-economic point of view, the proposed crops will overall have a very low positive cumulative impact.

Socio-Economic Impact Assessment

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Local	2	Local	2	Local	2	Local	2
Duration	Short Term	1	Short Term	1	Medium Term	2	Long Term	3

Intensity	Very Low	1	Low	2	Low	2	Low-Medium	3
Probability	Likely	3	Likely	3	Likely	3	Likely	3
Cumulative Impact	None		Very Low (Positive)		Very Low (Negative)		Very Low (Positive)	
Status	**Positive** (economic attributes outweigh the negative social impacts)		**Positive** (economic attributes outweigh the negative social impacts)		**Positive** (economic attributes outweigh the negative social impacts)		**Positive** (economic attributes outweigh the negative social impacts)	
Confidence	High		High		High		High	
Significance	**Very Low**	**12**	**Very Low**	**15**	**Low**	**18**	**Low-Moderate**	**24**
Extent to which impacts can be reversed	Any negative environmental impacts that may impact economic sustainability can be successfully reversed by implementing the conditions of the EMP.							

STRUCTURES OF ARCHAEOLOGICAL AND CULTURAL INTEREST

These sites represent the heritage of communities and are therefore protected in terms of current legislation. In addition, all materials/buildings older than 60 years are protected. The Northern Cape is rich in fossils and archaeological heritage and therefore the area will be subject to a Phase 1 Archaeological and Paleontology Report will be completed by Dr. Lloyd Rossouw who has a BA Hons (SU), MSc (Wits), and Ph.D. (UFS).

In summary, the report indicated that the field assessment indicates that the farm is located within a wider region that has previously yielded ample archaeological evidence of prehistoric human occupation (Humphreys 1982; Beaumont & Vogel 1995). However, visible evidence of Stone Age/Prehistoric presence at two out of 16 areas is considered minor in terms of overall impact. The low-density, *ex situ* stone tool component observed in Areas 5 and 8 has been mapped and recorded. All the areas are assigned an archaeological site rating of Generally Protected C (Low significance), but it is noted that the potential occurrence of isolated and unmarked graves, subsurface burial cairns or intact subsurface archaeological finds not recorded during this survey can never be excluded.

Thus, it is recommended that the development can proceed, provided that the relevant heritage authority (SAHRA) and a qualified archaeologist be informed immediately in the event of potential archaeological exposure during the construction phase of the proposed development.

Direct Impact

Construction & Operational Phase:

Exposure or semi-exposure to preserve archaeological findings is most likely to occur during the clearing of vegetation or ploughing of land. Regardless of the archaeological status, the operators of earthmoving equipment should be informed of the applicant's obligation to preserve archaeological findings and to inform management when anything of interest is noted on the site. The following general rules will apply during the construction phase (the detailed mitigation and protocols can be viewed in the EMP):

- The operator of the excavator should be briefed regarding this aspect and a reporting channel must be developed.
- Management will be informed when anything of interest is observed on the site and it will be reported immediately to the South African Heritage Resources Agency (SAHRA). In such a case all operations would be suspended immediately.
- Any found will be fenced off immediately.
- An environmental awareness plan will be compiled to inform the operators of earthmoving equipment of the applicant's obligation to protect any archaeological or cultural artefacts and to inform the applicant when anything of interest is noted on the site.

Indirect Impact

Construction & Operational Phase:

In terms of a possible negative indirect impact, if any human remains are uncovered, it could lead to a crime and police investigation. Depending on the findings, could lead to trauma counselling for family members who might be the victim of the crime, which could have a potential negative social impact. While such investigations are underway, it might also cause all operations to be suspended in such a particular area, until the investigation has been completed which could have a financial impact on the applicant.

In terms of a possible positive indirect impact, any subsurface evidence of archaeological sites or remains, e.g. stone tool artifacts, bone or ostrich eggshell fragments, charcoal and ash heaps, or remnants of stone-made structures or unmarked graves, or archaeological structures such as stone-build enclosures, or buildings, fossils, etc. could lead to exciting discoveries and research in terms of this regions heritage.

Since the survey area is assigned an archaeological site rating of Generally Protected C, it is rated a low impact.

Cumulative Impact

There is no cumulative impact expected unless a significant recovery is made, which can cumulative increase the knowledge of this region's heritage richness.

Heritage Impact Assessment

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Sub Regional	3	Sub Regional	3	Site Specific	1	Site Specific	1
Duration	Permanent	4	Permanent	4	Short Term	1	Short Term	1
Intensity	Low	2	Very Low	1	Low	2	Very Low	1
Probability	Probable	2	Probable	2	Probable	2	Probable	2
Cumulative Impact	None		None		None		None	
Status	Negative		Negative		Neutral		Neutral	
Confidence	High		High		High		High	
Significance	**Low**	**18**	**Low**	**16**	**Very Low**	**8**	**Insignificant**	**6**
Extent to which impacts can be reversed	Impacts can be mitigated through providing training and protocol (to earthmoving operators) to follow the protocols in the event of uncovering any archaeological findings.							

ENVIRONMENTAL STATEMENT

Summary of significant direct impacts with and without mitigation during the construction and operational phases.

Environmental parameter	CONSTRUCTION (no mitigation)	CONSTRUCTION (with mitigation)	OPERATIONAL (no mitigation)	OPERATIONAL (with mitigation)
Topography	Very Low	Insignificant	Low	Very Low
Soil Properties	Low	Very Low	Low-Moderate	Low
Soil Erosion	Low	Very Low	Moderate	Low

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Soil Pollution	Very Low	Very Low	Low-Moderate	Low
Land Use	Low	Very Low	Moderate-High	Very Low
Flora	Moderate-High	Moderate	Low-Moderate	Low-Moderate
Fauna	Moderate-High	Low-Moderate	Low	Very Low
Ecologically Sensitive Areas	Moderate-High	Moderate	Moderate-High	Moderate
Water	Low-Moderate	Low	Low-Moderate	Low
Air quality: Dust	Low-Moderate	Low	Low-Moderate	Low
Air quality: Pesticides	Low	Very Low	Moderate-High	Low-Moderate
Noise	Low	Very Low	Low	Very Low
Waste	Very Low	Very Low	Low	Very Low
Visual & Aesthetics	Low-Moderate	Very Low	Low-Moderate	Very Low
Traffic	Low	Very Low	Low	Very Low
Socio-Economic	Very Low (+)	Very Low (+)	Low (+)	Low-Moderate (+)
Heritage / Archaeology	Low	Low	Very Low	Insignificant

Due to the nature of the development, the natural flora component and sensitivity of the site will be permanently destroyed during the construction phase. As the crops are established and operational the impacts will mostly be depended on the management of the site and could be rated moderate-high negative impacts on the land use, flora, fauna, ecological sensitivity, and air quality due to the use of pesticides if no mitigation measures are implemented.

The benefit of crop rotation is of great value to farmers not only from a financial perspective but also from an environmental and social-economic perspective. Rotation can also help manage diseases caused by pathogens that survive in the soils or in crop debris and pathogens whose populations decline in the absence of a susceptible host (Seminis, 2020). In terms of insect management, crop rotation is not effective for managing insect pests, but crop rotation can be used to break the life cycle of such insect pests with limited mobility and narrow host ranges. Crop rotation can also be used to help manage weed problems because different crops compete with weed species in diverse ways. Crops vary in their time of planting rate of canopy development, canopy height, row spacings, and harvest times, which creates varied environmental conditions that can prevent the buildup of a few weed species.

Thus, although there is a benefit to crop rotation, the nature of the development will permanently destroy the natural component and habitat of the irrigation areas, thus the impact on flora, fauna, and ecological sensitivity is rated moderate-high during the construction phase without mitigation. As the crops are established and operational the impacts will mostly be depended on the management of the site and land use impacts and impacts caused by pesticides could be moderate-high without mitigation. Since the impact on the ecological sensitivity will be permanent and definite, the impact will remain moderate-high without mitigation during the operational phase. Soil

erosion could potentially be moderate without mitigation during the operational phase. All other impacts are rated between low-moderate to low without mitigation.

Thus, even with no mitigation, none of the impacts during any of the development phases were rated 'High'. The more significant impact is on the land use, vegetation, fauna, and ecologically sensitive sites that are rated moderate-high can be reduced to moderate or low-moderate with mitigation. All other impacts with mitigation can be effectively reduced to between 'Moderate' and 'Insignificant' and will result in these impacts being mitigated to acceptable levels.

The soil scientist and flora specialist recommendations, irrigation scheduling, crop rotation planning, and correct management, e.g. soil management, pivot planning, translocation of plant species, control of alien vegetation, etc. will further mitigate the potential impacts.

The socio-economic impacts will largely result in a small boost in the local economy and provide few causal and permanent employment opportunities and impacts are regarded as a small positive impact.

It is concluded that if all the mitigation measures are adhered to, the impacts associated with the proposed project will have no significant adverse long-term environmental impact on the surrounding environment and the long-term impacts can be reduced to acceptable levels.

Positive impacts associated with the project include:

- Employment opportunities and skills development, and
- Contributing to the local economy and helping to retain valuable spending in the area.

It is the opinion of the appointed Environmental Assessment Practitioner (EAP) that provided the recommended mitigation measures are implemented and the farm is managed in an environmentally sound manner and according to the EMP, there should be no reason to prevent the proposed development from being approved.

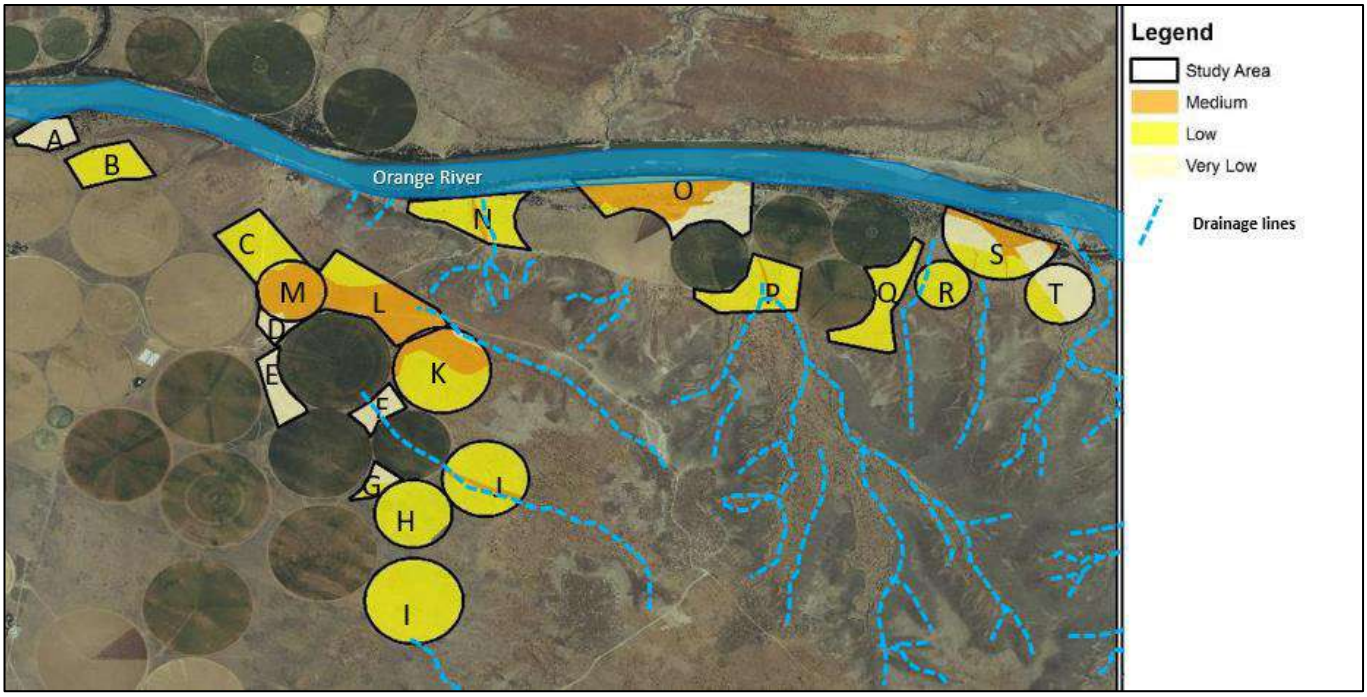


FIGURE 41: ENVIRONMENTAL SENSITIVITY MAP. THE BLUE LINES REPRESENT DRAINAGE LINES AND THE ORANGE RIVER, THE BLACK POLYGONS OF THE PROPOSED SITE, AND THE SHADES OF YELLOW AND ORANGE THE SITE ECOLOGICAL IMPORTANT AREAS.

RECOMMENDATIONS FROM SPECIALISTS

Soil survey: Digital Soils Africa

1. General soil requirements for Vineyard Production

Vineyards are best suitable for soil that has a pH between 5.5 and 6.5 and has a required phosphorus between 40 to 50 ppm. Additionally, for vineyards to be successful a depth of between 600 mm and 800 mm is required. By breaking up the soil, deep ripping can allow roots to penetrate the soil and access water and nutrients. Soil texture is one of the most important components regarding vineyards, a sandy soil will require intensive irrigation in order to achieve production goals, while a clay soil struggles with cultivation and cracks that disrupts water and nutrient movement.

Specific Zwemkuil situation

Soil depth

Vineyard production requires less soil depth than traditional agricultural produce. The area shown as suitable for vineyard has sufficient depth for vineyard roots to develop and is suitable for production. On the unsuitable area, vineyard roots will be restricted, and the available water and nutrients will be limited.

Soil texture

The soil texture is generally very sandy, with clay percentages generally under 20%. Dryland vineyard will not be suitable for these soil types as no water would be retained, while drip irrigation would be better suited for the soil type.

pH

The pH(KCl) of the soil samples is between 5.7 and 7.4. The more alkaline soils (Red apedal horizon of profiles 75 and Orthic of 88) require a reduction in pH, while the rest of the area has a suitable pH for vineyards. It is recommended that acidifying fertilizers be used on the soils to lower the pH. Liming is not required. Regular soil sampling will inform the farmer of best management practices concerning alkalinity/acidity.

Phosphorous

Calcuim carbonate (Found in Coega and Brandvlei and soils with Neocarbonate horizons) exerts a major influence on P fixation. The phosphorous within the soil (6-8 mg/kg) is below the required rate of 40 mg/kg. and it is recommended phosphate be applied to prevent plant deficiencies. Phosphate availability is largely dependent on the pH. Soil pH values below 5.5 and between 7.5 and 8.5 limit phosphate availability to plants due to phosphorous being highly fixated at very low pH soils (pH 3-4) and moderately fixated at pH 7.5-9 (USDA, 2001). Therefore, the more alkaline soils of Zwemkuil could experience P deficiency.

Conclusion

The soils indicated as suitable for vineyards are generally suitable for vineyard production. The pH is not within the optimal range and acidic fertilization should be applied; it is also expected that soil pH will decrease with continued cultivation. The texture is suitable for vineyards under drip irrigation. It is recommended that phosphate be applied to prevent plant deficiencies.

General soil requirements for Pecan nut Production

Pecan nut trees perform best in fertile, well- drained, deep soil which consists of a medium texture. The soil depth should at least be 2 m deep. The soil should not be calcareous as calcareous soil causes deficiencies in micro-nutrients, especially zinc. The pH recommendation for pecan-nut trees is 6.5 to 7. Suitability for pecan-nut trees were defined as suitable (depths of 1000 mm and non-calcareous) and moderately suitable (depths of 1000 mm and calcareous).

Specific Zwemkuil situation

Soil depth

Soils with a freely drained depth >1000 mm were considered to have sufficient depth for pecans, which is a large portion of Zwemkuil farm

Soil texture

The soil texture is generally very sandy, with clay percentages under 20%. Pecan-nut trees prefer soil that are freely drained and has sandy loam texture. All the soils meet the textures requirements.

pH

The pH(KCl) of the soil samples is between 5.7 and 7.4. More acidifying fertilizers should be applied in the alkaline soils (Red apedal of profile 75 and Orthic of profile 88). A slightly acidic pH was found for the rest of the area. Liming is not required on the alkaline soils as it is anticipated that the pH will lower with continued cultivation and irrigation. Soils that are more alkaline could lead to micro-nutrient deficiencies. Regular soil sampling will inform the farmer of best management practices concerning alkalinity/acidity.

Phosphorous

Calcuim carbonate exerts a major influence on P fixation as discussed with vineyard. The phosphorous within the soil (6-8 mg/kg) is low. The recommendations for pecan-nut tres are provided in below table.

Phosphorous recommendation for Pecan-nut trees

Plant nutrient	Year fertilizer application for trees during years			
Phosphorous	1	2	3	4
(g per tree)	34	68	102	136

Zinc

Zinc requirements within areas where pH is higher than 7 (Red apedal of profile 75 and Orthic of Profile 88) are especially at risk for zinc deficiencies. The pH can be decreased and thereby increasing zinc uptake in the roots or apply the zinc for foliage uptake. It is recommended to pursue lowing the pH, since the good drainage of the soils allows leaching which, with chemical amendments, can lower pH effectively.

Conclusion

The soils indicated as suitable for pecan-nut trees are both physically (depth and texture) and chemically suitable for Pecan-nut trees production. The pH is not within the optimal range and acidic fertilization as well as Zn should be applied; it is also expected that soil pH will decrease with continued cultivation.

Final Recommendation

It is recommended that the pivot placement does not exceed more than 10% of unsuitable soil. Areas with a freely drainable depth >1000 mm are suitable for irrigation with no restrictions, while soils with a depth of 700 - 1000 mm could be used for vineyard production under drip irrigation. Areas with a depth of less than 700 mm are considered not suitable for irrigation or vineyard.

The rest of the area is suitable for all irrigation. The laboratory results indicate that the chemical parameters are manageable. The exchangeable sodium percentage (ESP) values are low and the pH values indicate that salinity is not a major risk. The study area (excluding the Brandvlei soil areas) is of low risk to salinization, with low ESP and EC together with good drainage. A fertilization plan on soils with low CEC should be implemented to ensure maximum crop production.

Flora Survey: Dimela Eco Consulting

Planning and clearing/construction:

- Keep the vegetation clearing in Medium Site Ecological Importance (SEI) categories as small as possible and align with already modified areas.
- Endeavour to utilise as much Low and Very low SEI as possible and the areas of Medium SEI bordering it.
- Only clear the footprint needed for cultivation and associated activities.
- Maintain riparian areas and allow for naturally vegetated corridors through the cultivated areas.
- Narrow slithers of vegetation in-between cultivated areas play a role in ecological processes; however, these areas are prone to edge effects and low in species diversity. Therefore, open spaces should be as large as possible and preferably connected by the narrower vegetation in between crop areas.
- Prevent vehicular access into natural areas beyond the demarcated area to be cleared.
- Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.
- Apply for permits for the removal of protected tree species prior to clearing of the land. The final proposed footprint of clearing must be walked to determine whether *Boscia albitrunca* or *Harpagophytum procumbens* subsp *procumbens* (devil's claw) will be affected. If so, apply for permits for their removal (or relocation of *H procumbens)* prior to vegetation clearing.
- Contractors / clearing team should familiarize themselves with the protected species and the Rare *Tridentia virescens,* including the *Ammocharis carinica* that is a provincially protected plant (see below). If found during clearing, the species should be relocated to outside of the proposed clearing footprint and monitored for survival for at least two years.


Tridentia virescens


Ammocharis carinica *Boscia albitrunca*


Harpagophytum procumbens subsp *procumbens* (devil's claw)

- Limit fragmentation by roads and other linear developments etc. in conserved open space.
- Alien invasive species, in particular category 1b species that were identified within the study area, should be removed from the development footprint and immediate surrounds, prior to clearing or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation.
- All alien seedlings and saplings must be removed as they become evident for the duration of clearing
- All vehicles and equipment that enter the site must be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access to the areas to be cleared.

Operational:

- After clearing, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land must be left in a condition as close as possible to that prior to clearing.
- Prevent operational activities from impacting adjacent vegetation e.g. harvester and other machinery may not turn or park in naturally vegetated areas, and prevent drift from chemical herbicides and pesticides.
- Irrigated areas should be kept to a minimum and should not extend beyond the cultivated areas.

- Do not infringe on natural areas beyond the proposed cultivated areas and prevent the unnecessary removal and trampling of vegetation.
- Leave as much natural vegetation intact as possible.
- Ensure that areas outside of the operational footprint that was disturbed, are adequately rehabilitated and prevent dense stands of encroacher species.
- Continuously monitor the emergence of alien invasive plant species on the site and remove such species as soon as they become apparent.
- No operational activities may directly impact the watercourses or veer from dedicated roads.
- Limit the use of chemicals (pesticides and herbicides) and do not spray in windy conditions. Pesticides may impact pollinators and lead to a decline in species diversity and densities.
- Do not prevent the movement of mammals and insects, except to safeguard crops (e.g. grazing kudu's).
- Monitor the establishment of dense stands of encroacher species and remove or thin as soon as detected.
- If game or grazers will be excluded from the natural vegetation, a management plan to prevent densification or a shift in species composition should be implemented to maintain the vegetation in a natural to a near-natural state.

Heritage Impact Assessment: Paleo Field Service

In the *unlikely event* of Palaeontological Chance Finds Protocol for Developer:

- Palaeontologists monitoring for fossil remains and in the event of fossil discovery by workers in the field, they must be altered immediately.
- If, in the event that localised fossil material is discovered within or found eroding out of intact sedimentary *rocks*, it will in all probability resemble footprints on flat-surfaced rocks or it will look like tocks that resemble tree stumps, teeth, or objects with smooth rounded projections like a bearing or the curved area at the end of a bone.
- If, in the event that localised fossil material is discovered exposed or eroding out of intact superficial overburden (topsoils), it will in all probability resemble modern-looking, but more or less lithified animal bones and teeth and it will most likely be those belonging to bovids (very common, late Neogene fossils belonging to the biological family of very common ruminant mammals that includes wildebeest, buffalo, antelopes, etc.).
- If any newly discovered palaeotological resources prove to be significant, a Phase 2 rescue operation may be required subject to permits issued by South African Heritage Resources Agency (SAHRA).
- The decision regarding the Environmental Auhtorisation Application must be communicated to SAHRA and uploaded to the SARHA Case application.
- In the meantime, *ex situ* remains (fossils that were exposed and removed during the construction phase) must be wrapped in paper towels or heavy-duty tin foil and stored in a safe place. The material should not be washed or cleaned in any way.

- *In situ* material remains (fossils that were identified or exposed, but not removed during the construction phase) must be kept in place and protected from further damage by covering it with light but rigid objects like a box, bucket, or metal sheet until further confirmation by the palaeontologist.

Archaeological Chance Finds Protocol for Developer:

- Any subsurface evidence of archaeological sites or remains, e.g. stone tool artifacts, bone or ostrich eggshell fragments, charcoal and ash heaps, or remnants of stone-made structures or unmarked graves found during the construction phase of the development, must be reported to SAHRA APM Unit (Tel. 021 462 5402).
- Potential archaeological structures such as stone-build enclosures, buildings or graves must be avoided by a no-go buffer zone until further confirmation by the archaeologist. Smaller *in situ* material must be kept in place and protected from further damage by covering it with light but rigid object like a box, bucket, or metal sheet.
- If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit must be alerted immediately. A professional archaeologist must be contracted as soon as possible to inspect the findings. In such a case, all operations would be suspended immediately in such a particular area.
- If newly discovered heritage resources prove to be of archaeological significance, a Phase 2 rescue operation may be required, subject to permits issued by SAHRA.

OPINION IF THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORIZED

Considering the soil suitability and the SEI, it is, therefore, the opinion of the EAP that 406 Ha on Portion 2 and the Remainder of Farm Zwem Kuil No. 37 and the Remainder of Farm Smitskloof No. 38 be approved and the remaining areas surrounding the irrigated areas (as indicated on the soil maps which total to 98.7 Ha) be excluded from vegetation clearing. These sections should be used for environmental offset purposes and any plant species that can be transplanted from the pivot areas.

It is the opinion of the EAP, considering the above, that this project can therefore be approved on the condition of the list below.

CONDITIONS OF AUTHORIZATION

- 406Ha approved according to the layout plans in the EMP and the remaining 98.7 Ha be used as part of the environmental offset plan to plant vegetation that can be transplanted and removed from the affected areas.
- Vegetation clearing and crop establishment should only be approved for the area under the application.
    - 100m buffer zone must be maintained at all times between the clearing of vegetation and the Orange River and 32m from the drainage lines.

- Crop rotation strategy and irrigation scheduling be implemented. A soil scientist is contracted to design the irrigation scheduling.
- A soil scientist is contracted to design the irrigation scheduling.
- All the mitigation measures listed in the Environmental Management Plan must be implemented.
- The Applicant must ensure that the clearing of vegetation remains within the designated area and that no unauthorized activities occur.
- Workers must be educated on environmental management aspects.
- Permits for protected plant species must be obtained before it is removed.

ASSUMPTIONS, UNCERTAINTIES, AND GAPS IN KNOWLEDGE

A limitation is that the site was only visited once on 15-16 February 2022 for 8 hours, which limits the number of fauna species recorded on site. Some animals seek shelter or hide when they hear a vehicle approaching and this may also decrease the number of species recorded. However, this sampling scenario is not viable due to time constraints and budget constraints.

The gaps in knowledge of the EPA are the skill to identify plant species, soil, and heritage important findings. These were covered by the specialists appointed and the EAP relies on the expertise of these specialists.

Ultimately, it can be concluded that this environmental assessment is considered sufficient and with correct identification of impacts and ratings.

EAP UNDERTAKING

The EAP herewith confirms

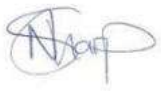
a) the correctness of the information provided in the reports; [X]

b) the inclusion of comments and inputs from stakeholders and I&AP's; [ ] (*To be completed with the Final EIA, once the public participation has been completed*).

c) the inclusion of inputs and recommendations from the specialist reports where relevant; [X]

d) that the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties are correctly reflected herein. ☐ (*To be completed with the Final EIA, once the public participation has been completed*).

During the Scoping Phase Public Participation, one comment was received that was included as information in the Draft EIA. Since this is a Draft EIA and currently under public review for public participation, any comments received will therefore be considered and included in the Final EIA.



_____
Signature of the Environmental Assessment Practitioner/s

Digital Soils Africa (Pty) Ltd
Name of the company

12 July 2022
Date

FINANCIAL PROVISION FOR REHABILITATION / CLOSURE

This is a permanent change from grazing to crop production and it is highly unlikely that the proposed development will ever or at least within the next 20 years be decommissioned, and therefore financial provision for rehabilitation and closure is not applicable at this stage.

However, should the Applicant elect to decommission the project 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 and appropriate financial provision is calculated.

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

DEVIATION FROM THE APPROVED SCOPING REPORT

There has been no deviation from the approved Scoping Report.

REFERENCES

Ala-Kokko, K., Nalley, L.L., Shew, A. M., Tack, J.B., Chaminuka, P., Matlock, M.D., D'Haese, M., 2021. Economic and ecosystem impacts of GM maize in South Africa, Global Food Security, Volume 29, 2021, 100544, ISSN 2211-9124.

Al-Kaisi, M., 2021. Value of crop rotation in nitrogen management. Iowa State University Extension and Outreach. Integrated Crop Management. https://crops.extension.iastate.edu/encyclopedia/value-crop-rotation-nitrogen-management. 28/07/20201, 12:02

Almond, J. & Pether, J. 2009; SAHRA Palaeotechnical Report. *Palaeontological Heritage of the Northern Cape*. https://sahris.sahra.org.za/sites/default/files/website/articledocs/NC%20palaeotechnical%20report.pdf. 29/07/2021, 10:50

ARC (Agricultural Research Council), 2014. Insects pest of seeds or seedlings. http://www.arc.agric.za/arc-sgi/Pages/Crop%20Protection/Insects-pests-of-seeds-or-seedlings.aspx. 30/07/2021, 10:58.

Balfour, D., Holness, S., Jackelman, J., Skowno, A., 2016. National Protected Area Expansion Strategy for South Africa. Department of Environmental Affairs. https://www.environment.gov.za/sites/default/files/docs/national_protectedareas_expansionstrategy2016_ofsouthafrica.pdf. 02/08/2021, 09:32.

Bell, R.A., 2016. Insect pests of maize in Kwazulu Natal. KwaZulu-Natal Province: Agriculture and Rural Development, the Republic of South Africa. https://www.kzndard.gov.za/insect-pests-of-maize-in-kwazulu-natal. 28/07/2021, 10:18.

BFAP (Bureau for Food and Agricultural Policy), 2015. Adding value in the South African maize value chain. file:///C:/Users/27824/Downloads/ADDING%20VALUE%20IN%20THE%20SOUTH%20AFRICAN_%20MAIZE%20VALUE%20CHAIN%2013%20April%202017.pdf. 28/07/2021, 13:20.

BioNet-Eafrinet, 2011. Achyranthes aspera (Devil's Horsewhip). https://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Achyranthes_aspera_(Devils_Horsewhip).htm#:~:text=aspera%20can%20be%20controlled%20by,herbicide%2Dresistance%20has%20been%20documented. 26/05/2022, 11:13

Bucas, K. 2006. Natural and anthropogenic influences on the water quality of the Orange River, South Africa. University of Johannesburg. https://core.ac.uk/download/pdf/54186428.pdf. 20/05/2021, 14:26.

CABI, 2022. Invasive Species Compendium, Boerhavia Diffusa (Red Spiderling). https://www.cabi.org/isc/datasheet/9460. 26/05/2022, 11:33

Chauhan, M.S, Yadav, J.P.S., and & Gangopadhyay,S. (2008). Chemical control of soilborne fungal pathogen complex of seedling cotton, Tropical Pest Management, 34:2, 159-161.

Coale, M. J. 2017. The economic benefits of the South African Agricultural Research Council's wheat breeding program: 1992-2015. University of Arkansas, Fayetteville. ScholarWorks@UARK 12-2017. https://scholarworks.uark.edu/cgi/viewcontent.cgi?article=4149&context=etd. 05/08/20201, 13:51.

DA (Department of Agriculture) South Africa, 2000. Cultivating Pecon nuts. https://www.nda.agric.za/docs/pecan/pecan.htm. 30/03/2022, 10:42.

DAFF (Department of Agriculture, Forestry and Fisheries) South Africa, 2012. Production Guideline for grapes. https://www.nda.agric.za/docs/brochures/grapesprod.pdf. 30/03/2022, 09:58.

DAFF (Department of Agriculture, Forestry and Fisheries) South Africa, 2016. Production Guideline for wheat. https://www.dalrrd.gov.za/Portals/0/Brochures%20and%20Production%20guidelines/Wheat%20-%20Production%20Guideline.pdf. 05/08/2021, 13:17

DAFF (Department of Agriculture, Forestry and Fisheries). 2017. A Profile of the South African maize market value chain. https://www.nda.agric.za/doaDev/sideMenu/Marketing/Annual%20Publications/Commodity%20Profiles/field%20crops/Maize%20Market%20Value%20Chain%20Profile%202017.pdf. 21/07/2021, 13:55

Dimela Eco Consulting (2022) Proposed clearing of indigenous vegetation on the farm, Zwem Kuil 37, north-east of Prieska, Northern Cape Province, Terrestrial Vegetation Compliance Report and Habitat Assessment.

Devi, P.A., Paramasivarn, M., Prakasam, V. (2015). Degradation pattern and risk assessment of carbendazim and mancozeb in mango fruits. Environ Monit Assess 187: 1-6.

Dugmore, H. 2011. Pecan nut profits. https://www.farmersweekly.co.za/uncategorized/pecan-nut-profits/#:~:text=Take%20one%20mature%20pecan%20nut,start%20flowing%2C%20writes%20Heather%20Dugmore, 29/03/2022, 09:44.

Du Plessis, J., 2003. Maize production. Compiled by Directorate Agriculture Information Services Department of Agriculture in cooperation with ARC-Grain Crops Institute. https://www.arc.agric.za/arc-gci/Fact%20Sheets%20Library/Maize%20Production.pdf. 22/07/2021.

Ellis, M.A. Controlling grape black rot in home fruit plantings.https://ohiograpeweb.cfaes.ohio-state.edu/sites/grapeweb/files/imce/Controlling%20Grape%20Black%20Rot%20in%20Home%20Fruit%20Plantings.pdf. 26/05/2022, 15:32

Gale, J. 2020. *South African raisin industry gears up for growth.* https://raisinsa.co.za/south-african-raisin-industry-gears-up-for-growth/, 2021/01/28, 13:31.

Global Africa Network, 2020. Agri-Processing an ideal vehicle to drive economic growth in the Northern Cape. https://www.globalafricanetwork.com/company-news/agri-processing-drives-economic-growth-in-northern-cape-province/, 29/03/2022, 09:15.

Grain SA, 2016. Practical crop rotation principles. https://www.grainsa.co.za/practical-crop-rotation-principles. 28/07/2021, 11:01.

Hagen, L., 2022. How to get rid of powdery milde. https://www.gardendesign.com/how-to/powdery-mildew.html#:~:text=Powdery%20mildew%20fungicide%3A%20Use%20sulfur,and%20new%20growth%20will%20emerge. 26/05/2022, 14:35

Hayes, B. 2022. Bacterial leaf spot: How to identify and control this deadly plant disease. https://morningchores.com/bacterial-leaf-spot/. 26/05/2022, 15:06

Heusch B. 1988. Terrior management: erosion control techniques (*Aménagement de terroir: techniques de lutte contre l'érosion).* CNEARC Montpellier, 199 p.

Hilton-Taylor, C. 2000. The IUCN red list of threatened species. IUCN, Gland, Switzerland and Cambridge, United Kingdom.

Huynh, H.T., Hufnagel, J., Wurbs, A., Bellingrath-Kimura, S.D., 2019. Influences of soil tillage, irrigation and crop rotation on maize biomass yield in a 9-year field study in Müncheberg, Germany, Field Crops Research, Volume 241, 107565, ISSN 0378-4290.

Ivens, G.W. 1967. East Africa Weeds and their control. Nairobi, Kenya: Oxford University Press.

Lyddon, C., 2021. Focus on South Africa. https://www.world-grain.com/articles/15331-focus-on-south-africa. 05/08/2021, 14:12

Masayuki, S., Taku, K., and Clinton, F.D. 2020. Direct and indirect effects of noise pollution alter biological communicates in and near noise-exposed environments. *Proc. R. Soc. B.* **287:** 20200176. https://royalsocietypublishing.org/doi/10.1098/rspb.2020.0176. 21-05-2021, 10:45

Meissner, H.H. & Scholtz, Michiel & Palmer, Anthony. (2013). Sustainability of the South African Livestock Sector towards 2050 Part 1: Worth and impact of the sector. South African Journal Of Animal Science. 43. 10.4314/sajas.v43i3.5.

Missouri Botanical Garden. Downy Mildew of Grapes. https://www.missouribotanicalgarden.org/gardens-gardening/your-garden/help-for-the-home-gardener/advice-tips-resources/pests-and-problems/diseases/downy-mildew/downy-mildew-of-grapes.aspx. 26/05/2022, 14:43

Mogala, M., 2017. A profile of the South African maize market value chain. Department of Agriculture, Forestry and Fisheries.
https://www.nda.agric.za/doaDev/sideMenu/Marketing/Annual%20Publications/Commodity%20Profiles/field%20crops/Maize%20Market%20Value%20Chain%20Profile%202017.pdf. 28/07/20201, 13:32.

Mucina, L. and Rutherford, M.C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

Naguib, Marc. (2013). Living in a noisy world: Indirect effects of noise on animal communication. Behaviour. 150. 1-16. 10.1163/1568539X-00003058.

Norcal Ag Service, 2019. *Protect your grapes: how minimizing dust can impact yield.* https://norcalagservice.com/dust-and-vineyards/. 2021/09/30, 13:12.

Paleo Field Services, 2022. Phase 1 Heritage Impact Assessment for establishment of new agricultural pivots on the farm Zwemkuil 37, Prieska, NC Province.

Quinn, Laura & Vos, J. & Fernandes-Whaley, Maria & Roos, Claudine & Bouwman, Hindrik & Kylin, Henrik & Pieters, Rialet & Van den Berg, Johnnie. (2011). Pesticide Use in South Africa: One of the Largest Importers of Pesticides in Africa. 10.5772/16995.

Roose, E., 1996. Land husbandry – components and strategy. *Food and agriculture organization of the United Nations.*
http://www.fao.org/3/t1765e/t1765e0t.htm#:~:text=Loamy%20sand%2C%20rich%20in%20particles,vulnerable%20soil%20(Bagnold%201937).&text=Coarse%20sand%20and%20gravelly%20or,erosion%20is%20about%2080%20microns. 2021/09/29, 15:13.

Shaw, J., Jenkins, A., Allan, D., & Ryan, P. (2016). Population size and trends of Ludwig's Bustard *Neotis ludwigii* and other large terrestrial birds in the Karoo, South Africa. *Bird Conservation International, 26*(1), 69-86. Doi:10.1017/S0959270914000458.

Sharma, K.K. (2007). Pesticide residue analysis manual. Directorate of Information and Publications of Agriculture. Indian Council of Agricultural Research, New Delhi.

Seminis, 2020. Importance of crop rotation. Agronomic Spotlight. https://www.seminis-us.com/resources/agronomic-spotlights/importance-of-crop-rotation/. 27/07/2021, 14:18

Singh, Simranjeet & Singh, Nasib & Kumar, Vijay & Datta, Shivika & Wani, Abdul & Singh, Damnita & Singh, Karan & Singh, Joginder. (2016). Toxicity, monitoring and biodegradation of the fungicide carbendazim. Environmental Chemistry Letters. 14. 10.1007/s10311-016-0566-2.

Smithers, R.H.N. 1986. South African Red Data Book – Terrestrial Mammals. South African National Scientific Programmes Report No. 125.

STATS SA, 2016. http://www.statssa.gov.za/?p=9922. 05/08/2021, 14:06.

STATS SA, 2020. Census of commercial agricultura CoCA2017. Fact sheets Version 2. http://www.statssa.gov.za/publications/Report-11-02-01/CoCA%202017%20Fact%20Sheets.pdf. 30/07/2021, 10:43.

Urska, 2019. *Five tips to optimize spraying in vineyard.* https://www.evineyardapp.com/blog/2019/03/06/5-tips-to-optimize-spraying-in-vineyard/ 2021/09/30, 14:40.

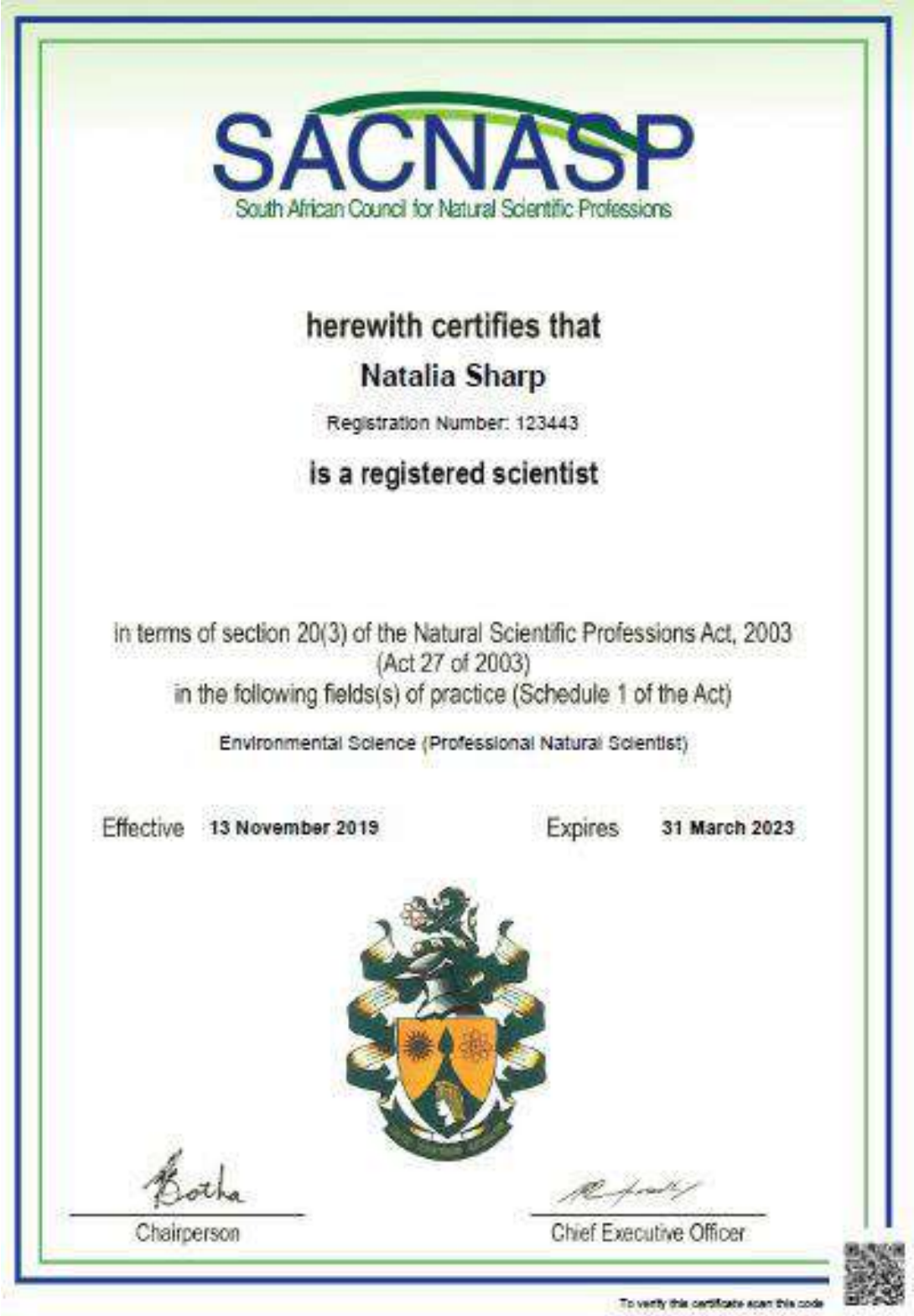
Visser, L., 2017. *Quality of two veld types in the Northern Cape as quantified in grazing sheep*. Department of Animal and Wildlife Sciences, University of Pretoria. https://repository.up.ac.za/bitstream/handle/2263/60868/Visser_Quality_2017.pdf?isAllowed=y&sequence=1. 1/10/2021, 09:14.

Voster, F., (2015). The adverse effects of over-irrigation. *ARC-Institute for Agricultural Engineering*. https://www.arc.agric.za/arc-iae/News%20Articles%20Library/The%20adverse%20effects%20of%20over-irrigation.pdf. 2021/09/29, 10:37

Vromans, D.C., Maree, K.S., Holness, S.D., Job, N. and Brown, A.E. (2010). The Garden Route Biodiversity Sector Plan for the George, Knysna and Bitou Municipalities. South African National Parks. Knysna.

Young, J., 2017. A regional overview of the Northern Cape. https://www.globalafricanetwork.com/company-news/a-regional-overview-of-the-northern-cape/. 28/07/2021, 13:44.

APPENDIX A – EAP QUALIFICATION



SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Natalia Sharp

Registration Number: 123443

is a registered scientist

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

Environmental Science (Professional Natural Scientist)

Effective **13 November 2019** Expires **31 March 2023**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

1 Kemsley Street
Gqeberha
6001

Environmental Assessment Practitioners Association of South Africa

Registration No. 2020/230

Herewith certifies that

Natalia Sharp

is registered as an

Environmental Assessment Practitioner

Registered in accordance with the prescribed criteria of Regulation 15. (1) of the Section 24H Registration Authority Regulations (Regulation No. 849, Gazette No. 40154 of 22 July 2016, of the National Environmental Management Act (NEMA), Act No. 107 of 1998, as amended).

Effective: 01 March 2022

Expires: 28 February 2023

Chairperson

Registrar

SAQA

natalie@dsafrica.co.za

1 Kemsley Street
Gqeberha
6001

DIE UNIVERSITEIT VAN DIE ORANJE-VRYSTAAT

THE UNIVERSITY OF THE ORANGE FREE STATE

HIERMEE WORD VERKLAAR DAT DIE GRAAD THIS IS TO CERTIFY THAT THE DEGREE

Baccalaureus Scientiae
Bachelor of Science

TOEGEKEN IS AAN
HAS BEEN CONFERRED UPON

NATALIA POTGIETER

NADAT AAN DIE STATUTE EN REGULASIES VAN DIE UNIVERSITEIT VOLDOEN IS. AS BEWYS DAARVAN PLAAS ONS ONDERSKEIE HANDTEKENINGE EN DIE SEËL VAN DIE UNIVERSITEIT HIERONDER.

IN ACCORDANCE WITH THE STATUTES AND REGULATIONS OF THE UNIVERSITY. AS WITNESS OUR RESPECTIVE SIGNATURES AND THE SEAL OF THE UNIVERSITY BELOW.

WAARNEMEND VICE-CHANCELLOR

DEKAAN/DEAN

BLOEMFONTEIN
2019-03-16

REGISTRATEUR/REGISTRAR

12/4/2019

www.dsafrica.co.za natalie@dsafrica.co.za

1 Kemsley Street
Gqeberha
6001

UNIVERSITEIT VAN DIE VRYSTAAT

UNIVERSITY OF THE FREE STATE

HIERMEE WORD VERKLAAR DAT DIE GRAAD THIS IS TO CERTIFY THAT THE DEGREE

Honneursbaccalaureus Scientiae

in LIMNOLOGIE
in LIMNOLOGY

TOEGEKEN IS AAN
HAS BEEN CONFERRED UPON

NATALIA POTGIETER

NADAT AAN DIE STATUTE EN REGULASIES VAN DIE UNIVERSITEIT VOLDOEN IS. AS BEWYS DAARVAN PLAAS ONS ONS ONDERSKEIE HANDTEKENINGE EN DIE SEEL VAN DIE UNIVERSITEIT HIERONDER.

IN ACCORDANCE WITH THE STATUTES AND REGULATIONS OF THE UNIVERSITY, AS WITNESS OUR RESPECTIVE SIGNATURES AND THE SEAL OF THE UNIVERSITY BELOW.

VISEKANSELIER/VICE-CHANCELLOR

DEKAAN/DEAN

REGISTRATEUR/REGISTRAR

10/4/2019

UNIVERSITEIT VAN DIE VRYSTAAT

UNIVERSITY OF THE FREE STATE

HIERMEE WORD VERKLAAR DAT DIE THIS IS TO CERTIFY THAT THE

Magister in Omgewingsbestuur
Magister in Environmental Management

TOEGEKEN IS AAN
HAS BEEN CONFERRED UPON

NATALIA POTGIETER

NADAT AAN DIE STATUTE EN REGULASIES VAN DIE UNIVERSITEIT VOLDOEN IS, AS BEWYS DAARVAN PLAAS ONS ONS ONDERSKEIE HANDTEKENINGE EN DIE SEËL VAN DIE UNIVERSITEIT HIERONDER.

IN ACCORDANCE WITH THE STATUTES AND REGULATIONS OF THE UNIVERSITY, AS WITNESS OUR RESPECTIVE SIGNATURES AND THE SEAL OF THE UNIVERSITY BELOW.

VICE-CHANCELLOR

DEAN

100+ UV-UFS 1904 - 2004

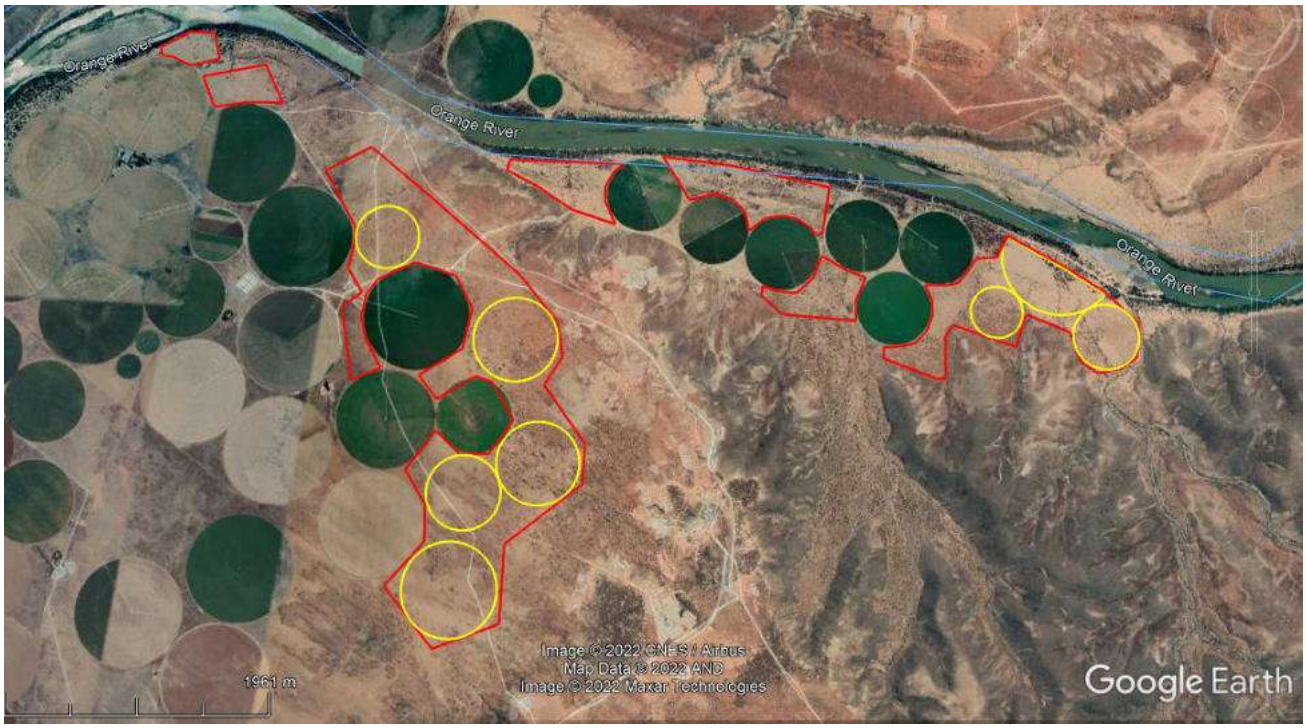
REGISTRAR/REGISTRAR

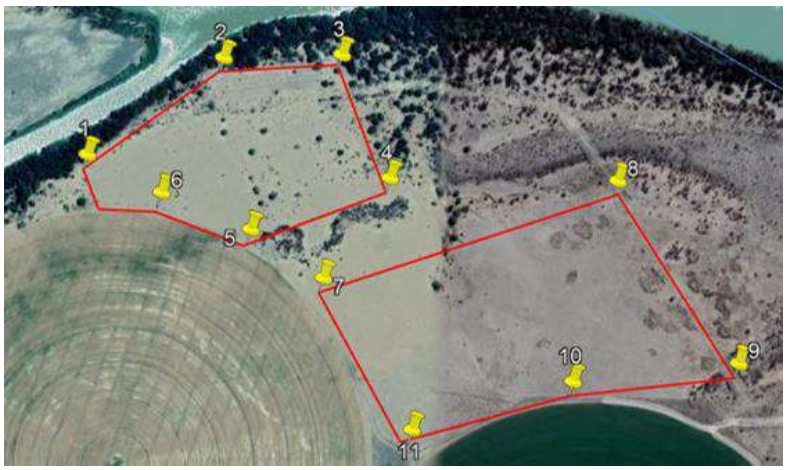
REGISTRATION
2004 06 22
9900015014

12/4/2019

1 Kemsley Street
Gqeberha
6001

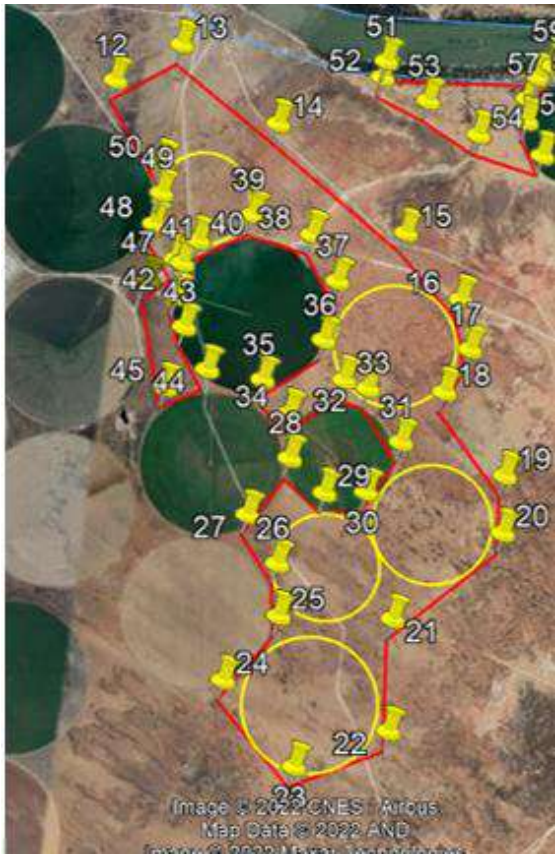
APPENDIX B – SITE PLAN





UPPER WESTERN SECTION OF THE APPLICATION AREA

1 Kemsley Street
Gqeberha
6001



SOUTHERN SECTION OF THE APPLICATION AREA

THE UPPER EASTERN SECTION OF THE APPLICATION AREA

www.dsafrica.co.za natalie@dsafrica.co.za

1 Kemsley Street
Gqeberha
6001

Coordinates of the site

ID	X	Y
1	23,0188511	-29,4183826
2	23,02107203	-29,41698806
3	23,023008	-29,41693026
4	23,0238151	-29,4186782
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19	23,05779684	-29,44230255
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21	23,05269207	-29,44969954
22	23,05320463	-29,45497763
23	23,04837075	-29,45719545
24	23,04397192	-29,4535656
25	23,04652111	-29,45023248

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1 Kemsley Street
Gqeberha
6001

26	23,04608951	-29,4477739
27	23,04416598	-29,44564468
28	23,0460454	-29,442733
29	23,04817005	-29,44416395
30	23,05040742	-29,44387699
31	23,05195668	-29,44131314
32	23,04980022	-29,43897009
33	23,04846558	-29,43871028
34	23,04572963	-29,44061784
35	23,04404326	-29,43917027
36	23,04709123	-29,43692866
37	23,04742555	-29,43404484
38	23,04573718	-29,43198822
39	23,04238164	-29,4313787
40	23,03958325	-29,43292979
41	23,03888251	-29,43409694
42	23,03877631	-29,43572442
43	23,03941569	-29,43712754
44	23,04096472	-29,43901595
45	23,03881228	-29,44012132
46	23,03713739	-29,43514574
47	23,03847655	-29,43396357
48	23,03706923	-29,43240879
49	23,03725679	-29,43087452
50	23,03709746	-29,42946973
51	23,0485961	-29,42322482
52	23,0484927	-29,42401745

natalie@dsafrica.co.za

1 Kemsley Street
Gqeberha
6001

53	23,05113685	-29,42488054
54	23,05409839	-29,42622797
55	23,05772161	-29,42684012
56	23,0566245	-29,4252894
57	23,05654147	-29,42419779
58	23,05702169	-29,42311914
59	23,0577081	-29,42247155
60	23,06081067	-29,42158014
61	23,06339732	-29,42439669
62	23,06533005	-29,4237611
63	23,06683045	-29,42396269
64	23,06790607	-29,42475272
65	23,06841636	-29,4260655
66	23,06961088	-29,42501833
67	23,07094439	-29,42469365
68	23,07212913	-29,42471669
69	23,0732708	-29,42522919
70	23,07382277	-29,42576495
71	23,07428322	-29,42546174
72	23,07442625	-29,42220614
73	23,06634111	-29,42153865
74	23,0744466	-29,4271512
75	23,07397644	-29,42879315
76	23,07274981	-29,42993894
77	23,07128608	-29,43005282
78	23,07004215	-29,42982835
79	23,07007288	-29,43050023

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80	23,07189618	-29,43161583
81	23,07763382	-29,43130943
82	23,07756528	-29,42989562
83	23,07798395	-29,42875823
84	23,07810474	-29,42823952
85	23,0766498	-29,4279444
86	23,082841	-29,42822114
87	23,08343604	-29,42918666
88	23,08367102	-29,43023833
89	23,08341081	-29,4313691
90	23,08256566	-29,43237217
91	23,08135959	-29,43273999
92	23,08010185	-29,43294266
93	23,08018848	-29,43371704
94	23,0846089	-29,43460733
95	23,08523093	-29,43446838
96	23,08488143	-29,43147618
97	23,08542382	-29,43073689
98	23,09049959	-29,43173152
99	23,09097896	-29,42936685
100	23,09457671	-29,43016694
101	23,09571792	-29,4320947
102	23,0970641	-29,43276357
103	23,09885575	-29,43222233
104	23,10004696	-29,43135752
105	23,10010893	-29,43007691
106	23,09989903	-29,42891241

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107	23,0982619	-29,42780587
108	23,09698297	-29,42712442
109	23,09365908	-29,42572302
110	23,08897185	-29,42400644
111	23,08821608	-29,42565467
112	23,086589	-29,4259346
113	23,08604932	-29,4269654
114	23,08540359	-29,42779775
115	23,08466033	-29,42804102

Total area under application: 504.7 Ha
Area expected to be cleared: 406 Ha
Area set aside for offset: 98.7 Ha

List of SGID of the properties under application:

C060 00000 0000037 00000

C060 00000 0000037 00002

C060 00000 0000038 00000

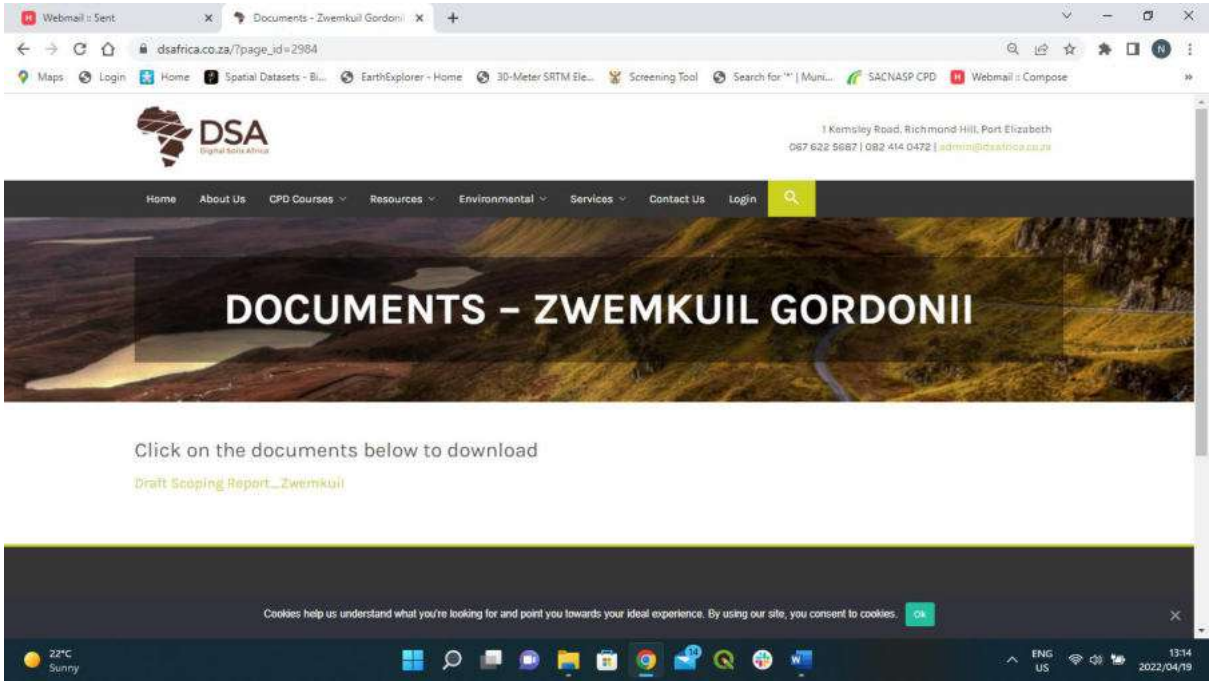
A Notice Board were erected along the proposed boundary next to the gravel road in accordance with NEMA Regulations. Below is an aerial photo indicating the location of placing the board. The red polygon represents the study area under application, while the yellow drop pins represent the location of the board.

FIGURE 42: LOCATION OF THE NOTICE BOARD

Response for potential I&AP's was requested to be submitted by 18 May 2022 and those who registered/commented will be recorded in the I&AP registry.

FIGURE 43: NOTICE BOARD PLACED ALONG THE GRAVEL ROAD

Proof that the document was placed on DSA website.



Public Participation advert placement in the Oewer Newspaper in accordance with the NEMA Regulations, on 15 April 2022, time to register is given until 18 May 2022.

No response was received due to the placement of the advertisement.

Kareeberg Munisipaliteit

42/2022

KWOTASIE: PLASTIESE VULLISSAKKE

Skriftelike, getekende kwotasies word hiermee ingewag vir die verskaffing en aflewering v.o.s. Carnarvon van **90 000 by 40 mikron swart plastiese sakke (750mm x 950mm)**, verpak in hoeveelhede van ses-en-twintig per pak met die nodige sakbinders. Kwoteerders se aandag word daarop gevestig dat aflewering van die helfte by die toekenning van die kwotasie moet geskied en die balans drie maande later.

Kwoteerders moet hulle belastingnakomingsstatus PIN verstrek. Die unieke MAAA nommer moet ook op die Kwotasie verstrek word. Kwotasies sal verwerp word indien die voorgeskrewe verklaring van belange vorm (MBD 4) nie aangeheg is nie, sowel as die MBD 1. Die ingevulde vorms MBD 6.1, MBD 8 en MBD 9 moet ook aangeheg wees met bewyse dat geen gelde aan 'n munisipaliteit verskuldig is nie, ten opsigte van dienste en eiendomsbelasting. Die BBEE vrystelling verklaring moet oorspronklik beëdig wees. In geval van 'n maatskappy moet die direkteure se rekenings aangeheg word. Die 80/20 puntestelsel is van toepassing. Let wel dat alle vorms wat benodig word op die webtuiste, www.kareeberg.co.za beskikbaar is.

Verseëlde kwotasies gemerk **"KWOTASIE: PLASTIESE VULLISSAKKE"** moet die ondergetekende voor of op **Vrydag, 29 April 2022** om **12:00** bereik, waarna dit in die openbaar oopgemaak sal word. Kwoteerders moet die geldigheidsduur van die kwotasie aandui.

Die Munisipaliteit verbind hom nie om die laagste of enige kwotasie te aanvaar nie, en behou die reg voor om enige kwotasie as geheel of gedeeltelik te aanvaar.

Mnr. A.P.F. van Schalkwyk
Waarnemende
Munisipale Bestuurder
Tel. 053 382 3012

Posbus 10
Carnarvon 8925
14 April 2022

LANGSTE BRUG

REISIGERS tussen die kontinente Europa en Asië sal dit nou binne ses minute kan doen wanneer hulle met die pas voltooide Canakkale brug reis. Die president van Turkye het die brug amptelik geopen op Vrydag 18 Maart 2022.

Neef Gert se Sêgoed

As jou inkomste pad af is, het jou uitgawes die spoor byster geraak.

BRUG VAN BYNA VYF KILOMETER

Europa tot Asië binne 6 minute

KAAPSTAD – In 'n seremonie bygewoon deur die president van Turkye Vrydag 18 Maart 2022 is die Canakkale brug amptelik geopen agtien maande voor skedule.

Dit is die wêreld se langste hangbrug en die hoogste toring suspensie brug.

Die Turkse Ministerie van Infrastruktuur en Vervoer het die konstruksie van die brug gefinansier saam met ander vennote.

Die brug maak die verbinding tussen Europa en Asië moontlik in ses minute deur die Canakkale seestraat. Dit voorsien ook 'n alternatiewe roete vir die Istanbul Seestraat oorgang. Dit sorg vir vinniger en goedkoper vervoer van vrag, en versterk die ekonomiese, politieke en toerisme bande van die streek.

Die totale lengte van die brug is 4 608 meter, met 'n sentrale oorspanning van 2 023 meter en 'n totale hoogte van 318 meter. Dit maak van die brug die langste middel oorspanningsbrug en hoogste toring suspensie brug in die wêreld.

Die brug verbind Gelibolu aan die Europese kant met Lapseki aan die Asiatiese kant. Dit word Canakkale genoem ter ere van en in herinnering van die Canakkale Geveg gedurende die Eerste Wêreldoorlog tussen Turkye en die Geallieerde magte.

25 Jaar gelede

MESSENGER: 4 Julie 1997. Op 1 Junie 1997 het Hutchinson SAPD opgehou om te funksioneer soos van ouds. Na deeglike ondersoek is bevind dat dit onprakties en finansieel nie lonend is om Hutchinson verder as 'n aparte polisiestasie te laat voortbestaan nie. Die administrasie van die stasie word nou in geheel vanaf Victoria-Wes behartig.

JVZ CONSTRUCTION
quality civil construction services

Hantam Munisipaliteit (CALVINIA)

Gemeenskap Skakelbeampte

Konstruksie van Calvinia Oos Rioolpompstasie

- ★ Werwer: **JVZ Konstruksie**
- ★ Ligging: **Calvinia, Hantam Munisipaliteit, Noord-Kaap**
- ★ Salaris: **Onderhandelbaar**
- ★ Betrekking Tipe: **Vastetermyn Kontrak**
- ★ Regstellende Aksiegeleentheid: **Ja**
- ★ Byvoordele: **Nie ingesluit nie**

Die Hantam Munisipaliteit het 'n vakature vir 'n Gemeenskap Skakelbeampte te Calvinia. Die kandidaat sal aangestel word op 'n voltydse vastetermyn kontrak vir die duurte van die projek. Persone wat voldoen aan die vereistes hieronder, en 'n gerespekteerde inwoner is in die Calvinia gemeenskap, word hiermee uitgenooi om aansoek te doen.

DOEL VAN DIE POS:

Die primêre doelwit van hierdie pos is om te verseker dat die plaaslike gemeenskap maksimum voordeel trek uit hierdie konstruksiekontrak deur toegang na plaaslike arbeid (vaardige, gedeeltelik vaardig en onvaardige arbeid). Die GSB sal dien as skakelbeampte vir die kontrakteur om te verseker dat inligting na die gemeenskap en ander belanghebbendes vloei.

VEREISTES:

- ★ Grade 12 Sertifikaat en basiese rekenaar vaardighede sal as aanbeveling dien
- ★ Moet beskik oor uitstekende kommunikasie vaardighede
- ★ Moet betroubaar en verantwoordelik wees
- ★ Moet bekend wees met die Calvinia omgewing en omliggende gebiede
- ★ **MOET 'N PERMANENT INWONER VAN CALVINIA WEES**
- ★ Moet tans werkloos wees
- ★ Bereid wees om soms onder moeilike omstandighede sy pligte uit te voer
- ★ Vaardighede in die hantering van konflik situasies
- ★ Moet basies kennis van konstruksie hê, en in staat wees om met die kontrakteur te kommunikeer
- ★ Mag nie self 'n kontrakteur wees nie
- ★ Bereid wees om van tyd tot tyd lang en ongereelde ure te werk indien die omstandighede dit vereis

PLIGTE:

- ★ Skakeling tussen die gemeenskap en die kontrakteur.
- ★ Verantwoordelik om op te tree as skakel tussen die kontrakteur en plaaslike arbeidsbronne
- ★ Maak gebruik van die munisipale databasis van plaaslike arbeidsbronne.
- ★ Verantwoordelik om die kontrakteur op hoogte te hou van gemeenskapsake en moontlike dinamika.
- ★ Bystand aan die kontrakteur se toesighoudende personeel met die bestuur van plaaslike arbeiders.
- ★ Rapporteer maandeliks aan die gemeenskap strukture aangaande plaaslike betrokkenheid, indiensneming, opleiding en diensbillikheid status van werknemers.
- ★ Uitvoering van basiese administratiewe take verwant aan die indiensneming van plaaslike arbeid.

NOTA: Slegs bewese inwoners van Calvinia sal in ag geneem word vir hierdie aanstelling en aansoekers moet kan bewys lewer van hulle vaste woonadres. Belangstellende persone word versoek om 'n aansoekvorm by die plaaslike munisipale kantoor te voltooi en dit, tesame met 'n CV, afskrif van hulle ID dokument en bestuurders lisensie in te dien voor of op 12:00 Donderdag 21 April 2022. Aanstelling van die suksesvolle kandidaat sal gedoen word ongeveer een week na sluiting.

DIE MUNISIPALE BESTUURDER
HANTAM MUNISIPALITEIT
T: 027 341 8500

NELSON MANDELA RYLAAN
CALVINIA 8190

NOTICE OF AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE CLEARING OF VEGETATION ON 504,7 HA ON PORTION 2 & REMAINDER OF FARM ZWEM KUIL NO. 37 AND REMAINDER OF FARM SMITSKLOOF NO. 38, PRIESKA

Notice is hereby given in terms of Section 41 of the Schedule published in GNR 326, of the NEMA Regulations (2014 as amended in April 2017) of the intent to submit a Scoping Report and Environmental Impact Assessment to undertake the following:

Location:

Ptn 2 & Remainder of Farm ZwemKuil No. 37 & Remainder of Farm Smitskloof No. 38, Prieska, Northern Cape (29° 26' 05.43"S; 23° 03' 03.81"E)

Proponent:

ZwemkuilGordonii CC

Activities:

1. GNR 325: 7 April 2017, Activity (15): The clearance of an area of 20Ha or more of indigenous vegetation.
2. GNR 324: 7 April 2017, Activity (12) g.ii.: The clearance of an area of 300m² or more indigenous vegetation in the Northern Cape within a critically biodiversity area identified in bioregional plans.

If you consider yourself an interested and/or affected person/party, it is important that you register and comment in writing to Digital Soils Africa before or on **18 May 2022**. Should you require further information or access to environmental documentation, please contact the office before the said date.

Please send your enquiries and/or comments to:

Digital Soils Africa
1 Kemsley Street
Port Elizabeth 6001
Tel: 067 622 5687
Email: natalie@dsafrica.co.za

Date of Notice:

14 April 2022

NAMAKWA DISTRIKSMUNISIPALITEIT

KENNISGEWING NR. 06/2022

KONSEP 2022-2027 GEÏNTEGREERDE ONTWIKKELINGSPLAN (GOP) KONSEP 2022/2023 BEGROTING

Kennis geskied hiermee ingevolge Regulasie 3 (4)(b) van die Plaaslike Regering: Munisipale Beplanning- en Prestasiebestuursregulasies, 2001, Artikel 21 van die Plaaslike Regering: Munisipale Stelselswet, 2000 (Wet 32 van 2000) en Artikel 22 van die Wet op Plaaslike Regering: Munisipale Finansiële Bestuur, 2003 (Wet 56 van 2003) dat die Konsep 2022-2027 GOP en die Konsep 2022/2023-begroting vir die Namakwa Distriksmunisipaliteit beskikbaar is vir die publiek se vertoë en kommentaar.

Die Konsep 2022-2027 GOP en Konsep 2022/2023 begroting is verkrygbaar op die webtuiste, www.namakwa-dm.gov.za en lê ook ter insae by die Munisipale Kantore van die Namakwa Distriksmunisipaliteit te:

> Springbok, Van Riebeeckstraat
> Calvinia, Stiglingstraat

Skriftelike kommentaar of vertoë oor die Konsep 2022-2027 GOP en die Konsep 2022/2023-begroting moet die Kantoor van die Munisipale Bestuurder vóór of om 12:00 op Vrydag, 13 Mei 2022 bereik.

Navrae kan gerig word aan: Namakwa Distriksmunisipaliteit, Privaatsak X20, Springbok, 8240 of tel. 027 712 8000 of faks 027 712 8040, of per e-pos na info@namakwa-dm.gov.za

C J FORTUIN, MUNISIPALE BESTUURDER

Acknowledge of Draft and Final Scoping Report received for public participation review and processing from the Department of Agriculture, Environmental Affairs, Rural Development, and Land Reform:

agriculture, environmental affairs,
rural development and land reform

Department:
agriculture, environmental affairs,
rural development and land reform .
NORTHERN CAPE PROVINCE
REPUBLIC OF SOUTH AFRICA

SASKO Building
90 Long Street
Private Bag X6102
Kimberley
8300

Tel. 053-8077300
Fax: 053-8077328

Enquiries : T Mthombeni
Dipatlisiso :
Imibuzo :
Navrae :

Reference : NC/EIA/03/PIX/SIY/PRI1/2022
Tshupelo :
Isalathiso :
Verwysing :

Date : 27th April 2022
Leshupelo :
Umhla :
Datum :

Ms. Natalie Sharp
DIGITAL SOILS AFRICA (PTY) LTD
1 Kemsley Street
PORT ELIZABETH
6001

Email: natalie@dsafrica.co.za

Dear Sir/Madam

APPLICATION FOR ENVIRONMENTAL AUTHORISATION: THE CLEARING OF VEGETATIION FOR THE ESTABLISHEMENT OF CROP ON PORTION 2 AND THE REMAINDER OF FARM ZWEM KULI NO 37 AND THE REMAINDER OF FARM SMITSKLOOF NO 38, IN PRIESKA: SIYATHEMBA LOCAL MUNCIPALITY, PIXLEY KA SEME DISTRICT MUNICIPALITY.

The Department confirms having receipted the **draft scoping report** for the abovementioned project as required in terms of the Environmental Impact Assessment Regulations, 2014 as amended.

The reference number for this project is: NC/EIA/03/PIX/SIY/PRI1/2022. Kindly quote this reference number in any future correspondence in respect of the application.

Please draw the applicant's attention to the fact that the activity may not commence prior to an environmental authorization being granted by the Department.

Kindly note the responsible officer for this project is **Mr. T Mthombeni** and can be contacted at this numbers, Cell: **053 8077300**.

Regards

G. Letimela
Senior Administration Clerk

agriculture, environmental affairs,
rural development and land reform

Department:
agriculture, environmental affairs,
rural development and land reform.
NORTHERN CAPE PROVINCE
REPUBLIC OF SOUTH AFRICA

SASKO Building
90 Long Street
Private Bag X6102
Kimberley
8300

Tel. 053-8077300
Fax: 053-8077328

Enquiries : T Mthombeni
Dipatlisiso :
Imibuzo :
Navrae :

Reference : NC/EIA/03/PIX/SIY/PRI1/2022
Tshupelo :
Isalathiso :
Verwysing :

Date : 23th May 2022
Leshupelo :
Umhla :
Datum :

Ms. Natalie Sharp
DIGITAL SOILS AFRICA (PTY) LTD
1 Kemsley Street
PORT ELIZABETH
6001

Email: natalie@dsafrica.co.za

Dear Sir/Madam

APPLICATION FOR ENVIRONMENTAL AUTHORISATION: THE CLEARING OF VEGETATIION FOR THE ESTABLISHEMENT OF CROP ON PORTION 2 AND THE REMAINDER OF FARM ZWEM KULI NO 37 AND THE REMAINDER OF FARM SMITSKLOOF NO 38, IN PRIESKA: SIYATHEMBA LOCAL MUNCIPALITY, PIXLEY KA SEME DISTRICT MUNICIPALITY.

The Department confirms having receipted the **final scoping report** for the abovementioned project on the 20th May 2022 as required in terms of the Environmental Impact Assessment Regulations, 2014 as amended.

The reference number for this project is: NC/EIA/03/PIX/SIY/PRI1/2022. Kindly quote this reference number in any future correspondence in respect of the application.

Please draw the applicant's attention to the fact that the activity may not commence prior to an environmental authorization being granted by the Department.

Kindly note the responsible officer for this project is **Mr. T Mthombeni** and can be contacted at this numbers, Cell: **053 8077300**.

Regards

G. Letimela
Senior Administration Clerk

1 Kemsley Street
Gqeberha
6001

Consultation letter sent to DWS and Department of Agriculture, Environmental Affairs, Rural Development and Land Reform during the Scoping Phase

www.dsafrica.co.za natalie@dsafrica.co.za

1 Kemsley Street
Richmond Hill
Gqeberha
6001
0824140472
natalie@dsafrica.co.za
www.dsafrica.co.za

2022-04-14

Department of Water and Sanitation
Private Bag X5912
Upington
8800
Attention: Mr. Steven Shibambu

ENVIRONMENTAL IMPACT APPLICATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, FOR THE CLEARING OF VEGETATION ON PORTION 2 AND REMAINDER OF FARM ZWEM KUIL NO. 37 AND REMAINDER OF FARM SMITSKLOOF NO. 38, PRIESKA. APPLICANT: ZWEMKUIL GORDONII CC. Scoping Public Participation Phase.

Zwemkuil Gordonii CC appointed Digital Soils Africa (Pty) Ltd (DSA) to conduct the necessary environmental impact assessment and public participation for the above-mentioned project.

In terms of Section 41 of NEMA Regulations, you have been identified as an Interested and Affected Party and are invited to participate in the public participation. All written comments will be responded to and forwarded to the relevant departments, in the form of a Public Participation Report.

This communication, therefore, serves to inform you of the intention of Zwemkuil Gordonii CC to apply for environmental authorisation and cultivation of virgin soil on 504,7 Ha to establish crops that, if approved, will be developed over the next 5 years. You have been identified as an interested and affected party (I&AP) in the project and the purpose of this letter is therefore to:

- Inform you of the locality of the proposed site.
- Allow you to raise any informed comments you might have in respect of the proposed development.
- Incorporate any written comments in the Interested & Affected Parties' Register and Scoping Report to be submitted to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in terms of Regulation 19 published in GNR 326 on 7 April 2017 under NEMA 107 of 1998.

This consultation process is important as it raises your awareness as to the nature of the proposed development and grants you the opportunity to raise any comments/observations/concerns you might have thereon and submit such in writing. Should any observation/concern be identified as a definite and significant environmental/social impact, the relevant matter will be further investigated, assessed and where necessary, mitigation measures will be developed and captured in the Final Scoping Report to satisfactorily address any identified impact.

To ensure that your detailed written comments are captured in the I&AP Register and submitted to all applicable Regulating Authorities as an integral part of the environmental assessment process, your response is required in writing **not later than 18 May 2022** no later than 5pm. This is done in accordance with GNR 326, chapter 2, Regulation 3, of the Environmental Impact Assessment Regulations (2014), as amended on 7 April 2017, of the National Environmental Management Act of 1998. Below is the link to the Scoping Report for your attention.

1 Kemsley Street
Richmond Hill
Gqeberha
6001
0824140472
natalie@dsafrica.co.za
www.dsafrica.co.za

Where we are in the process

- Please note that in an attempt to follow a more 'green friendly' approach, a hard copy of the Draft Scoping Report will not be placed in a public place as a hard copy for the public, nor would one be couriered to your Department, rather a digital copy will be made available on the DSA website.
- A digital Draft Scoping Report has been submitted for Public Participation to other Departments, the Local and District Municipalities, and I&AP's (general public).

Way Forward

1. The outcome of this consultation process will be submitted to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform as part of the Final Scoping Report.
2. Upon completion of the Scoping process, the EIA process will commence.
3. The Draft EIA & EMP document will be submitted for public review and the outcome of that consultation process will be submitted to the said Department as part of the final EIA & EMP.
4. If the said Departments decision-making process results in approval of the clearance of vegetation an Environmental Authorization will be issued and the EMP approved. All registered Interested & Affected Parties will be notified of the issue of the Environmental Authorization.
5. The approved activities would then proceed and be conducted in accordance with the approved EMP.
6. Environmental audits should be conducted and submitted to the said Department for evaluation and any appropriate decision-making.

The documents will be made available on the DSA website, www.dsafrica.co.za. Please follow the link to Services, Environmental Services, Documents and choose the Zwemkuil link. To access the loaded documents use the password: zWem@no37.

Yours sincerely

Natalie Sharp
Pri.Sci.Nat (Reg nr. 123443)
Reg. EAP (EAPASA)

1 Kemsley Street
Richmond Hill
Port Elizabeth
6001
0824140472
natalie@dsafrica.co.za
www.dsafrica.co.za

2022-04-14

Department of Agriculture, Environmental Affairs, Rural Development and Land Reform
Directorate Environmental Quality/Assessment Management
Private Bag X6102
Kimberley
8300
Attention: Ms. Dineo Moleko

SUBMISSION OF DRAF SCOPING REPORT IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, FOR THE CLEARING OF VEGETATION ON PORTION 2 AND REMAINDER OF FARM ZWEM KUIL NO. 37 AND REMAINDER OF FARM SMITSKLOOF NO. 38, PRIESKA. APPLICANT: ZWEMKUIL GORDONII CC. Scoping Public Participation Phase.

Zwemkuil Gordonii CC appointed Digital Soils Africa (Pty) Ltd (DSA) to conduct the necessary environmental impact assessment and public participation for the above-mentioned project.

Due to the very tight timeframes that NEMA provides once an application for a Scoping and EIA has been submitted, it is important to engage in Public Participation (30 days) within the 44 days timeframe. The application for the abovementioned development was submitted manually and couriered to your offices, and received by Agnus in your office on 5 April 2022, however to date, no letter of acknowledgement has been received from the Department. Numerous attempts have been made to contact Ms. Moleko and Ms. Letimela with no success. Considering the situation, please accept the draft Scoping Report for public participation.

In terms of Section 41 of NEMA Regulations, you have been identified as an Interested and Affected Party and are invited to participate in the public participation. All written comments will be responded to and forwarded to your Department, in the form of a Public Participation Report within the Final Scoping Report once the public participation has been completed for the Scoping Phase.

The purpose of this letter and attached draft Scoping Report is therefore to:

- Inform you of the locality of the proposed environmental authorization application.
- Allow you the opportunity to raise concerns or comments in respect of the proposed project detailed in the Draft Scoping Report.

Public Participation Process

If you would like to participate in the process, please submit comments in writing **on or before 18 May 2022** until 5pm. If no comments are received from you, it will then be regarded that you do not have any comments. This is done in accordance with GNR 326, chapter 2, Regulation 3, of the Environmental Impact Assessment Regulations (2014), as amended on 7 April 2017, of the National Environmental Management Act of 1998.

Attached is a hard copy of the Draft Scoping Report or alternatively, follow the link to the Scoping Report for your attention.

1 Kemsley Street
Richmond Hill
Port Elizabeth
6001
0824140472
natalie@dsafrica.co.za
www.dsafrica.co.za

Where we are in the process

- Please note that in an attempt to follow a more 'green friendly' approach, a hard copy of the Draft Scoping Report will not be placed in a public place as a hard copy for the public, rather a digital copy will be made available on the DSA website.
- A Background Information Document and link to the digital copy of the Draft Scoping Report have been submitted for Public Participation to other Departments, the Municipality (Local and District), the ward councillor, and I&AP's (general public) for the comment period.

Way Forward

- The Draft Scoping Report and required specialist reports will be subjected to review by all registered I&AP's and relative governmental departments, following the time frames as stipulated in Section 3 (1) & (8) of the NEMA regulations (30 days).
- The documents will be made available on the DSA website, www.dsafrica.co.za. Please follow the link to Services, Environmental Services, Documents, and choose the Zwemkuil link. To access the loaded document use the password: zWem@no37. In addition, a hard copy of the Draft Scoping Report was sent to the DAEARDLR via couriers.
- All comments received and responses written during the 30 days will be captured in the Public Participation Report and submitted to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Final Scoping Report.
- The Department will make the final decision and will either accept or reject the Scoping Report and proceed with the EIA.

Yours sincerely

Natalie Sharp
Pri.Sci.Nat (Reg nr. 123443)
Reg. EAP (EAPASA)

Background Information document sent to all I&AP's as identified during the Scoping Phase.

BACKGROUND INFORMATION REGARDING CLEARING OF VEGETATION ON PTN 2 & REMAINDER OF FARM ZWEM KUIL NO. 37 & REMAINDER OF FARM SMITSKLOOF NO. 38, PRIESKA

ZWEMKUIL GORDONII CC

APRIL 2022

DSA
Digital Soils Africa

+27 82 414 0472

www.dsafrica.co.za

natalie@dsafrica.co.za

1 Kemsley Street

Port Elizabeth

1 Kemsley Street
Richmond Hill
6001

PURPOSE OF THIS DOCUMENT

The purpose of this document is to provide all I&AP's with information about the intent of Zwemkuil Gordonii CC to apply for environmental authorisation and certificate for cultivation of virgin land on 504,7 Ha to establish crops on Portion 2 & Remainder of Farm Zwem Kuil No. 37 and Remainder of Farm Smitskloof No. 38, Prieska in the Northern Cape Province.
As an identified I&AP, you are invited to register and comment on any aspect related to the proposed development between the 14th of April 2022 and 18th of May 2022.

BRIEF PROJECT DESCRIPTION

The site is situated north-east of Prieska in the Northern Cape (29° 26' 05.43"S; 23° 03' 03.81"E most centre point of the site) on Portion 2 and the Remainder of Farm Zwem Kuil No. 37 and the Remainder of Farm Smitskloof No. 38, within the Siyathemba Municipal area. The farm can be reached by travelling along the R357 for about 18km onto the Muishoek road. This Muishoek road turns into a gravel road and the farm is reached about 30km straight along this gravel road, until a T-junction is reached. Zwem Kuil farm is left off the T-junction, for another 5km.

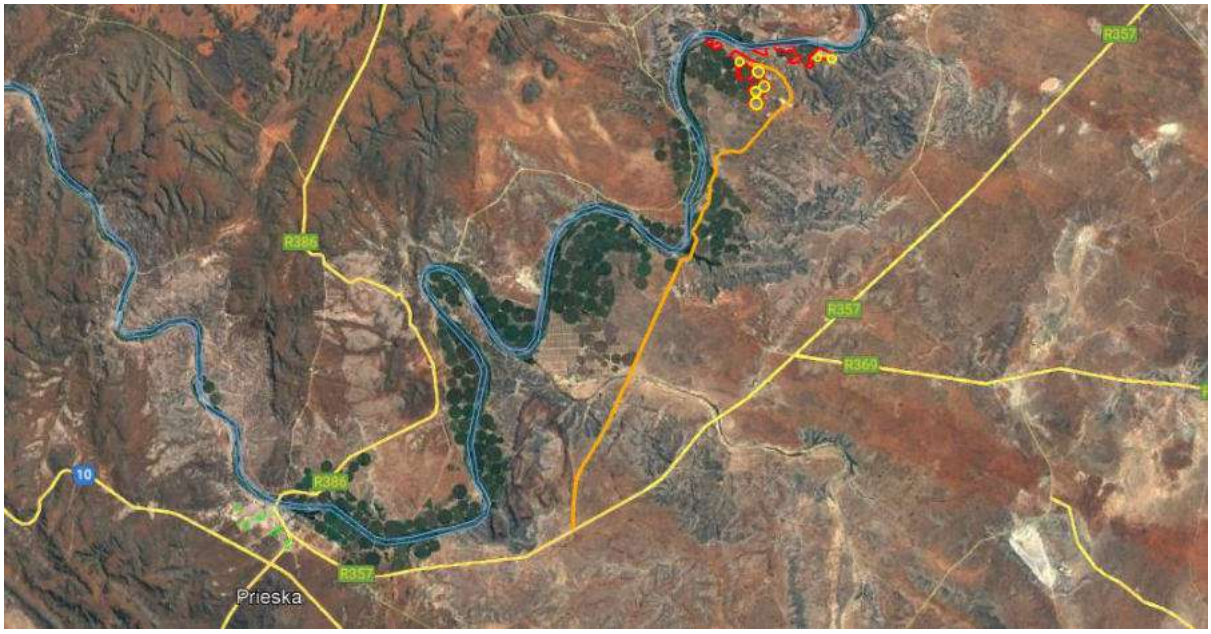


Figure 1: Site location

Digital Soils Africa (Pty) LTD (DSA) was tasked by Zwemkuil Gordonii CC to conduct environmental investigations and complete the environmental application and cultivation of virgin soil. Although 504.7 Ha are under application, only 406 Ha will potentially be cleared from vegetation to establish crops based on soil suitability. There are existing pivots on the farm and the applicant would like to establish another 6-7 pivots for maize/wheat/lucerne crops and utilise the areas between the existing pivots on the farm for either vineyard or pecan nut crops.

1 Kemsley Street
Richmond Hill
6001

NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998) AS AMENDED

Environmental Assessment

DSA was appointed by Zwemkuil Gordonii CC as the independent environmental assessment practitioner (EAP) to undertake the Environmental Application and apply for GNR 325 listed activities and the submission of a Scoping Report and Environmental Impact Assessment. According to the latest Government Notice No. 324; 325 & 327, the following Listed Activities were triggered:

GNR 325 (15): The clearance of an area of 20 hectares or more of indigenous vegetation.	*An area of 406 Ha of natural veldt used for grazing will be cleared to establish crops.*
GNR 324: (12) g.ii. The clearance of an area of 300 m^2 or more of indigenous vegetation in the Northern Cape within a critical biodiversity area identified in bioregional plans.	*Although the threshold for clearing of vegetation is covered in the GNR 325 (15) activity, the site does fall within a CBA 1 & 2 area.*

POTENTIAL ENVIRONMENTAL ISSUES

The full impact on all environmental parameters will be concluded in the EIA and EMP phases. For background information, the most important potential environmental issues that will be addressed in the assessment include, but are not limited to:

Soil Suitability:

A soil survey was conducted on the farm to determine whether the land would be suitable for the cultivation of maize/wheat/lucern/vineyard/pecan nuts. About 504,7 Ha of land was investigated. The soil report and findings were the leading factors in deciding to allocate the crop areas. The soil report concluded that approximately 330 Ha of the survey area is suitable for irrigation. Soils with a freely drainable depth of 1000 mm, which included the Hutton, Augrabies, Prieska, Addo, and sections of the Plooysburg, Prieska, Glenrosa and Vaalbos soil forms were suitable for irrigation. The soil forms not suitable for irrigation (Sections of the Plooysburg, Vaalbos, Brandvlei, Prieska, and Glenrosa) were suitable for vineyards under drip irrigation as the soil could be mechanically altered to accommodate vineyards. The area for vineyard production was approximately 76 Ha. The areas not suitable for irrigation or vineyard production were the Coega and parts of the Glenrosa, Vaalbos, Plooysburg, and Brandvlei soil forms. Soil that had a freely drainable depth of <700 was unsuitable for irrigation and vineyard production.

Loss of on-site fauna and flora:

The site, according to Mucina and Rutherford (2006), hosts two vegetation types, namely the Upper Gariep Alluvial vegetation, which has a vulnerable conservation status and the Northern Upper Karoo, which has a least threatened conservation status. A vegetation survey will be

conducted by a SACNASP registered ecologist to evaluate the sensitivity of the site in terms of the flora component and ecological status.
The occurrence of faunal species within the proposed area is likely, however, it is farm properties and generally fenced-in camps, which will hinder 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*).
The clearing of vegetation would be restricted to limited areas and the fairly slow clearance rate would provide adequate time for migration of any animals remaining on-site to be sustained in similar adjoining habitats. Also, noise generated by vehicles will cause most animals to vacate the site temporarily. If certain species were to be affected they would simply vacate the proposed cleared areas during the day and return during the night. Since adequate buffer zones will be maintained from drainage lines, the clearing of vegetation will not impact amphibian species.

Sensitive Sites:

According to the Northern Cape Biodiversity Conservation Plan, the site falls within a Terrestrial CBA 1 area.
According to the Spatial Development Framework environmental sensitivity of the municipal area has been mapped and the site falls within an environmental area that is rated 2 and thus fairly low sensitivity.
To assess the sensitivity of the environment onsite verification is therefore essential. The preliminary investigation indicated that the site does not host sensitive fauna or flora, however, a SACNASP registered scientist will be appointed to conduct the vegetation survey and to determine the ecological importance.
The clearing of vegetation will be restricted to approved areas and a 100m buffer area between the clearance and drainage lines and Orange River will be maintained, thus no surface water systems will be impacted.
The objective will be to reduce the biodiversity impact due to the clearance of vegetation through an 'offset plan'. The principal approach to biodiversity offsets is to provide a '*like for like or better*' area to compensate for the area which will be negatively affected. Offsets that do not involve securing and managing habitat but include funding research, education, staffing, etc. are generally believed to be unacceptable for impacts on biodiversity. Biodiversity offsets are to be used in cases where the EIA process identifies negative residual impacts of 'medium' or 'high' significance on biodiversity. Activities resulting in impacts of 'low' significance may not require an offset. In other words, biodiversity offsets can provide a mechanism to compensate for significant residual impacts on biodiversity. It refers to measures over and above

rehabilitation to compensate for the residual negative effects on biodiversity, after every effort has been made to minimise and then rehabilitate impacts.

PUBLIC PARTICIPATION

In terms of the NEMA, public participation forms an integral part of the environmental assessment process. The public participation process provides people who may be affected by the proposed development with an opportunity to provide comments and raise issues of concern about the project or make suggestions that may result in enhanced benefits for the project.
For this application, there will be two phases of public participation.

1. Scoping Phase
2. EIA Phase.

This is the first phase, and during the Scoping Phase, *potential* interested and affected parties (I&APs) are given notice via a notice board and local newspaper advertisement informing the public of the application. The *registered* I&APs are considered directly abutting neighbours and organs of state that have jurisdiction over the area, e.g. the Municipality, Ward counsellor, etc. and would be provided with a Background Information Document and given access to a digital copy of the Scoping Report on Digital Soils website for comment.
Comments and issues raised during the Scoping Phase of the public participation process will be captured, evaluated, and included in a Public Participation Report. These issues will be addressed and included in the final Scoping Report, which will be submitted to the Department of Agriculture, Environmental Affairs, Rural Development, and Land Reform.

During the EIA Phase (which is the second phase) of public participation, only those I&AP's that are registered would be given notice and access to a digital copy of the Environmental Impact Assessment Report on Digital Soils website for comment.
Comments and issues raised during the EIA Phase of the public participation process will be captured, evaluated, and included in a Public Participation Report. These issues will be addressed and included in the final EIA Report, which will be submitted to the Department of Agriculture, Environmental Affairs, Rural Development, and Land Reform.

To register and/or submit a comment as an Interested and Affected Party, please respond in writing to the following email: natalie@dsafrica.co.za on or before 18 May 2022 no later than 5pm.
Alternatively, a copy of the Draft Scoping Report is also available on the DSA website at www.dsafrica.co.za. Please follow the link to Services, Environmental Services, Documents and choose the Zwemkuil link. To access the loaded documents use the password: zWem@no37.

If you have any other questions or inquiries, please do not hesitate the contact the office at 067 622 5687. If no comments are received from you, it will then be regarded that you do not have any comments.

1 Kemsley Street
Gqeberha
6001

Response from Dirk Ernst Loots

www.dsafrica.co.za natalie@dsafrica.co.za

Dirk Ernst Loots Snr

Application for clearing of the natural vegetation on the Remainder of Farm Smitskloof No. 38, Prieska for establishing crops.

I, Dirk Ernst Loots (ID nr. 5603135003081) is the owner of the abovementioned property and are aware of the application to clear vegetation for the establishing of crops on the said property.

I would like to indicate that I support the application and have no objection to the proposed development.

Date & Signed by D.E. Loots

11-03-2022

1 Kemsley Street
Gqeberha
6001

Proof of consultation sent via email during the Scoping Phase:

The contacts used during this public participation were obtained from the Applicant and the Department's websites to ensure the BID was delivered to the Departments.

It has also come to the attention of the Department of Forestry, Fisheries and the Environment that there is uncertainty regarding the applicability of the requirements of the Protection of Personal Information Act, 2013 (Act No. 14 of 2013) (POPIA) to the requirements of the Environmental Impact Assessment Regulations, 2014, relating to registers of interested and affected parties and the inclusion of comments in reports. Please note the following in this regard:

Register of interested and affected parties:

Regulation 42 of the Environmental Impact Assessment Regulations, 2014, as amended (EIA Regulations) provides for the opening and maintenance of a register of interested and affected parties (I&APs), **by the proponent or applicant,** which must contain personal information (names, contact details and addresses). It is therefore the duty of the proponent or applicant to collect the information that must be contained in the register.

Regulation 42 further requires that these registers must be submitted to the competent authority (CA). There is no legal requirement in the EIA Regulations that such registers must be included in the reports that are published for public consultation purposes or be made publicly available as part of the EIA process. Since the information in the registers is personal/private information, it should not be included in or attached to reports and be made available in the public domain. CAs, applicants and environmental assessment practitioners (EAPs) should take note that, if this information was previously included in reports and shared in the public domain, this now requires reconsideration in accordance with the POPIA. The Department realises that EAPs may have included some personal information in these reports when they receive and compile them. Likewise, this information may reach CAs who also now need to be sensitive about the management of this information.

It is the duty of the proponent or applicant to collect the information that must be contained in the register. Despite the fact that, in practice, this task is often performed by the EAP, it is the proponent or applicant that remains responsible to comply with the applicable legislative provisions. The applicant or proponent must therefore ensure that the EAP is aware of the POPIA requirements and that registers should not be included in reports and be made available in the public domain.

Comments and responses information:

Regulation 19(1)(a) of the Environmental Impact Assessment Regulations 2014 (EIA Regulations) provides that where basic assessment must be applied to an application, the applicant must, within 90 days of receipt of the application by the CA submit to the CA a basic assessment report, inclusive of any specialist reports, an EMPR, a closure plan or the plans, reports and calculations contemplated in the Financial Provisioning Regulations, which have been subjected to a public participation process of at least 30 days and which reflects the incorporation of comments

www.dsafrica.co.za natalie@dsafrica.co.za

received, including any comments of the CA. There are similar requirements for the scoping report and the environmental impact assessment reports required in terms of the EIA Regulations.

The applicant or EAP on behalf of the applicant is therefore required by law to submit reports, including comments received on such reports, summaries of the issues raised, and an indication of the manner in which the comments/issues were incorporated or reasons for not incorporating comments/issues in the reports, where such are not incorporated. It is not expressly required that names or personal information of those who provided comments should be included in the reports. It is however appreciated that it is often the practice to include the name/details of the person who provided the comments in the reports. In many instances those who commented enquire about/ seek confirmation of the inclusion of their comments in the reports. It is therefore important to be able to indicate the comment received in relation to the person/entity who submitted this. Furthermore, it is necessary for the CA to be aware of the persons who submitted comments, when considering the reports (including the comments). For these reasons the names of the commenting parties are intrinsically linked to the comments that are submitted by them and are often also included in the reports, but this must now be done with the careful consideration of and compliance with the POPIA requirements.

The definition of "personal information" in the POPIA includes: *"(h) the name of the person if it appears with other personal information relating to the person or if the disclosure of the name itself would reveal information about the person*". Since circumstances may arise where a name, included as part of the comments, may reveal information about a person, it is advisable to err on the side of caution and ensure that there is compliance with the POPIA when names are included in the reports. In some instances more than just the name of the person may be revealed and in such cases the information would also fall within the ambit of the definition of "personal information" and therefore there needs to be compliance with the POPIA requirements. The approach to be followed should be guided by sections 3(3), 9, 12(1) and (2), 11 as well as 18 of the POPIA, as explained below.

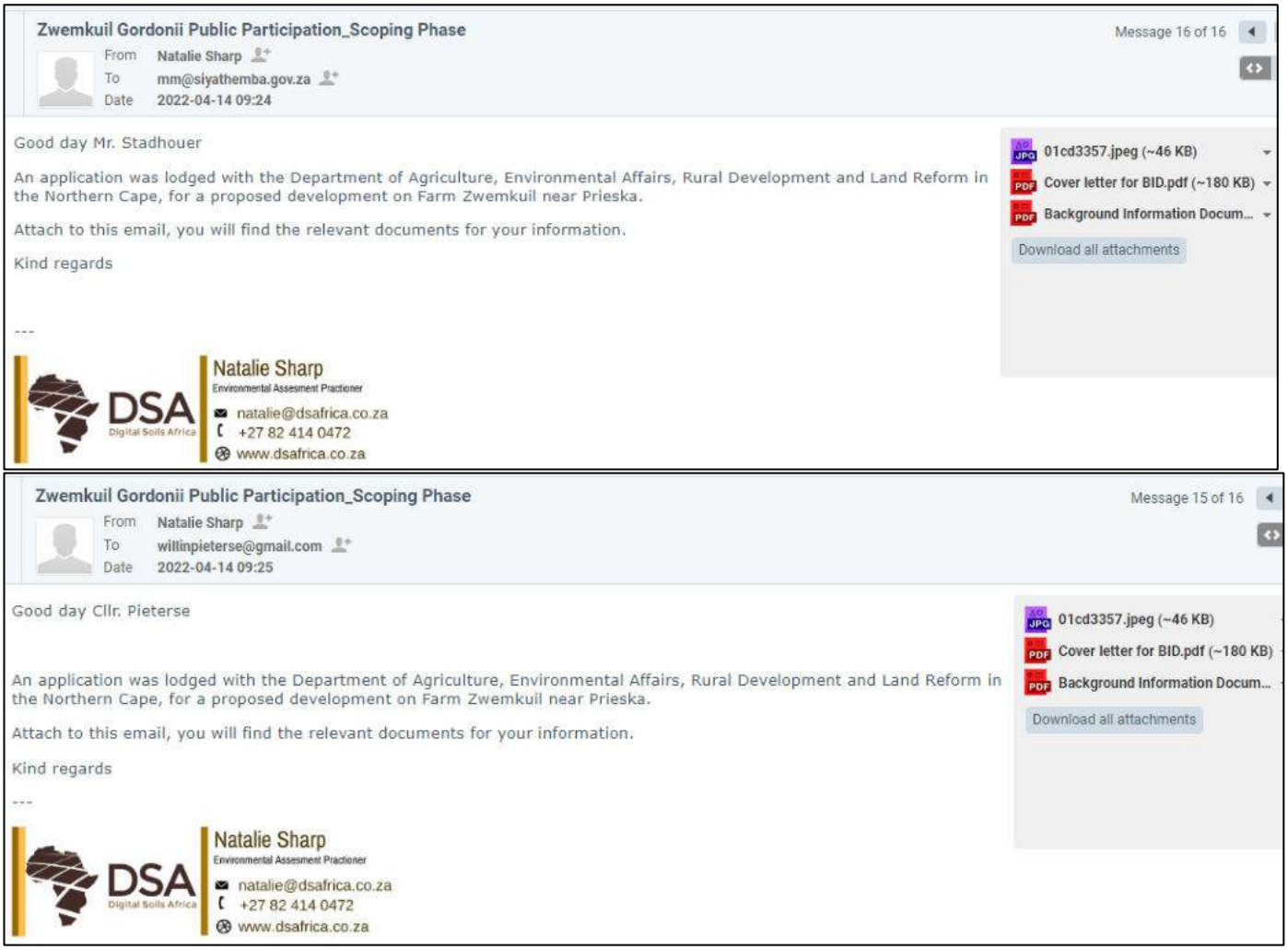
Section 3(3)(b) of POPIA provides that the POPIA must be interpreted in a manner that does not prevent any public or private body from exercising or performing its powers, duties and functions in terms of the law as far as such powers, duties and functions relate to the processing of personal information and such processing is in accordance with the POPIA or any other legislation, as referred to in section 3(2), that regulates the processing of personal information. Section 3(3)(b) of the POPIA should be read with and inform the interpretation of other relevant sections of POPIA.

For the current scenario the EAP and applicant has a legal duty to perform a function in terms of the EIA Regulations, which function requires the preparation of reports, that include comments made by process participants. POPIA must therefore be interpreted in a manner that does not prevent the applicant or EAP from performing its functions/duties under the EIA Regulations, as far as such functions/duties relate to the processing of personal information, and provided the processing is in accordance with POPIA and meets the requirements of the EIA Regulations. Furthermore, in light of the fact that the reports submitted by the EAPs are meant to provide the CAs with adequate information that will enable them to decide on applications received, adequate information may, at times, include incorporation of personal information in order for the reports to facilitate decision-making.

For this reason, the below email confirmation will be included, but email addresses will be excluded, as well as personal information during the EIA public participation Phase. The information will however be given to the Department in the submission of the final EIA report.

Emails during the Scoping Phase:

All IAP's were emailed, except for Mr. Giel van Niekerk who does not have an email address, therefore he received communication via Whatsapp, and the documents were sent to him in PDF format.



Zwemkuil Gordonii Public Participation_Scoping Phase

Message 16 of 16

From Natalie Sharp
To mm@siyathemba.gov.za
Date 2022-04-14 09:24

Good day Mr. Stadhouer

An application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

Attach to this email, you will find the relevant documents for your information.

Kind regards

Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

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Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments

Zwemkuil Gordonii Public Participation_Scoping Phase

Message 15 of 16

From Natalie Sharp
To willinpieterse@gmail.com
Date 2022-04-14 09:25

Good day Cllr. Pieterse

An application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

Attach to this email, you will find the relevant documents for your information.

Kind regards

Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

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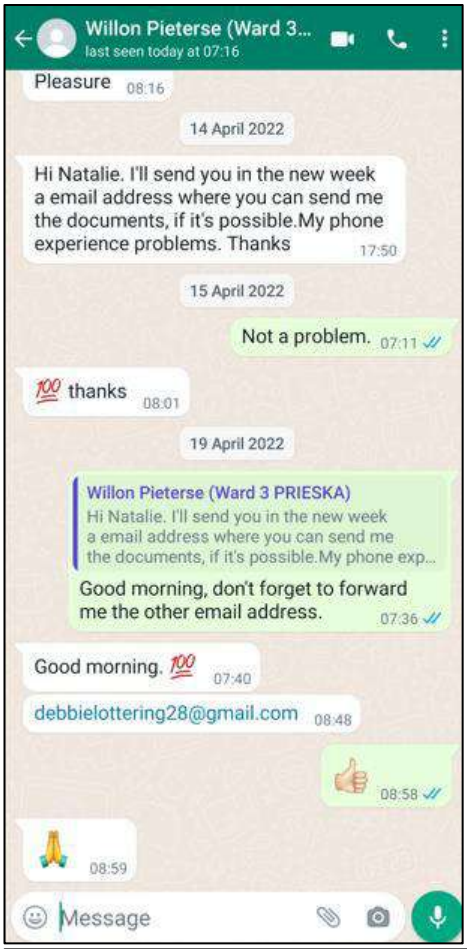
Willon Pieterse (Ward 3...
last seen today at 07:16
Pleasure 08:16
14 April 2022
Hi Natalie. I'll send you in the new week a email address where you can send me the documents, if it's possible.My phone experience problems. Thanks 17:50
15 April 2022
Not a problem. 07:11
thanks 08:01
19 April 2022
Willon Pieterse (Ward 3 PRIESKA)
Hi Natalie. I'll send you in the new week a email address where you can send me the documents, if it's possible.My phone exp...
Good morning, don't forget to forward me the other email address. 07:36
Good morning. 07:40
debbielottering28@gmail.com 08:48
08:58
08:59
Message


Fwd: Zwemkuil Gordonil Public Participation_Scoping Phase
Message 7 of 18
From Natalie Sharp
To debbielottering28@gmail.com
Date 2022-04-19 09:04
Good day Cllr. Pieterse,
As per your whatapp communication on 14, 15 & 19 April 2022, please see below email.
Kind regards

Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za
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Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments

Fwd: Zwemkuil Gordonii Public Participation_Scoping Phase

From Natalie Sharp
To debbielottering28@gmail.com
Date 2022-04-19 09:04

Good day Cllr. Pieterse

An application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

Attach to this email, you will find the relevant documents for your information.

Kind regards

Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

Zwemkuil Gordonii Public Participation_Scoping Phase

Message 14 of 16

From Natalie Sharp
To idh@pksdm.gov.za, idhpksdm@gmail.com
Date 2022-04-14 09:26

Good day Mr. Rodney Pieterse,

An application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

Attach to this email, you will find the relevant documents for your information.

Kind regards

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Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments

Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

Zwemkuil Gordonii Public Participation_Scoping Phase

Message 13 of 16

From Natalie Sharp
To Hlengani Alexia (UPN)
Date 2022-04-14 09:28

Good day Alexia Hlengani,

An application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

Attach to this email, you will find the relevant documents for your information.

Kind regards

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Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments

Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

Zwemkuil Gordonii Public Participation_Scoping Phase

Message 12 of 16

From Natalie Sharp
To ThembisileMA@dalrrd.gov.za
Date 2022-04-14 09:32

Good day Me. Thembisile Mabusa,

An application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

Please take note that an application for cultivation of virgin soil was lodged with Mr. Roux and he has acknowledge the application on 30 March 2022.

This communication therefore just serves the purpose to inform you that an environmental application is also underway and this is part of the consultation process with your Department regarding the environmental application.

Attach to this email, you will find the relevant documents for your information.

Kind regards

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Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments

Zwemkuil Gordonii Public Participation_Scoping Phase

Message 11 of 16

From Natalie Sharp
To CRobertson@ncpg.gov.za
Date 2022-04-14 09:33

Good day Crystal Robertson,

An application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

Attach to this email, you will find the relevant documents for your information.

Kind regards

DSA Digital Soils Africa
Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

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Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments

Zwemkuil Gordonii Public Participation_Scoping Phase

Message 10 of 16

From Natalie Sharp
To sinenhlanhla.xulu@dalrrd.gov.za
Date 2022-04-14 09:34

Good day,

An application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

Attach to this email, you will find the relevant documents for your information.

Kind regards

DSA Digital Soils Africa
Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

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Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments

Fw: Zwemkuil Gordonii Public Participation_Scoping Phase

Message 3 of 16

From Sinenhlanhla Xulu
To Andrew Lawrence, Ruaan Phillipson, Robert Lesabane
Copy Darlit Esterhuizen, natalie@dsafrica.co.za
Date Wed 09:41

Dear Colleagues

Kindly receive an application for a proposed development on Farm Zwemkuil for your further handling

Regards

Sinenhlanhla Xulu

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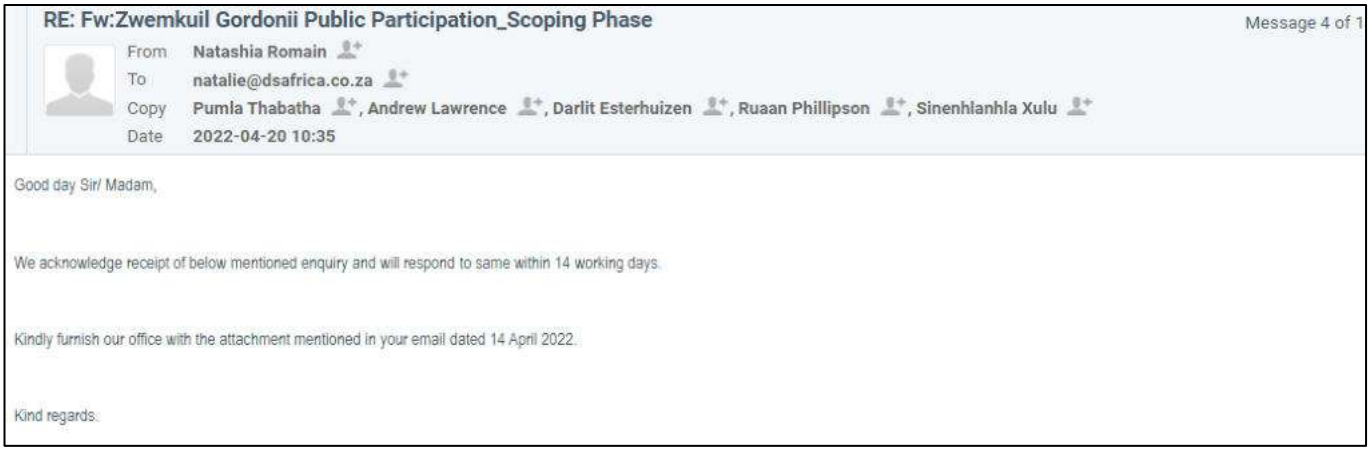
Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments



RE: Fw:Zwemkuil Gordonii Public Participation_Scoping Phase

Message 4 of 1

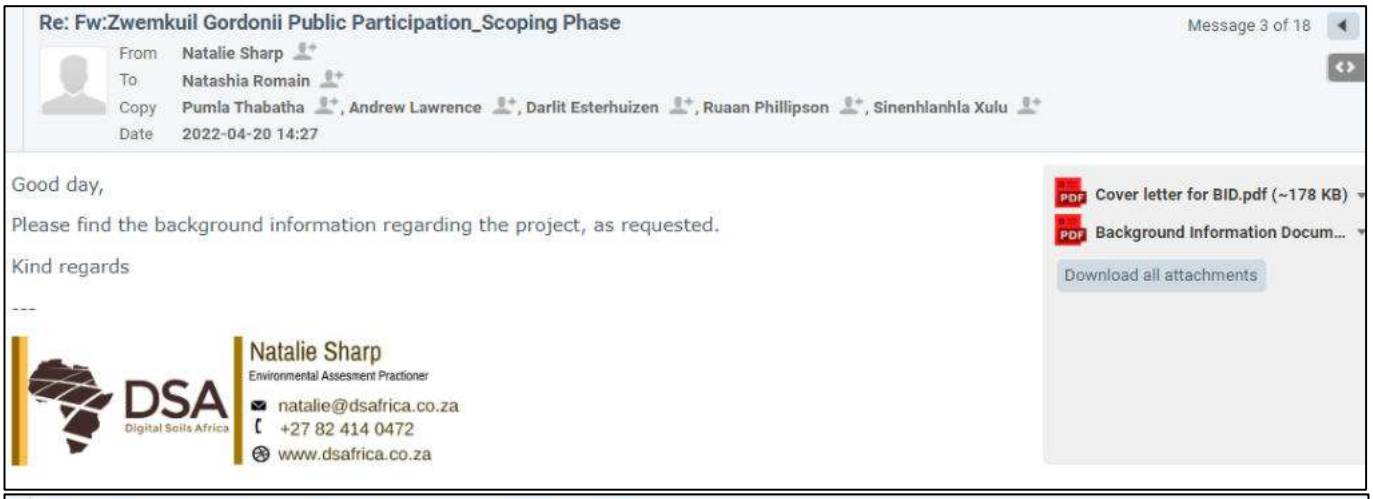
From Natashia Romain
To natalie@dsafrica.co.za
Copy Pumla Thabatha, Andrew Lawrence, Darlit Esterhuizen, Ruaan Phillipson, Sinenhlanhla Xulu
Date 2022-04-20 10:35

Good day Sir/ Madam,

We acknowledge receipt of below mentioned enquiry and will respond to same within 14 working days.

Kindly furnish our office with the attachment mentioned in your email dated 14 April 2022.

Kind regards.



Re: Fw:Zwemkuil Gordonii Public Participation_Scoping Phase

Message 3 of 18

From Natalie Sharp
To Natashia Romain
Copy Pumla Thabatha, Andrew Lawrence, Darlit Esterhuizen, Ruaan Phillipson, Sinenhlanhla Xulu
Date 2022-04-20 14:27

Good day,

Please find the background information regarding the project, as requested.

Kind regards

DSA Digital Soils Africa

Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

Cover letter for BID.pdf (~178 KB)
Background Information Docum...
Download all attachments

RE: Fw:Zwemkuil Gordonii Public Participation_Scoping Phase

Message

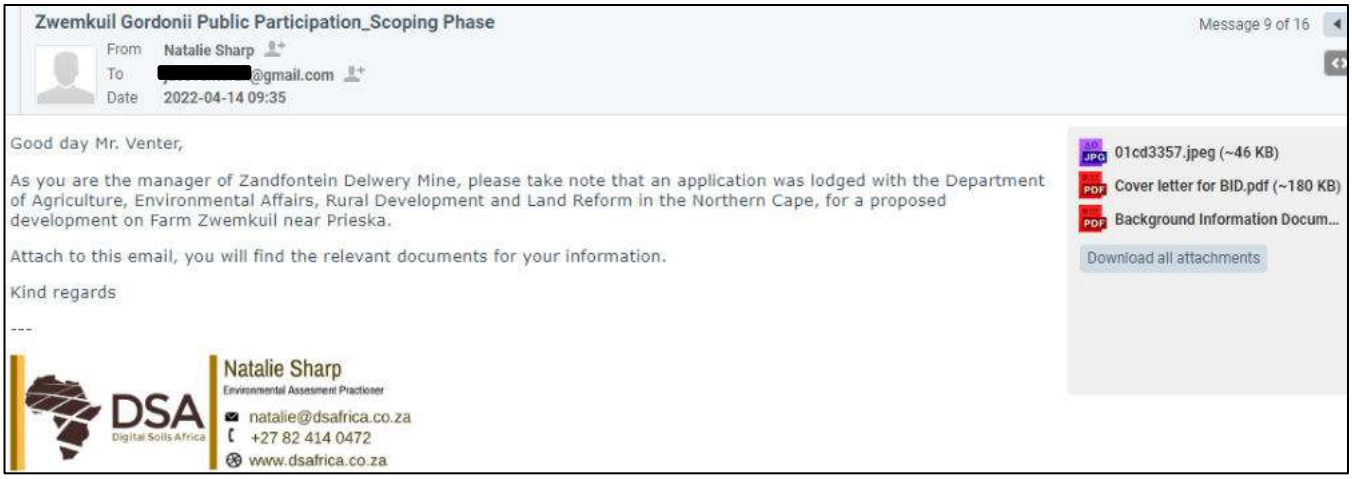
From Natashia Romain
To Natalie Sharp
Copy Pumla Thabatha, Andrew Lawrence, Darlit Esterhuizen, Ruaan Phillipson, Sinenhlanhla Xulu
Date 2022-04-21 10:01

Good day Sir/Madam,

Please find attached letter for your attention.

Kind regards

DSA.pdf (~153 KB)



Zwemkuil Gordonii Public Participation_Scoping Phase

Message 9 of 16

From Natalie Sharp
To [redacted]@gmail.com
Date 2022-04-14 09:35

Good day Mr. Venter,

As you are the manager of Zandfontein Delwery Mine, please take note that an application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

Attach to this email, you will find the relevant documents for your information.

Kind regards

DSA Digital Soils Africa
Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

01cd3357.jpeg (~46 KB)
Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments

Zwemkuil Gordonii Public Participation_Scoping Phase

Message 8 of 16

From Natalie Sharp
To [redacted]gmail.com
Date 2022-04-14 09:36

Good day Mr. Du Plessis,

An application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

Attach to this email, you will find the relevant documents for your information.

Kind regards

DSA Digital Soils Africa
Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

01cd3357.jpeg (~46 KB)
Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments

Zwemkuil Gordonii Public Participation_Scoping Phase

Message 7 of 16

From Natalie Sharp
To [redacted]@gmail.com
Date 2022-04-14 09:37

Good day Mr. Terblanche,

An application was lodged with the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Northern Cape, for a proposed development on Farm Zwemkuil near Prieska.

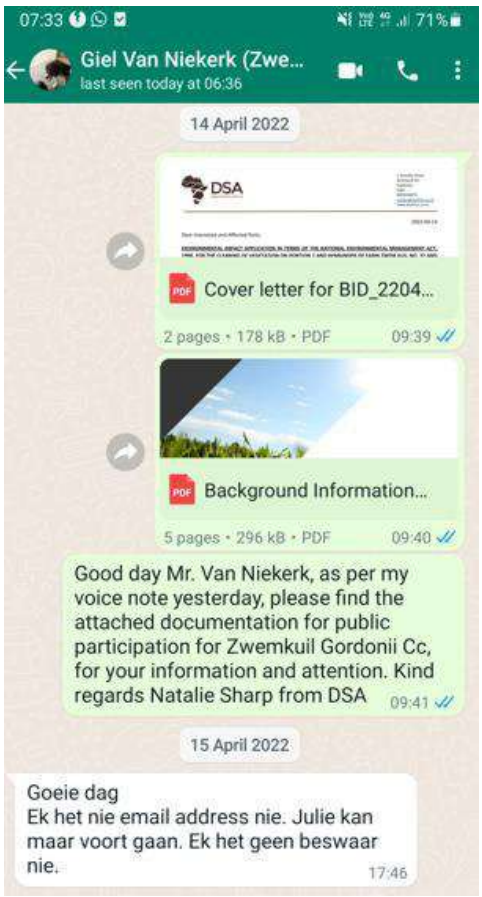
Attach to this email, you will find the relevant documents for your information.

Kind regards

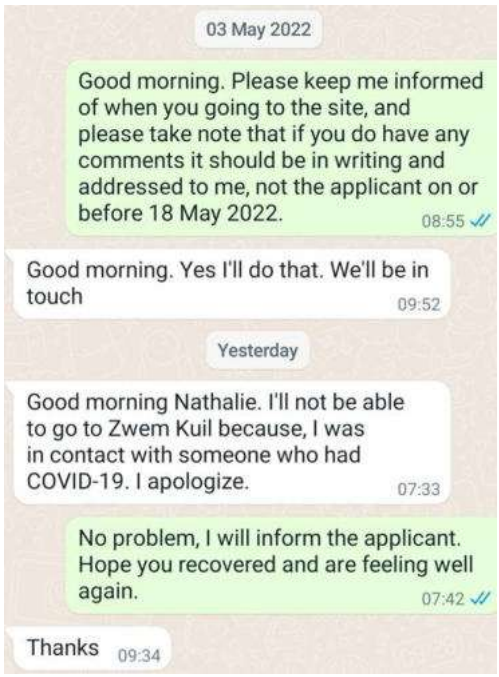
DSA Digital Soils Africa
Natalie Sharp
Environmental Assesment Practioner
natalie@dsafrica.co.za
+27 82 414 0472
www.dsafrica.co.za

01cd3357.jpeg (~46 KB)
Cover letter for BID.pdf (~180 KB)
Background Information Docum...
Download all attachments

Response from IA&P's



Whatsapp message from Mr. Giel van Niekerk



Whatsapp message from Cllr. Pieterse

1 Kemsley Street
Gqeberha
6001

Letter from the Office of the Regional Land Claims Commissioner: Northern Cape

www.dsafrica.co.za natalie@dsafrica.co.za

OFFICE OF THE REGIONAL LAND CLAIMS COMMISSIONER: NORTHERN CAPE
Hyesco Arcade, 4-8 Old Main Road, Kimberley, 8300 | PO Box 2458, Kimberley, 8300
Tel: (053) 807 5700 | Fax: (053) 831 6501

Enquiries: **Natashia Romain**

DIGITAL SOILS AFRICA
Email: natalie@dsafrica.co.za

Dear Mr / Ms

LAND CLAIMS ENQUIRY

PTN 2 & REMAINDER OF FARM ZWEMKUIL NO. 37
REMAINDER OF FARM SMITSKLOOF NO .38, PRIESKA

We refer to your letter received: **20 April 2022**.

We confirm that as at the date of this letter no land claims appear on our database in respect of the Properties. This includes the database for claims lodged by 31 December 1998; and those lodged between 1 July 2014 and 27 July 2016 in terms of the Restitution of Land Rights Amendment Act, 2014.

Whilst the Commission takes reasonable care to ensure the accuracy of the information it provides, there are various factors that are beyond the Commission's control, particularly relating to claims that have lodged but not yet been gazetted such as:

1. Some Claimants referred to properties they claim dispossession of rights in land against using historical property descriptions which may not match the current property description; and
2. Some Claimants provided the geographic descriptions of the land they claim without mentioning the particular actual property description they claim dispossession of rights in land against.

The Commission therefore does not accept any liability whatsoever if through the process of further investigation of claims it is found that there is in fact a land claim in respect of the above property.

If you are aware of any change in the description of the above property after 19 June 1913 kindly supply us with such description so as to enable us to do a further search.

Yours faithfully

Ms. M. Du Toit
Chief Director: Land Restitution Support-Northern Cape
Date: 21.04.2022

Register of I&AP's:

	Interested and Affected Party Name	Contact details (phone or email)	Address	Date received comments	Concerns raised	Response
1	Pixley Ka Seme District Municipality Att: Mr. Rodney Pieterse	053 631 0891 idh@pksdm.gov.za; idhpksdm@gmail.com	Private Bax X1012 De Aar 7000	No comment		
2	Siyathemba Municipality Att: IWJ Stadhouer (Municipal Manager)	076 442 8075 mm@siyathemba.gov.za	P O Box 16 Prieska 8940	No comment		
3	Ward Councillor Ward 3 Att: Mr. W. Pieterse	081 818 2602 / 065 680 0345 willinpieterse@gmail.com OR debbielottering28@gmail.com	P O Box 65 Niekerkshoop 8930	28 April 2022 3 May 2022 17 May 2022	Cllr. Pieterse indicated via whatapp that he would like to do a site visit to the farm before he can comment. Cllr. Pieterse indicated that he was not able to conduct a site visit as he was in contact with someone who tested positive for Covid.	28 April 2022 DSA responded and provided the applicants contact details for the Cllr to arrange his site visit. On 3 May 2022 DSA also indicated that comments must be in writing and received on or before 18 May 2022.

						On 17 May 2022 DSA indicated that we will inform the applicant that Cllr. Pieterse will not be able to conduct a site visit.
4	Department of Water and Sanitation (Upington) Att: A. Hlengani	054 338 5800 HlenganiA@dws.gov.za	Private Bag X5912 Upington 8800	No comment		
5	Department of Agriculture: Directorate Land Use & Soil Management Att: Me. Thembisile Mabusa	053 807 2612 / 064 869 0976 ThembisileMA@dalrrd.gov.za	P O Box 2303, Kimberley 8300	30 March 2022	Mr. Roux from the Department acknowledged receipt of the application for cultivation of soil. No comment was received regarding the environmental application.	
6	Northern Cape Department of Roads and Public Works Att: Crystal Robertson	083 839 2183 CRobertson@ncpg.gov.za	P O Box 3132 Kimberley 8300	No comment		
7	The Office of the Regional Land Claims Commissioner Land Restitution Support: Northern Cape Att: Sinenhlanhla Xulu or Natashia Romain	053 807 5700 sinenhlanhla.xulu@dalrrd.gov.za NRomain@dalrrd.gov.za	P O Box 2458 Kimberley 8300	20 April 2022	The Department forward internal communication to investigate if there are any land claims on the proposed property and requested that the background information document be forwarded again.	On 20 April 2022, DSA responded and resend the BID.

8	Zandfontein Delwery Mine Att: Jaco Venter	[redacted]		No comment		
9	Gerrie Du Plessis (neighbour)	[redacted]		No comment		
10	Frans Terblanche (neighbour)	[redacted]		No comment		
11	Giel van Niekerk (neighbour)	[redacted]	[redacted] Prieska 8940	15 April 2022	Mr. van Niekerk indicated that he has no objection to the proposed project.	DSA acknowledge receipt on 19 April 2022.
12	Bennie van Niekerk (neighbour)	[redacted]		No comment		

- No person registered or contacted the EAP during the pre-application consultation period as a result of the Notice Board.
- No person registered or contacted the EAP during the pre-application consultation period as a result of the advertisement

PUBLIC PARTICIPATION FOR THE EIA PHASE

In terms of Regulation 40 of the Schedule published in GNR 326 under NEMA 107 of 1998, interested and affected parties must be consulted as part of the public participation process. Thus the following steps were taken, in accordance with current legislation:

- All abutting neighbours and government offices as listed in the above I&AP Register were consulted with a detailed letter and sent via email and an opportunity was given to object or raise concern about the proposed project. The letter was emailed on 12 July 2022 and the comment period will stop on 12 August 2022.
- An application to the South African Resource Agency was submitted online as per their SAHRIS application format. An opportunity was given to object or raise concerns about the proposed project. The application is currently in process.

The Draft EIA Report has been submitted to all organs of the state which have jurisdiction in respect of the activity or any part thereof during the mentioned 30 day period. At the cessation of the 30 day comment period, the Public Participation Report will be finalized and submitted with the Final EIA Report to the DAEARDLR.

If no comment or written request to be registered as an IAP is received from potential IAPs during this 30 day consultation period, then the public participation process will be concluded and only entities regarded as registered IAPs will be given notice of the outcome of the environmental authorisation for the 20 day appeal process.

1 Kemsley Street
Gqeberha
6001

Consultation letter sent to DWS and Department of Agriculture during the EIA Phase

www.dsafrica.co.za natalie@dsafrica.co.za

1 Kemsley Street
Richmond Hill
Gqeberha
6001
0824140472
natalie@dsafrica.co.za
www.dsafrica.co.za

2022-07-12

Department of Water and Sanitation
Private Bag X5912
Upington
8800
Attention: Mr. Steven Shibambu

ENVIRONMENTAL IMPACT APPLICATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, FOR THE CLEARING OF VEGETATION ON PORTION 2 AND REMAINDER OF FARM ZWEM KUIL NO. 37 AND REMAINDER OF FARM SMITSKLOOF NO. 38, PRIESKA. APPLICANT: ZWEMKUIL GORDONII CC. EIA Public Participation Phase.

Zwemkuil Gordonii CC appointed Digital Soils Africa (Pty) Ltd (DSA) to conduct the necessary environmental impact assessment and public participation for the above-mentioned project.

Previously you were consulted during the *Scoping Phase* of the application. The project has proceeded into the *Environmental Impact Assessment* (EIA) Phase.

In terms of Section 41 of NEMA Regulations, you have been identified as an Interested and Affected Party and are invited to participate in the public participation. All written comments will be responded to and forwarded to the relevant departments, in the form of a Public Participation Report.

This communication, therefore, serves to inform you of the intention of Zwemkuil Gordonii CC to apply for environmental authorisation and cultivation of virgin soil on 504,7 Ha to establish crops that, if approved, will be developed over the next 5 years. You have been identified as an interested and affected party (I&AP) in the project and the purpose of this letter is therefore to:

- Inform you of the locality of the proposed site.
- Allow you to raise any informed comments you might have in respect of the proposed development.
- Incorporate any written comments in the Interested & Affected Parties' Register and Scoping Report to be submitted to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in terms of Regulation 19 published in GNR 326 on 7 April 2017 under NEMA 107 of 1998.

This consultation process is important as it raises your awareness as to the nature of the proposed development and grants you the opportunity to raise any comments/observations/concerns you might have thereon and submit such in writing. Should any observation/concern be identified as a definite and significant environmental/social impact, the relevant matter will be further investigated, assessed and where necessary, mitigation measures will be developed and captured in the Final EIA Report to satisfactorily address any identified impact.

To ensure that your detailed written comments are captured in the I&AP Register and submitted to all applicable Regulating Authorities as an integral part of the environmental assessment process, your response is required in writing **not later than 12 August 2022** no later than 5pm. This is done in accordance with GNR 326, chapter 2, Regulation 3, of the Environmental Impact Assessment Regulations (2014), as amended on 7 April 2017, of the National Environmental Management Act of 1998. Below is the link to the Scoping Report for your attention.

1 Kemsley Street
Richmond Hill
Gqeberha
6001
0824140472
natalie@dsafrica.co.za
www.dsafrica.co.za

Where we are in the process

- A Final Scoping Report was submitted to the Department.
- A Draft EIA Report has been submitted for Public Participation to other Departments, the Municipality (Local and District), ward councilor, and registered I&AP's.

Way Forward

1. The outcome of this consultation process will be submitted to the Department as part of the Final EIA Report.
2. On completion of the public participation for the EIA phase, the final document will be prepared and will be submitted to the said Department for decision making.
3. If the said Departments decision-making process results in approval of the clearance of vegetation an Environmental Authorization will be issued and the EMP approved. All registered Interested & Affected Parties will be notified of the issue of the Environmental Authorization.
4. The approved activities would then proceed and be conducted in accordance with the approved EMP.
5. Environmental audits should be conducted and submitted to the said Department for evaluation and any appropriate decision-making.

Please note that in an attempt to follow a more 'green friendly' approach, a hard copy of the Draft EIA Report will not be placed in a public place as a hard copy for the public, nor would one be couriered to your Department, rather a digital copy will be made available on the DSA website.
The documents will be made available on the DSA website, www.dsafrica.co.za. Please follow the link to Services, Environmental Services, Documents and choose the Zwemkuil link. To access the loaded documents use the password: zWem@no37.

Yours sincerely

Natalie Sharp
Pri.Sci.Nat (Reg nr. 123443)
Reg. EAP (EAPASA)

1 Kemsley Street
Richmond Hill
Port Elizabeth
6001
0824140472
natalie@dsafrica.co.za
www.dsafrica.co.za

2022-07-12

Department of Agriculture, Environmental Affairs, Rural Development and Land Reform
Directorate Environmental Quality/Assessment Management
Private Bag X6102
Kimberley
8300
Attention: Mr. T. Mtombeni **Ref: NC/EIA/03/PIX/SIY/PRI1/2022**

SUBMISSION OF DRAF SCOPING REPORT IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, FOR THE CLEARING OF VEGETATION ON PORTION 2 AND REMAINDER OF FARM ZWEM KUIL NO. 37 AND REMAINDER OF FARM SMITSKLOOF NO. 38, PRIESKA. APPLICANT: ZWEMKUIL GORDONII CC. EIA Public Participation Phase.

The Final Scoping Report was couriered to your department and acknowledged on 23 May 2022. To date, we have had no response on the Scoping Report and would presume there are no comments or responses and therefore we are proceeding with the EIA phase of this application.

In terms of Section 41 of NEMA Regulations, you have been identified as an Interested and Affected Party and are invited to participate in the public participation for the EIA phase. All written comments will be responded to and where necessary incorporated into the Final EIA and EMP.

The purpose of this letter and attached document is therefore to:

- Inform you of the locality of the proposed environmental authorization application.
- Allow you the opportunity to raise concerns or comments in respect of the proposed project detailed in the Draft EIA.

Public Participation Process

The purpose of the consultation is to provide you with access to the Draft EIA regarding the proposed project and provide the opportunity to raise any comments you might have on the proposed project.

To ensure that your detailed written comments are captured in the I&AP Register as an integral part of the environmental assessment process, your response is required in writing **not later than 12 August 2022** (until 5pm). This is done in accordance with GNR 326, chapter 2, Regulation 3, of the Environmental Impact Assessment Regulations (2014), as amended on 7 April 2017, of the National Environmental Management Act of 1998. Attached is a hard copy of the Draft EIA Report or alternatively, follow the link to the EIA Report for your attention. If no comments are received from you, it will then be regarded that you do not have any comments.

1 Kemsley Street
Richmond Hill
Port Elizabeth
6001
0824140472
natalie@dsafrica.co.za
www.dsafrica.co.za

Where we are in the process

- A Draft Scoping Report was couriered to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform for comments, acknowledged by the Department on 27 April 2022 for a 30 day comment period. The Department did not comment during this time.
- The Final Scoping Report was couriered to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform acknowledged by the Department on 23 May 2022 for the 43 day processing period. The Department did not respond during this time.
- A Draft EIA Report is now submitted to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform for comments as part of the public participation process.

Way Forward

- The Draft EIA Report and required specialist reports are subjected to review by all registered I&AP's and relative governmental departments, following the time frames as stipulated in Section 3 (1) & (8) of the NEMA regulations (30 days).
- The document will be made available on the DSA website, www.dsafrica.co.za. Please follow the link to Services, Environmental Services, Documents, and choose the Zwemkuil link. To access the loaded document use the password: zWem@no37. In addition, a hard copy of the Draft EIA Report was sent to the DAEARDLR via couriers.
- All comments received and responses written during the 30 days will be captured in the Public Participation Report and submitted to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform in the Final EIA Report.
- The Department will make the final decision regarding the environmental authorisation.

Yours sincerely

Natalie Sharp
Pri.Sci.Nat (Reg nr. 123443)
Reg. EAP (EAPASA)

Background Information document sent to all I&AP's as identified during the EIA Phase.

EIA PHASE: PUBLIC PARTICIPATION

BACKGROUND INFORMATION REGARDING CLEARING OF VEGETATION ON PTN 2 & REMAINDER OF FARM ZWEM KUIL NO. 37 & REMAINDER OF FARM SMITSKLOOF NO. 38, PRIESKA

ZWEMKUIL GORDONII CC

JULY 2022

DSA
Digital Soils Africa

+27 82 414 0472
www.dsafrica.co.za
natalie@dsafrica.co.za
1 Kemsley Street
Port Elizabeth

1 Kemsley Street
Richmond Hill
6001

PURPOSE OF THIS DOCUMENT

The purpose of this document is to provide all **registered** I&AP's with information about the intent of Zwemkuil Gordonii CC to apply for environmental authorisation and certificate for cultivation of virgin land on 504,7 Ha to establish crops on Portion 2 & Remainder of Farm Zwem Kuil No. 37 and Remainder of Farm Smitskloof No. 38, Prieska in the Northern Cape Province.

Previously you were consulted during the *Scoping Phase* of the application. The project has proceeded into the *Environmental Impact Assessment* (EIA) Phase. This consultation is therefore required by NEMA as part of the public participation.

As a registered I&AP, you are invited to register and comment on any aspect related to the proposed development between the12th of July 2022 and 12th of August 2022.

BRIEF PROJECT DESCRIPTION

The site is situated north-east of Prieska in the Northern Cape (29° 26' 05.43"S; 23° 03' 03.81"E most centre point of the site) on Portion 2 and the Remainder of Farm Zwem Kuil No. 37 and the Remainder of Farm Smitskloof No. 38, within the Siyathemba Municipal area. The farm can be reached by travelling along the R357 for about 18km onto the Muishoek road. This Muishoek road turns into a gravel road and the farm is reached about 30km straight along this gravel road, until a T-junction is reached. Zwem Kuil farm is left off the T-junction, for another 5km.

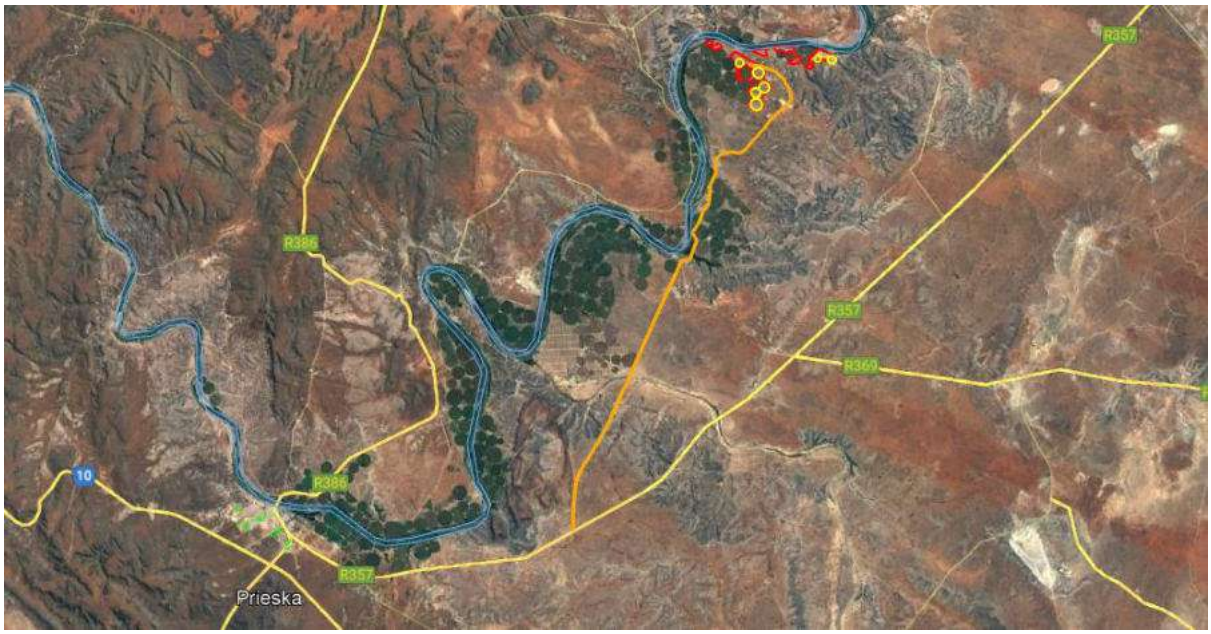


Figure 1: Site location

Digital Soils Africa (Pty) LTD (DSA) was tasked by Zwemkuil Gordonii CC to conduct environmental investigations and complete the environmental application and cultivation of virgin soil. Although 504.7 Ha are under application, only 406 Ha will potentially be cleared

from vegetation to establish crops based on soil suitability. There are existing pivots on the farm and the applicant would like to establish another 6-7 pivots for maize/wheat/lucerne crops and utilise the areas between the existing pivots on the farm for either vineyard or pecan nut crops.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998) AS AMENDED

Environmental Assessment

DSA was appointed by Zwemkuil Gordonii CC as the independent environmental assessment practitioner (EAP) to undertake the Environmental Application and apply for GNR 325 listed activities and the submission of a Scoping Report and Environmental Impact Assessment. According to the latest Government Notice No. 324; 325 & 327, the following Listed Activities were triggered:

GNR 325 (15): The clearance of an area of 20 hectares or more of indigenous vegetation.	*An area of 406 Ha of natural veldt used for grazing will be cleared to establish crops.*
GNR 324: (12) g.ii. The clearance of an area of 300 m^2 or more of indigenous vegetation in the Northern Cape within a critical biodiversity area identified in bioregional plans.	*Although the threshold for clearing of vegetation is covered in the GNR 325 (15) activity, the site does fall within a CBA 1 & 2 area.*

POTENTIAL ENVIRONMENTAL ISSUES

The full impact on all environmental parameters **is provided in the draft EIA and EMP**. For background information, a summary of the most important potential environmental issues is provided below:

Soil Suitability:

A soil survey was conducted on the farm to determine whether the land would be suitable for the cultivation of maize/wheat/lucern/vineyard/pecan nuts. About 504,7 Ha of land was investigated. The soil report and findings were the leading factors in deciding to allocate the crop areas. The soil report concluded that approximately 330 Ha of the survey area is suitable for irrigation. Soils with a freely drainable depth of 1000 mm, which included the Hutton, Augrabies, Prieska, Addo, and sections of the Plooysburg, Prieska, Glenrosa and Vaalbos soil forms were suitable for irrigation. The soil forms not suitable for irrigation (Sections of the Plooysburg, Vaalbos, Brandvlei, Prieska, and Glenrosa) were suitable for vineyards under drip irrigation as the soil could be mechanically altered to accommodate vineyards. The area for vineyard production was approximately 76 Ha. The areas not suitable for irrigation or vineyard production were the Coega and parts of the Glenrosa, Vaalbos, Plooysburg, and Brandvlei soil forms. Soil that had a freely drainable depth of <700 was unsuitable for irrigation and vineyard production.

Based on the findings of the soil report the Applicant must portion the areas allocated for vineyard pecan nut trees and other crops, such as maize, wheat, lucerne, etc., clear the site, and plant the relevant crops. With the recommendations of the soil scientist, the direct impact on the soil properties will decrease to low. The clearing of vegetation and establishing of the crops will continue into the operational phase on a crop rotation basis (applicable to the maize, wheat and lucerne fields) and without mitigation the impact can increase to low-moderate.

Loss of on-site fauna and flora:

The site, according to Mucina and Rutherford (2006), hosts two vegetation types, namely the Upper Gariep Alluvial vegetation, which has a vulnerable conservation status and the Northern Upper Karoo, which has a least threatened conservation status. A vegetation survey was conducted by a SACNASP registered ecologist (Dimela Eco Consulting) to evaluate the sensitivity of the site in terms of the flora component and ecological status.

The direct impact of the development is the complete removal of natural vegetation and the replacement of irrigated areas for crop production, thus the removal of natural vegetation will be permanent and to the extent of about 406Ha. Once the crop areas are operational, the impacts are likely to be contained to the cleared areas with minimum edge effects. According to Dimela Eco Consulting, the following impacts are expected, but can be mitigated:

1. Destruction of natural vegetation
2. Destruction of protected tree and plant species
3. Potential increase in invasive vegetation
4. Degradation of remaining natural vegetation
5. Bush densification
6. Potential pollution of the soil and water

The main mitigation measure to consider is to ensure that open, naturally vegetated areas remain through the cleared areas as ecological corridors while clustering the cleared as is proposed. This could assist the movement of pollinators and the continuation of ecological processes.

According to Dimela Eco Consulting, one species, listed as Rare, has a likelihood of occurring: *Tridentia virescens* and the likelihood of occurring is considered medium to low. No further plant species of conservation concern assessments are thought to be needed.

In terms of alien vegetation, according to Dimela Eco Consulting, the vegetation in the study area is prone to bush densification whereby open veld, in the absence of good veld management, becomes denser and dominated by stands of encroacher species e.g. "stands of plants of the kinds specified in Table 4 of Regulation 16 (CARA), where individual plants are closer to each other than three times the mean crown diameter". Plants in this group are not alien plants, but indigenous plants that tend to become abnormally abundant when the area is degraded. The plants themselves are thus not the problem, but their increased abundance or encroachment into vegetation serves as an indicator of poor land management practices. Several species occurring on the site could become encroachers e.g. *Lycium species, Rhigozum trichotomum, Senegalia mellifera* and *V karroo*. Clearing edge effects and operational

disturbances can result in the densification of such species, a change in vegetation composition, and a loss of species diversity, particularly grass and forb species.
During the construction phase the impact will be the highest and is rated moderate-high without mitigation, but decrease to low-moderate during the operational phase with mitigation.
The occurrence of faunal species within the proposed area is likely, however, it is farm properties and generally fenced-in camps, which will hinder 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*).
During the construction phase, the clearing of vegetation will destroy habitat and put animals at risk of being killed, and nesting places being destroyed will have a direct impact on animals living in the study area. Once clearing of natural vegetation has occurred the impact on the habitat had occurred and during the operational phase of planting and harvesting crops, the impact on the habitat will be negligible as the same area will be disturbed and replanted. Crops might provide food for animals, but not a shelter, except perhaps the pecan nut trees.
The clearing of vegetation would be restricted to limited areas and the fairly slow clearance rate would provide adequate time for migration of any animals remaining on-site to be sustained in similar adjoining habitats. Also, noise generated by vehicles will cause most animals to vacate the site temporarily. If certain species were to be affected they would simply vacate the proposed cleared areas during the day and return during the night. Since adequate buffer zones will be maintained from drainage lines, the clearing of vegetation will not impact amphibian species.
During the vegetation survey, no special ecological niche was identified that would provide a 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 conclusion, the 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-moderate. If certain species were to be affected they would simply vacate the proposed cleared areas during the day and return during the night.

Sensitive Sites:

According to the Northern Cape Biodiversity Conservation Plan, the site falls within a Terrestrial CBA 1 area.

According to the Spatial Development Framework environmental sensitivity of the municipal area has been mapped and the site falls within an environmental area that is rated 2 and thus fairly low sensitivity.
To assess the sensitivity of the environment onsite verification is therefore essential. The Site Ecological Importance (SEI) is discussed in detail in the report submitted by Dimela Eco Consulting. Much of the vegetation on the sites were in a good ecological condition, and due to its size and limited disturbances, rates high in its functional integrity and scores a medium SEI.
Most of this vegetation also falls within CBAs, which should ideally remain in a natural state. However, areas that were historically cleared and highly disturbed were rated as very low and low SEI. Also, most of the vegetation on the site is not unique and the Upper Nama Karoo vegetation is not considered threatened.
Dimela Eco Consulting identified five (5) species that were short-listed to have a possibility of occurring, and for which the habitat assessment was undertaken. None of these species was recorded in walked transects on the sites and the habitat assessment agrees with the screening tool report which indicates much of the site as being of low plant species sensitivity. Only one species, listed as Rare, has a likelihood of occurring: *Tridentia virescens*. Dimela Eco Consulting indicated that no further plant species of conservation concern assessments are thought to be needed.
The clearing of vegetation will be restricted to approved areas and a 100m buffer area between the clearance and drainage lines and Orange River will be maintained, thus no surface water systems will be impacted.
The objective will be to reduce the biodiversity impact due to the clearance of vegetation through an 'offset plan'. The principal approach to biodiversity offsets is to provide a '*like for like or better*' area to compensate for the area which will be negatively affected. Offsets that do not involve securing and managing habitat but include funding research, education, staffing, etc. are generally believed to be unacceptable for impacts on biodiversity. Biodiversity offsets are to be used in cases where the EIA process identifies negative residual impacts of 'medium' or 'high' significance on biodiversity. Activities resulting in impacts of 'low' significance may not require an offset. Since the impact is rated moderate-high without mitigation and reduced to moderate with mitigation, the remaining 98.7 Ha between the irrigated areas will be used as a nursery for the transplant of the geophytes species and control of alien vegetation as an offset plan.

PUBLIC PARTICIPATION

In terms of the NEMA, public participation forms an integral part of the environmental assessment process. The public participation process provides people who may be affected by the proposed development with an opportunity to provide comments and raise issues of concern about the project or to make suggestions that may result in enhanced benefits for the project.
For this application, there will be two phases of public participation.

1. Scoping Phase was completed.

2. EIA Phase, is in process.

During the Scoping Phase, *potential* interested and affected parties (I&APs) are given notice via a notice board and local newspaper advertisement in the Oewer Newspaper on 15 April 2022, informing the public of the application. No person or entity registered as a result of the notice boards or advertisement.

Registered I&APs were considered to be directly abutting neighbours and organs of state that have jurisdiction of the area, e.g. the Municipality, Ward counsilor, etc., and was be provided with a Background Information Document and given access to a digital copy of the Scoping Report on Digital Soils website for comment.

Comments and issues raised during the Scoping Phase of the public participation process were captured in the Final Scoping Report and draft EIA, evaluated, and included in a Public Participation Report. These issues were addressed and included in the Final Scoping Report, which was submitted to the Department of Agriculture, Environmental Affairs, Rural Development, and Land Reform, as well as the draft EIA.

During the EIA Phase of public participation, only those I&AP's that are registered are given notice and access to a digital copy of the Draft Environmental Impact Assessment Report (draft EIA) on the Digital Soils website for comment.

Comments and issues raised during the EIA Phase of the public participation process will be captured, evaluated, and included in a Public Participation Report. These issues will be addressed and included in the Final EIA Report, which will be submitted to the Department of Agriculture, Environmental Affairs, Rural Development, and Land Reform.

To submit a comment as an Interested and Affected Party, please respond in writing to the following email: natalie@dsafrica.co.za on or before 12 August 2022 no later than 5pm.

Alternatively, a copy of the Draft EIA Report is also available on the DSA website at www.dsafrica.co.za. Please follow the link to Services, Environmental Services, Documents and choose the Zwemkuil link. To access the loaded documents use the password: zWem@no37.

If you have any other questions or inquiries, please do not hesitate the contact the office at 067 622 5687. If no comments are received from you, it will then be regarded that you do not have any comments.

APPENDIX D

ENVIRONMENTAL MANAGEMENT PLAN

For the

Application for Environmental Authorisation for the clearing of vegetation on Ptn 2 and the Remainder of Farm Zwem Kuil No. 37 and the Remainder of Farm Smitskloof No. 38, Prieska

Prepared for

ZWEMKUIL GORDONII CC

Reference: NC/EIA/03/PIX/SIY/PRI1/2022

DSA
Digital Soils Africa

+27 82 414 0472
www.dsafrica.co.za
natalie@dsafrica.co.za
1 Kemsley Street
Port Elizabeth

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BACKGROUND

Digital Soils Africa (Pty) LTD (DSA) was tasked by Zwemkuil Gordonii CC to conduct environmental investigations and complete the Environmental Authorisation Application for the authorisation of clearing 406Ha of vegetation on Ptn 2 and the Remainder of the Farm Zwem Kuil No. 37 and the Remainder of Farm Smitskloof No. 38, 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 Zwemkuil Godronii CC (also referred to as the Applicant) 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.

The Applicant would like to develop 504.7Ha of which about 406Ha of vegetation will be cleared to establish pivots for irrigating maize, wheat crops, lucerne, and vineyard and pecan nut trees. The rest of the 98.7 Ha that are located between the proposed crop areas should be used as an offset area and preserve for conservation purposes and possible transplant of vegetation.

An application to cultivate virgin soil (or commonly known as a plough certificate) will also be applied for at the Department of Agriculture to ensure all legal requirements for such a development are met.

The Applicant has existing water use rights and therefore does 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.

DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

Environmental Assessment Practitioner (EAP): Natalia Sharp
Postal address: 1 Kemsley Road; Richmond Hill, Gqeberha, 6001
Telephone: 067 622 5687
Cell Phone: 082 414 0472
Email: natalie@dsafrica.co.za
EAP qualifications: B.Sc (Botany and Zoology) (UFS); B.Sc. (Hons) Limnology (UFS); Masters in Environmental Management: Evaluation of Phytoplankton as an indicator in a biomonitoring program, with special reference to the Modder River.
EAP Registrations/Associations: SACNASP (123443) & Reg. EAP (2020/230)

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 for detailed CV and qualifications). Natalie Sharp has worked in the environmental industry for over seventeen years.

SUMMARY OF THE CV

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] 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 36 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 11 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.

PURPOSE OF THE DOCUMENT

This document serves as a programme to manage the environmental impacts during the pre-construction, construction, and operational phases of the proposed development. This document will provide mitigation measures to prevent, reduce, avoid, or rehabilitate and mitigation measures must be implemented during all the phases of the development. The objective will be to limit the negative impacts and increase positive impacts.

The Environmental Management Plan (EMP) will also:

- Provide applicable legislative framework;
- Provide management objectives, and actions to achieve such objectives;
- List roles and responsibilities;
- Provide record-keeping methods, auditing or review, and report writing;

SITE LOCALITY

The site is situated north-east of Prieska in the Northern Cape (29° 26' 05.43"S; 23° 03' 03.81"E most centre point of the site) on Portion 2 and the Remainder of Farm Zwem Kuil No. 37 and the Remainder of Farm Smitskloof No. 38, within the Siyathemba Municipal area. The farm can be reached by travelling along the R357 for about 18km onto the Muishoek road. This Muishoek road turns into a gravel road and the farm is reached about 30km straight along this gravel road until a T-junction is reached. Zwem Kuil farm is left off the T-junction, for another 5km.

1 Kemsley Street
Gqeberha
6001

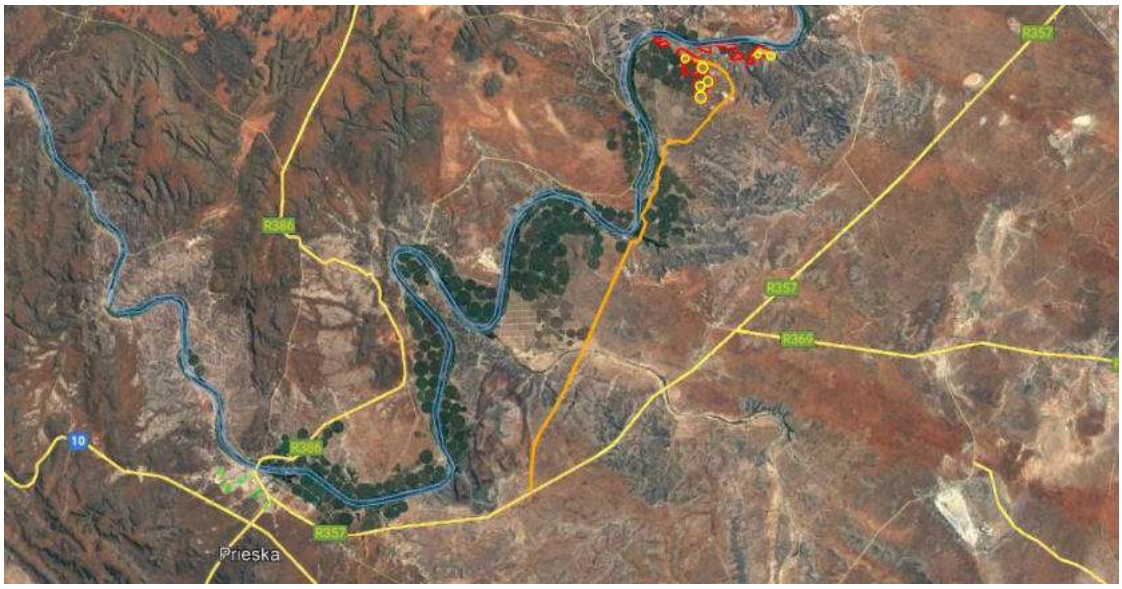

FIGURE 1: SITE LOCATION. THE ORANGE RIVER IS THE BLUE LINE, THE MUISHOEK ROAD IS THE ORANGE LINE, THE PROPOSED SITE IS REPRESENTED BY THE RED AND YELLOW POLYGONS.

SGID of the properties under application:

C060 0000 0000 0037 00000
C060 0003 0000 0037 00002
C060 0003 0000 0038 00000

www.dsafrica.co.za natalie@dsafrica.co.za

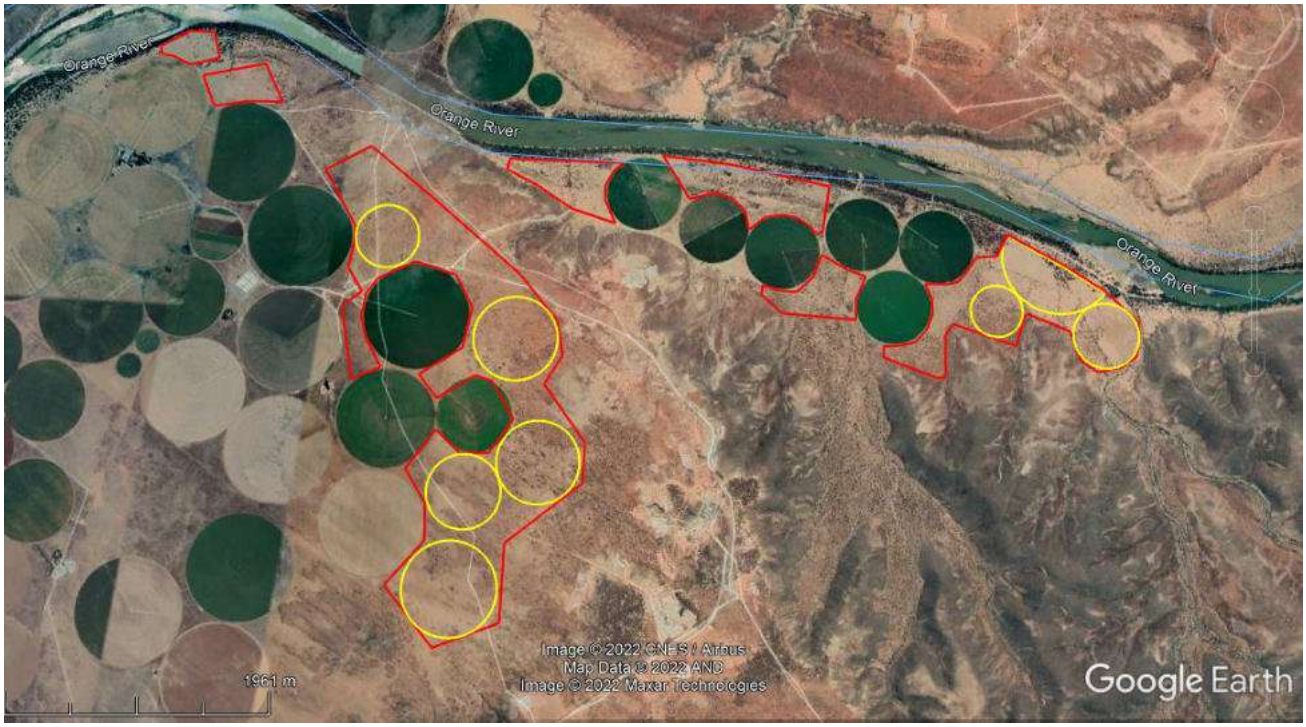

FIGURE 2: THE SITE IN TOTAL. THE RED POLYGON REPRESENTS THE ENTIRE SITE UNDER APPLICATION (EARMARKED NUTS OR VINEYARD CROP PRODUCTION). THE YELLOW POLYGONS REPRESENT THE PROPOSED AREAS FOR ADDITIONAL PIVOTS (MAIZE/WHEAT/LUCERNE).

Google Images of the different sites

natalie@dsafrica.co.za

FIGURE 3: UPPER WESTERN SECTION OF THE FARM UNDER APPLICATION

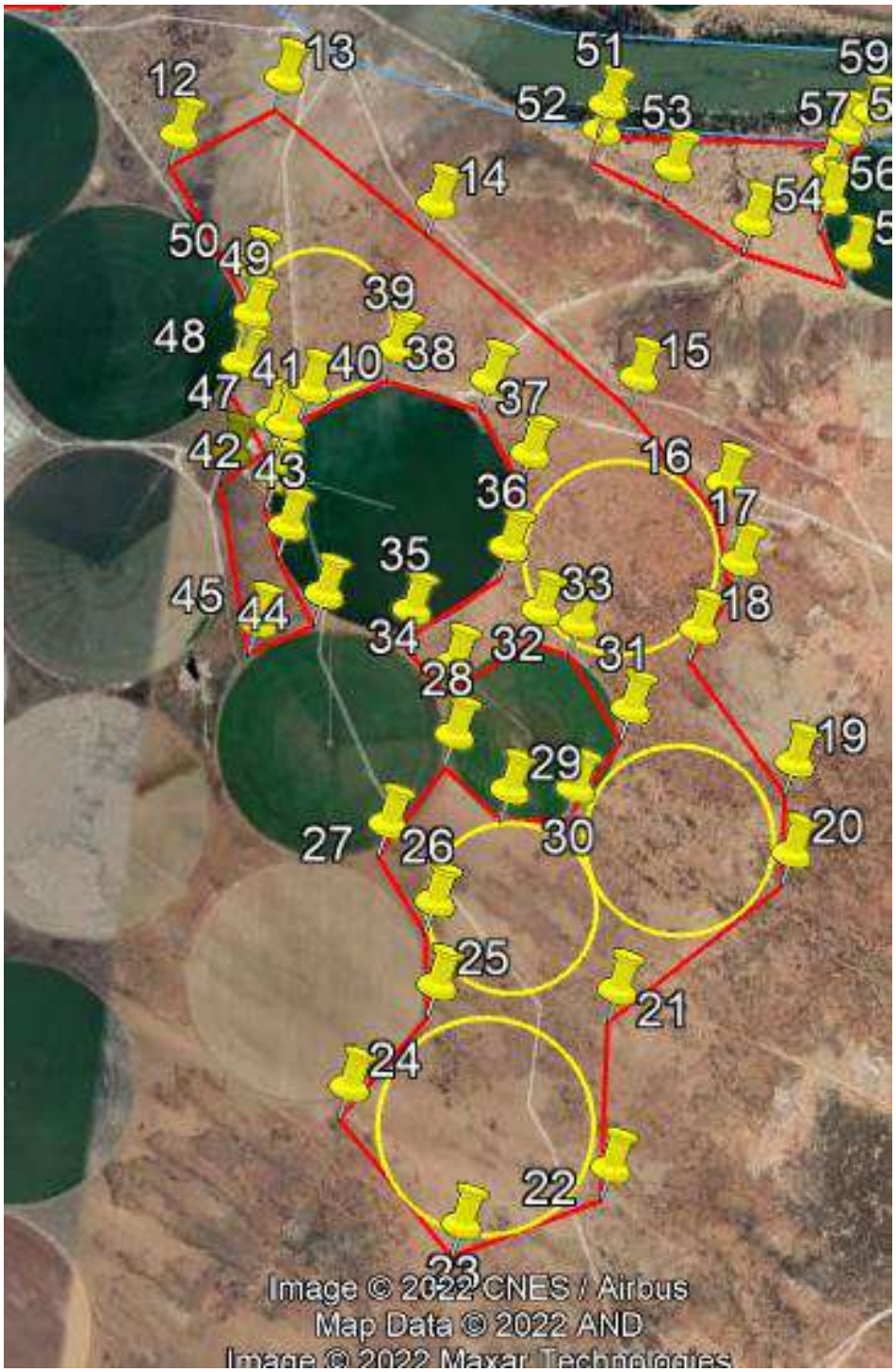

FIGURE 4:THE SOUTHERN SECTION OF THE FARM UNDER APPLICATION. THE RED POLYGON REPRESENTS THE SITE, WHILE THE YELLOW POLYGONS REPRESENT THE POSSIBLE PLACEMENT OF PIVOTS.

FIGURE 5:THE UPPER-EASTERN SECTION OF THE FARM UNDER APPLICATION. THE RED POLYGON REPRESENTS THE SITE, WHILE THE YELLOW POLYGONS REPRESENT THE POSSIBLE PLACEMENT OF PIVOTS.

Coordinates of the site

ID	X	Y
1	23,0188511	-29,4183826
2	23,02107203	-29,41698806
3	23,023008	-29,41693026
4	23,0238151	-29,4186782
5	23,02154241	-29,41942798
6	23,02007274	-29,41891235
7	23,02273873	-29,42010672
8	23,02754528	-29,41868791
9	23,02955175	-29,42126379
10	23,02684208	-29,42154452
11	23,0242143	-29,42225404
12	23,0339359	-29,42574302
13	23,03730643	-29,42363801
14	23,04312933	-29,42686638
15	23,05082288	-29,4313428
16	23,05424962	-29,43419303
17	23,0550756	-29,4365165
18	23,05397036	-29,43868232
19	23,05779684	-29,44230255
20	23,05805945	-29,44500666
21	23,05269207	-29,44969954
22	23,05320463	-29,45497763
23	23,04837075	-29,45719545
24	23,04397192	-29,4535656
25	23,04652111	-29,45023248
26	23,04608951	-29,4477739
27	23,04416598	-29,44564468
28	23,0460454	-29,442733
29	23,04817005	-29,44416395
30	23,05040742	-29,44387699
31	23,05195668	-29,44131314
32	23,04980022	-29,43897009
33	23,04846558	-29,43871028
34	23,04572963	-29,44061784
35	23,04404326	-29,43917027
36	23,04709123	-29,43692866
37	23,04742555	-29,43404484
38	23,04573718	-29,43198822
39	23,04238164	-29,4313787
40	23,03958325	-29,43292979
41	23,03888251	-29,43409694
42	23,03877631	-29,43572442
43	23,03941569	-29,43712754
44	23,04096472	-29,43901595
45	23,03881228	-29,44012132
46	23,03713739	-29,43514574
47	23,03847655	-29,43396357
48	23,03706923	-29,43240879
49	23,03725679	-29,43087452
50	23,03709746	-29,42946973
51	23,0485961	-29,42322482
52	23,0484927	-29,42401745
53	23,05113685	-29,42488054
54	23,05409839	-29,42622797
55	23,05772161	-29,42684012
56	23,0566245	-29,4252894
57	23,05654147	-29,42419779
58	23,05702169	-29,42311914
59	23,0577081	-29,42247155
60	23,06081067	-29,42158014
61	23,06339732	-29,42439669
62	23,06533005	-29,4237611
63	23,06683045	-29,42396269
64	23,06790607	-29,42475272
65	23,06841636	-29,4260655
66	23,06961088	-29,42501833
67	23,07094439	-29,42469365
68	23,07212913	-29,42471669
69	23,0732708	-29,42522919
70	23,07382277	-29,42576495
71	23,07428322	-29,42546174
72	23,07442625	-29,42220614
73	23,06634111	-29,42153865
74	23,0744466	-29,4271512
75	23,07397644	-29,42879315

76	23,07274981	-29,42993894
77	23,07128608	-29,43005282
78	23,07004215	-29,42982835
79	23,07007288	-29,43050023
80	23,07189618	-29,43161583
81	23,07763382	-29,43130943
82	23,07756528	-29,42989562
83	23,07798395	-29,42875823
84	23,07810474	-29,42823952
85	23,0766498	-29,4279444
86	23,082841	-29,42822114
87	23,08343604	-29,42918666
88	23,08367102	-29,43023833
89	23,08341081	-29,4313691
90	23,08256566	-29,43237217
91	23,08135959	-29,43273999
92	23,08010185	-29,43294266
93	23,08018848	-29,43371704
94	23,0846089	-29,43460733
95	23,08523093	-29,43446838
96	23,08488143	-29,43147618
97	23,08542382	-29,43073689
98	23,09049959	-29,43173152
99	23,09097896	-29,42936685
100	23,09457671	-29,43016694
101	23,09571792	-29,4320947
102	23,0970641	-29,43276357
103	23,09885575	-29,43222233
104	23,10004696	-29,43135752
105	23,10010893	-29,43007691
106	23,09989903	-29,42891241
107	23,0982619	-29,42780587
108	23,09698297	-29,42712442
109	23,09365908	-29,42572302
110	23,08897185	-29,42400644
111	23,08821608	-29,42565467
112	23,086589	-29,4259346
113	23,08604932	-29,4269654
114	23,08540359	-29,42779775
115	23,08466033	-29,42804102

Total area under application: 504.7 Ha
Area expected to be cleared: 406 Ha
Area set aside for offset: 98.7 Ha

www.dsafrica.co.za natalie@dsafrica.co.za

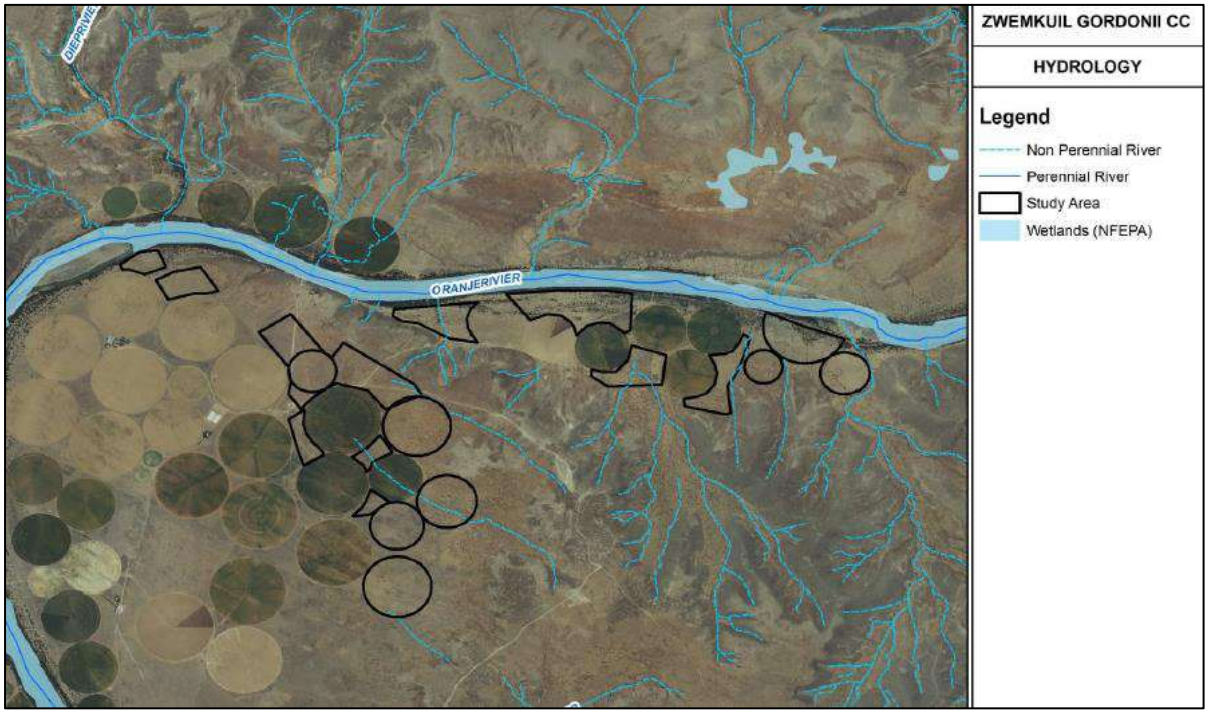

FIGURE 6: SENSITIVE AREAS INDICATED ABOVE. THE BLUE LINES REPRESENT DRAINAGE LINES AND THE ORANGE RIVER, THE BLACK POLYGONS THE PROPOSED SITE.

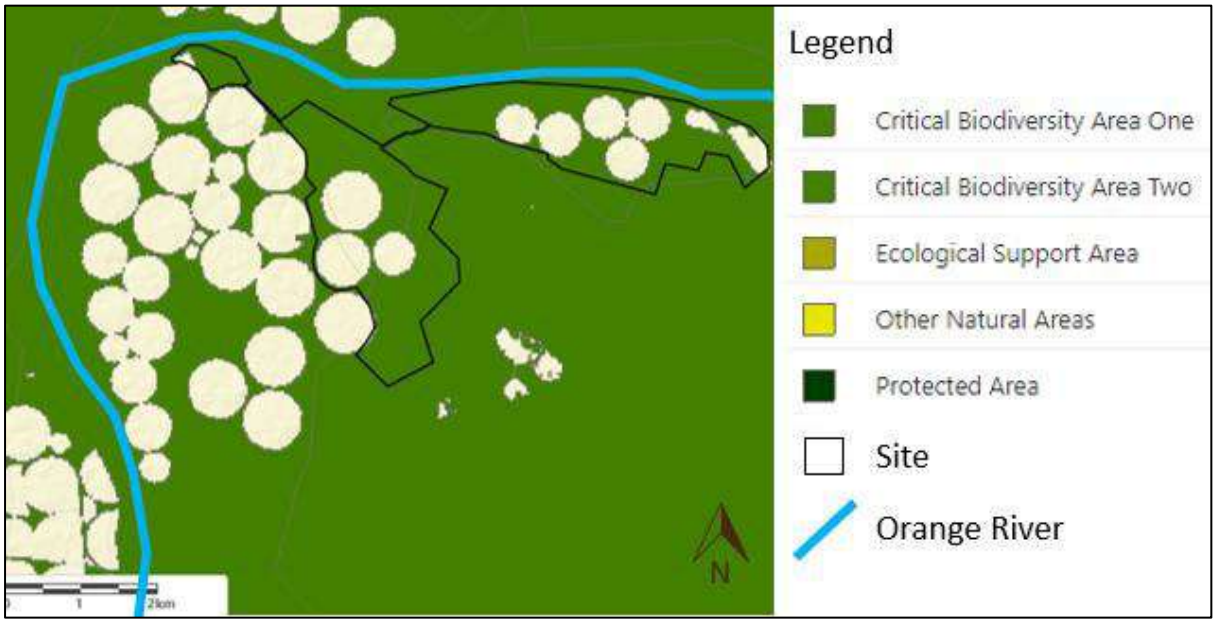

FIGURE 7: THE SITE FALLS WITHIN CBA ACCORDING TO THE BGIS OF THE NORTHERN CAPE BIODIVERSITY CONSERVATION PLAN.

DESCRIPTION OF THE PROPOSED LISTED ACTIVITIES

Act. No.	Listings	Describe the portion of the proposed project to which the applicable listed activity relates.	Coordinates of listed activities (centre point coordinates of the listed activity location)
Activity 15	The clearance of an area of 20 hectares or more of indigenous vegetation.	The site is 504.7 Ha in size, but only 406Ha of vegetation will be cleared for the establishment of crops. Therefore the transformation of grazing land to crop land.	29° 26' 18.33"S 23° 02' 47.71"E

The proposed development will transform 406 Ha of natural vegetation currently being used as a natural grazing area into maize, wheat, lucerne, vineyard and pecan nuts on the Ptn 2 and the Remainder of Farm Zwem Kuil No. 37, and the Remainder of Farm Smitskloof No. 38, Prieska. The 98.7Ha area between the crop areas will be used as a nursery to transplant vegetation rescued from the site.

The clearance of vegetation will take place over the next 5 years.

LEGISLATIVE REVIEW

ENVIRONMENTAL ASSESSMENTS UNDERTAKEN FOR THE DEVELOPMENT

In terms of the National Environmental Management Act 107 of 1998 ("NEMA"), environmental authorization must be obtained before any person can conduct activities that cause damage to the environment. Environmental legislation intends to regulate the interaction of human life with the natural environment. The purpose of environmental legislation is to protect and preserve the environment for current and future generations. The following Acts and Regulations apply to the proposed project:

LEGISLATION

The legislation was discussed in detail in the Final Scoping Report and would therefore not be repeated in this section. A summary of the applicable legislation include:

- Section 24 of the **Constitution of the Republic of South Africa Act (No 108 of 1996)**
- The **National Environmental Management Act (Act No 107 of 1998)**
- The **Environmental Impact Assessment Regulations**: 324, 325, 326 & 327 of 7 April 2017.

In terms of 2014 NEMA EIA Regulations, as amended, the activities listed in the below Table (Table 1) will be triggered by the clearing of vegetation, thereby requiring an EA from the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARDLR).

TABLE 1: EIA LISTED ACTIVITIES

Government Notice No. R325 Activity No(s):	Details of Activity(ies) requiring a Scoping Report and EIA
Activity 15	The clearance of an area of 20 hectares or more of indigenous vegetation.

- The **National Water Act (No. 36 of 1998) (NWA)**
- The **National Environmental Management: Biodiversity Act**
- The **National Environmental Management: Protected Areas Act**
- The **National Forests Act No. 84 of 1998 (NFA) & List of Protected Tree Species under the National Forest Act, 1998 (Act No. 84 of 1998)**
- **Conservation of Agricultural Resources Act (Act 43 of 1983)**
- **Bio-regional Plans:**

In terms of the provincial and local protected areas and considering all the maps available and data presented, it is concluded that the NPAES, the Northern Cape PAES, the Northern Cape Biodiversity Conservation Plan (NCBCP), and the Pixley Ka Seme SDF all indicate that the proposed site does not fall within any biodiversity-sensitive area.

- **Northern Cape Nature Conservation (Act 09 of 2009)**
- **The Provincial Spatial Development Framework for the Northern Cape (Office of the Premier of the Northern Cape, 2012)**
- The **National Heritage Resources Act (No 25 of 1999)**

PROJECT DESCRIPTION

Development/Phases

The majority of the surveyed area is suitable for irrigation, due to the A and B horizons that are characteristically sandy and therefore will facilitate good drainage. The drainage restricting layers were the major determining factor for suitability. Approximately 5% of the area has a shallow depth and is not suitable for irrigation or vineyard, while essentially 15% is suitable for vineyard production under drip irrigation. The rest of the area is suitable for all irrigation.

Therefore, it was recommended in the soil report that the irrigation areas do not exceed more than 10% of unsuitable soil. Areas with a freely drainable depth >1000 mm is suitable for irrigation with no restrictions, while soils with a depth of 700 - 1000 mm could be used for vineyard production under drip irrigation. Areas with a depth of less than 700 mm are considered not suitable for irrigation or vineyard.

The clearance of vegetation will take place over the next 5 years. The construction phase will result in the clearing of natural veld on the allocated irrigation areas according to the soil report and preparing the soil.

After about 5 years after the commencement of the project, all the areas applied for should be cleared and the crop production should be established. It will be managed and maintained by the farmer and will be a permanent establishment.

This is a permanent change from natural grazing to crop production. Should the activity be authorized, it is highly unlikely that the proposed development will be decommissioned. However, should crop production cease, the site will be used for pasture. Should the Applicant elect to decommission the crops and pasture land at any point in the future, the necessary authorization must be obtained and the correct decommissioning protocol must be followed. The relevant Government 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 a near-natural state with natural vegetation cover. A qualified botanical specialist should be contacted for more information on rehabilitation techniques.

Ownership

The proposed site and two properties are owned by the JJ Loots Family Trust and Mr. D.E. Loots. The Applicant is Zwemkuil Gordonii CC, of which Mr. JJ Loots is a director and Trust member of the JJ Loots

Family Trust, and his father is Mr. D.E. Loots. On 11 Maart 2022, Mr. D.E. Loots indicated he supports the proposed development. Mr. JJ Loots will therefore manage and maintain the site during the construction and operational phases, and if need be the decommissioning phase.

Zoning

The site is zoned Agriculture and the proposed development is not an application for a change of land used. The project will simply entail the change of grazing land to crop production. Therefore, *no* application in terms of the Subdivision of Agricultural Land Act (SALA) Act 70 of 1970 for sub-division and rezoning, is necessary.

Water source

In terms of the Orange River, Blocks A, N, O and S (see Figure 8) will be positioned more than 100m from the river, therefore no Section 21 (c) & (i) applications are required. In terms of the natural drainage lines on the farm, there are a few that run through the proposed site, specifically Blocks J, L, P & N. DWS will be consulted, but it is proposed that 32m distance from the drainage lines be kept which will not impact the natural drainage of the site.

The Applicant has an existing water use right, DWS was however consulted during the public participation process, therefore a Section 21 (a) application in terms of the NWA is not required. In the future, they might apply for an increase in usage, however, at this stage, it is not required.

In terms of NEMA, the clearing of vegetation will not take place within 32m from the drainage line and would not trigger any additional listed activity.

Irrigation

Yield losses are the consequence of over- or under-irrigation and the problem can be greatly overcome by scheduling water use. 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 to prevent soil degradation and protect the water resource.

Drainage

According to the soil report, the A and B horizons are characteristically sandy and therefore will facilitate good drainage and the soil texture results confirm the morphological interpretations and good drainage is expected on the soils.

The laboratory results indicate that the chemical parameters are manageable. The exchangeable sodium percentage (ESP) values are low and the pH values indicate that salinity is not a major risk. The study area (excluding the Brandvlei soil areas) is of low risk to salinization, with low ESP and EC together

with good drainage. A fertilization plan on soils with low CEC should be implemented to ensure maximum crop production.

METHOD STATEMENT & ACTIVITY SPECIFIC MANAGEMENT PLAN

The Method Statements set out the materials, labour, and method that the contractor proposes using to carry out an activity, identified by the Environmental Officer and/or Project Manager/Farm Manager. The Method Statements contain sufficient detail such that the Environmental Officer and Project/Farm Manager can assess whether the Contractor's proposal is following the requirements of the Environmental Management Plan. The contractor must sign each Method Statement along with the Environmental Officer and Project/Farm Manager to formalize the approved Method Statement. Method Statements and/or Management Plans must be submitted by the Contractor to the Project/Farm Manager and Environmental Officer for approval before the commencement of the activity.

The Method Statements for this project, as a minimum, must include:

- Soil Management and Erosion;
- Stormwater control/drainage;
- Flora & Fauna Management;
- Water Quality & Aquatic Health;
- Fires
- Waste

Method Statements must address the following aspects:

- What – a brief description of the work to be undertaken;
- How – a detailed description of the process of work, methods, and materials;
- Where – a description of the location of the work (if applicable); and
- When – the sequencing of actions with commencement and completion date estimates.

Since this is a farm project it is unlikely that an Environmental Control Officer will be appointed. Therefore, such responsibilities and duties will be transferred to the Project/Farm Manager and/or Applicant, who must monitor the implementation of the Method Statements and activity-specific management plans during the operation phase of the project.

FIGURE 8: PROPOSED LABELLING OF THE DIFFERENT BLOCKS OF THE STUDY AREA.

A soil suitability study for the proposed crop establishment was completed by the soil scientists of Digital Soils Africa (Pty) Ltd to establish if the soil is suitable for the establishment of crops. The results indicated that the drainage is sufficient and crops can be planted at the proposed site. The only restriction is that Blocks C, D, E, L & M must only be used for vineyards under drip irrigation and only include 10% of the unsuitable soils in the development. Ideally, Blocks G, H, I, J & K are best suited for pecan nut trees, while the remaining areas can be used for maize, wheat, lucerne, etc.

Application to cultivate virgin soil and environmental applications were completed by Digital Soils Africa (Pty) Ltd and submitted to the Department of Agriculture (Directorate Land Use & Soil Management), Environmental Affairs (Environmental Impact Management Unit), Rural Development and Land Reform.

PRE-CONSTRUCTION PHASE MANAGEMENT

Upon pre-application field investigations, an initial 504.7 Ha was presented as a potential development area. However, specialist studies conducted during the Scoping phase, have indicated that only 406 Ha is suitable for development to minimize the impacts on the physical, biological, and socio-economic aspects of the proposed development.

The soil report and findings were the leading factors in deciding to allocate the irrigated areas. Deep soil depths, favoured soil types, and drainage led to the best soil suitability areas.

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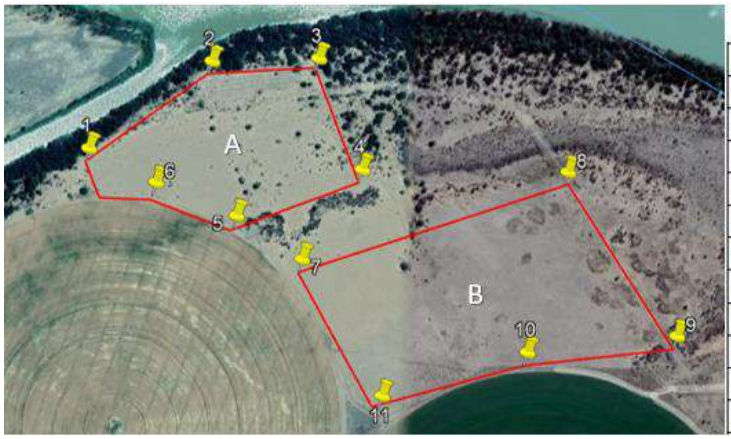
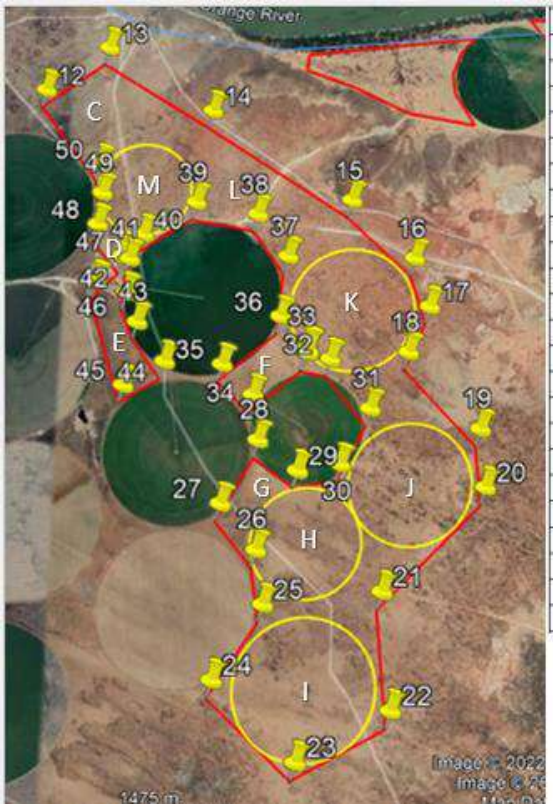
The next step is to demarcate the irrigated areas before clearing the vegetation to avoid unnecessary disturbance. The development perimeter must be demarcated using beacons.



ID	X	Y
1	23,0188511	-29,4183826
2	23,02107203	-29,41698806
3	23,023008	-29,41693026
4	23,0238151	-29,4186782
5	23,02154241	-29,41942798
6	23,02007274	-29,41891235
7	23,02273873	-29,42010672
8	23,02754528	-29,41868791
9	23,02955175	-29,42126379
10	23,02684208	-29,42154452
11	23,0242143	-29,42225404

FIGURE 9: COORDINATES OF BLOCKS A & B: RECOMMENDED CROP ESTABLISHMENT CAN INCLUDE MAIZE, WHEAT, LUCERNE, & VINEYARD.



12	23,0339359	-29,42574302
13	23,03730643	-29,42363801
14	23,04312933	-29,42686638
15	23,05082288	-29,4313428
16	23,05424962	-29,43419303
17	23,0550756	-29,4365165
18	23,05397036	-29,43868232
19	23,05779684	-29,44230255
20	23,05805945	-29,44500666
21	23,05269207	-29,44969954
22	23,05320463	-29,45497763
23	23,04837075	-29,45719545
24	23,04397192	-29,4535656
25	23,04652111	-29,45023248
26	23,04608951	-29,4477739
27	23,04416598	-29,44564468
28	23,0460454	-29,442733
29	23,04817005	-29,44416395
30	23,05040742	-29,44387699
31	23,05195668	-29,44131314
32	23,04980022	-29,43897009
33	23,04846558	-29,43871028
34	23,04572963	-29,44061784
35	23,04404326	-29,43917027

36	23,04709123	-29,43692866
37	23,04742555	-29,43404484
38	23,04573718	-29,43198822
39	23,04238164	-29,4313787
40	23,03958325	-29,43292979
41	23,03888251	-29,43409694
42	23,03877631	-29,43572442
43	23,03941569	-29,43712754
44	23,04096472	-29,43901595
45	23,03881228	-29,44012132
46	23,03713739	-29,43514574
47	23,03847655	-29,43396357
48	23,03706923	-29,43240879
49	23,03725679	-29,43087452
50	23,03709746	-29,42946973

FIGURE 10: COORDINATES OF BLOCKS C, D, E, F, G, H, I, J, K, L, & M: RECOMMENDED CROP ESTABLISHMENT CAN INCLUDE VINEYARD UNDER DRIP IRRIGATION FOR BLOCKS, C, D, E, L & M AND ONLY INCLUDE 10% OF THE UNSUITABLE SOILS IN THE DEVELOPMENT. RECOMMENDED PECAN NUT TREES FOR BLOCKS G, H, I, J & K.

51	23,0485961	-29,42322482	63	23,06683045	-29,42396269	75	23,07397644	-29,42879315
52	23,0484927	-29,42401745	64	23,06790607	-29,42475272	76	23,07274981	-29,42993894
53	23,05113685	-29,42488054	65	23,06841636	-29,4260655	77	23,07128608	-29,43005282
54	23,05409839	-29,42622797	66	23,06961088	-29,42501833	78	23,07004215	-29,42982835
55	23,05772161	-29,42684012	67	23,07094439	-29,42469365	79	23,07007288	-29,43050023
56	23,0566245	-29,4252894	68	23,07212913	-29,42471669	80	23,07189618	-29,43161583
57	23,05654147	-29,42419779	69	23,0732708	-29,42522919	81	23,07763382	-29,43130943
58	23,05702169	-29,42311914	70	23,07382277	-29,42576495	82	23,07756528	-29,42989562
59	23,0577081	-29,42247155	71	23,07428322	-29,42546174	83	23,07798395	-29,42875823
60	23,06081067	-29,42158014	72	23,07442625	-29,42220614	84	23,07810474	-29,42823952
61	23,06339732	-29,42439669	73	23,06634111	-29,42153865	85	23,0766498	-29,4279444
62	23,06533005	-29,4237611	74	23,0744466	-29,4271512			

FIGURE 11: COORDINATES OF BLOCKS N, O & P: RECOMMENDED CROP ESTABLISHMENT CAN INCLUDE MAIZE, WHEAT, & LUCERNE.

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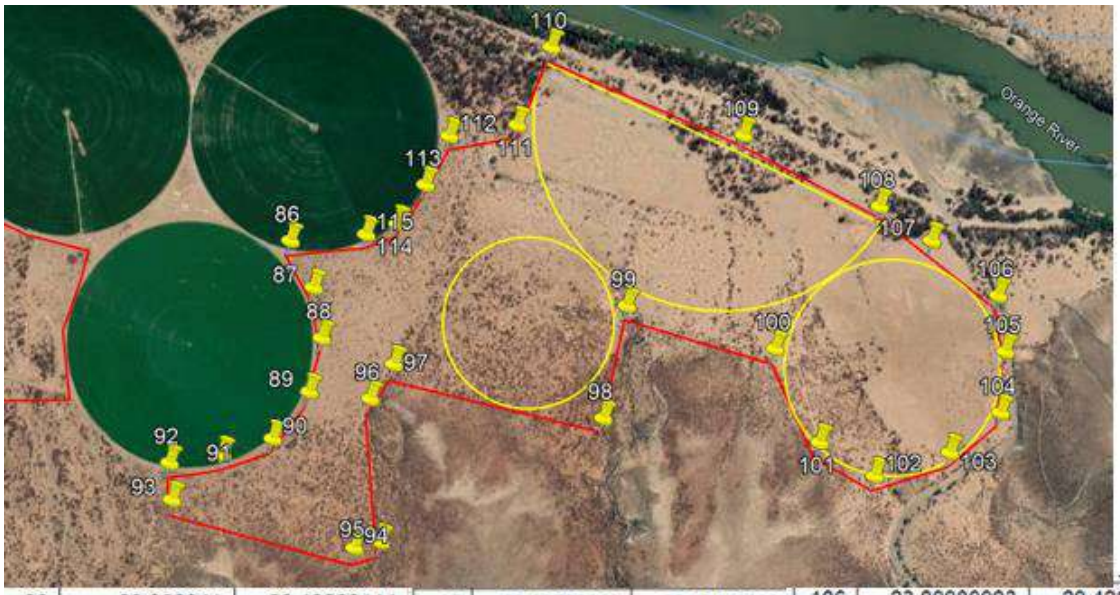

86	23,082841	-29,42822114	95	23,08523093	-29,43446838	106	23,09989903	-29,42891241
87	23,08343604	-29,42918666	96	23,08488143	-29,43147618	107	23,0982619	-29,42780587
88	23,08367102	-29,43023833	97	23,08542382	-29,43073689	108	23,09698297	-29,42712442
89	23,08341081	-29,4313691	98	23,09049959	-29,43173152	109	23,09365908	-29,42572302
90	23,08256566	-29,43237217	99	23,09097896	-29,42936685	110	23,08897185	-29,42400644
91	23,08135959	-29,43273999	100	23,09457671	-29,43016694	111	23,08821608	-29,42565467
92	23,08010185	-29,43294266	101	23,09571792	-29,4320947	112	23,086589	-29,4259346
93	23,08018848	-29,43371704	102	23,0970641	-29,43276357	113	23,08604932	-29,4269654
94	23,0846089	-29,43460733	103	23,09885575	-29,43222233	114	23,08540359	-29,42779775
			104	23,10004696	-29,43135752	115	23,08466033	-29,42804102
			105	23,10010893	-29,43007691			

FIGURE 12: COORDINATES OF BLOCKS Q, R, S & T: RECOMMENDED CROP ESTABLISHMENT CAN INCLUDE MAIZE, WHEAT, & LUCERNE.

Important of the pre-construction management is to consult and appoint:

- A soil scientist to design the irrigation scheduling.
- Botanist to assist in translocating plant species.

CONSTRUCTION PHASE MANAGEMENT

Should the activity be authorized, the overall goal for the construction phase is to manage the activities associated with the construction of the site in such a way that:

- The receiving environment is protected from degradation and harm;
- There is timeous detection of, and responses to, environmental change due to monitoring;

- The activity complies with all relevant legislation, permits, and authorizations.

The Applicant is responsible for the ongoing management of the site. All measures and conditions described by the soil scientist, botanist, heritage specialist, in this EMP, the Environmental Authorisation, and any other relevant documents/legislation, should be strictly adhered to during the construction and operational phase.

Project activities in the Construction phase may include:

- Plant and animal search and rescue;
- Cut, destroy and/or transplant protected tree species – considering that no removal may take place without appropriate permits from the Department of Forestry;
- Construction of irrigation system as per soil scientist design for the irrigation scheduling;
- Alien vegetation control measurements;
- Environmental awareness training;
- Erosion control mechanisms and soil management; and
- Waste management.

OPERATION PHASE MANAGEMENT

The overall goal for the operational phase is to manage the activities associated with the operation and maintenance of the site in such a way that:

- The development maintains its positive socio-economic impact;
- Management of soil is kept in good condition through:
    - Monitoring the drainage,
    - Irrigation scheduling,
    - Monitor drainage so that accumulation does not impact abutting crops,
    - Monitoring efficiency of crop rotation, and
    - Fertilization.
- Management of alien vegetation is sufficient to prevent spreading or causing fire hazards;
- Managing crop health;
- The activity complies with all relevant legislation, permits, and authorizations.

The Applicant is responsible for ongoing management of the site until the farm is sold or an application for closure is submitted. All measures and conditions described in this EMP, the Environmental Authorisation, and any other relevant documents/legislation, should be strictly adhered to during the operational phase.

ORGANIZATIONAL REQUIREMENTS

The Applicant should be familiar with the requirements of the EMP and should execute all maintenance activities in an environmentally responsible manner.

This overview offers a perspective of the proposed organization of the EMP and the recommended responsibilities of key members of the project team. The ultimate responsibility and public accountability for the EMP and general environmental management reside with the Applicant.

The workers will be responsible for implementing the instructions from the farm manager (or Applicant), and it is recommended that the farm manager appoints a responsible worker to report back on a daily/weekly/monthly basis, ensuring compliance with the conditions of the EMP. If needed, to provide a basic level of environmental training to the responsible worker/s.

If needed, an independent and external Environmental Control Officer (ECO) can be appointed by the Applicant to assist and advise on the implementation of the EMP and to conduct environmental audits no less than once every five (5) years unless otherwise instructed by the DAEARDLR.

ROLES AND RESPONSIBILITIES

AUTHORITIES

The issuing of the necessary permits/licences/certificates and authorizations is the responsibility of the authorities, in this case, the Department of Agriculture (*for the approval of cultivating virgin land*), Environmental Affairs (*for environmental authorisation approval*), Rural Development and Land Reform (DAEARDLR). The authorities will also ensure that the Applicant complies with the conditions of the Environmental Authorisation and other permits/licenses/approvals.

Authorities are entitled to perform site inspections to ensure compliance with the conditions and of non-compliance, the authorities may provide instructions to ensure an action plan with corrective measures is carried out or to cease with the project, especially in the case of long-term non-compliance.

APPLICANT

The Applicant, in this case, Zwemkuil Gordonii CC has the responsibility for environmental management during the pre-construction, construction and operational phase until the property is sold or an application for closure is made. Thereafter it will be the responsibility of the landowner or new tenants.

The EMP becomes legally binding to the Applicant and everyone acting on behalf of the Applicant during the construction and operation activities. The activities are regarded as permanent therefore there is no provision made for decommissioning activities.

In summary, the Applicant is responsible for:

- Reviewing the environmental monitoring programme in the EMP or as recommended by the Environmental Control Officer (ECO) if one is appointed;
- Ensuring that the required environmental audits are undertaken on a timely basis and that the results of the audits are communicated to all personnel that are responsible;
- Implementing an environmental monitoring programme approved by the authorities and providing such results to the authorities;
- Conducting regular site inspections and monitoring to ensure compliance with the EMP;
- Advising on actions to be taken in the event of incidents or public complaints;
- Keeping a complaint register on-site/on the farm.

FARM MANAGER OR SENIOR PRODUCTION MANAGER

The Farm Manager's responsibility is to monitor staff, crops, purchasing supplies, and maintain a professional network of communication between the staff and the Applicant and other duties the Applicant would require.

The Applicant can appoint a Farm Manager / Senior Production Manager to also be responsible for the environmental management during the operational phase and must report to the Applicant regularly.

RESPONSIBLE CONTRACTORS

It is the responsibility of Contractors (clearing of the vegetation, construction of irrigation system, drainage systems, etc.) to ensure that there is compliance with the environmental specifications contained in the Environmental Impact Assessment (EIA), the Environmental Management Programme (EMP), and the Environmental Authorisation (EA). This implies that Contractors must familiarise themselves with the documentation and understand the restrictions and conditions. If any

infringements are noted, the ECO (if one is appointed) or/and the Applicant must be notified before further action is taken.

Contractors will also be responsible for the workforce on-site and could appoint a suitable Farm Manager who must report to the Contractors.

SUB-CONTRACTORS

Sub-contractors must operate under the supervision of the Contractors and are liable for issues associated with their actions.

ENVIRONMENTAL CONTROL OFFICER

An Environmental Control Officer (ECO) can be appointed by the Applicant to advise and assist where necessary and to monitor the implementation of the EMP, as an external function. The ECO must have previous experience in environmental management and compliance monitoring.

The ECO should conduct an independent evaluation of compliance with the EMP, but is not responsible for enforcing the conditions of the EMP.

Specific responsibilities include:

- Undertake environmental site audits as determined by the responsible authority;
- Recommend environmentally appropriate solutions to environmental problems;
- Recommend additional environmental management measures, if applicable;
- To assist in environmental training for the staff;
- Help raise awareness for environmental sensitive issues and help foster an appropriate environmental attitude towards the environment;
- Respond to non-compliance and provide corrective actions and procedures;
- Assist the Applicant if liaising with authorities is required.

SOIL SCIENTIST

The Soil Scientist must conduct a soil survey which must be included in the application for the cultivation of virgin soil. The Soil Scientist must assist with the irrigation scheduling by surveying the soil hydraulic properties, which is essential for variable rate irrigation, and the farm-scale water balance.

The Soil Scientist can also recommend fertilization for the crops, and assist with farm planning to help the Applicant optimize management to maximize profits.

The Soil Scientist should also allow for environmental protection works within the project budget, and determine the imposition of penalties for infringement of the Environmental Specifications and implement it.

SUITABLE QUALIFIED PERSON FOR DESIGN OF DRAINAGE SYSTEM

A suitably qualified person must assess and design a drip drainage system to ensure drainage on the site (with specific reference to Blocks C, D, E, L & M) does not harm/damage crops of the Applicant, or the environment.

MITIGATION MEASURES & MONITORING

The following maintenance and mitigation measures are recommended for implementation by the Applicant for the construction phase and the duration of the operational phase.

**Please note that this section will be amended and completed when all comment has been received from Commenting Authorities and interested and affected parties.*

Summary of significant impact with and without mitigation during the construction and operational phases.

Environmental parameter	CONSTRUCTION (no mitigation)	CONSTRUCTION (with mitigation)	OPERATIONAL (no mitigation)	OPERATIONAL (with mitigation)
Topography	Very Low	Insignificant	Low	Very Low
Soil Properties	Low	Very Low	Low-Moderate	Low
Soil Erosion	Low	Very Low	Moderate	Low

Soil Pollution	Very Low	Very Low	Low-Moderate	Low
Land Use	Low	Very Low	Moderate-High	Very Low
Flora	Moderate-High	Moderate	Low-Moderate	Low-Moderate
Fauna	Moderate-High	Low-Moderate	Low	Very Low
Ecologically Sensitive Areas	Moderate-High	Moderate	Moderate-High	Moderate
Water	Low-Moderate	Low	Low-Moderate	Low
Air quality: Dust	Low-Moderate	Low	Low-Moderate	Low
Air quality: Pesticides	Low	Very Low	Moderate-High	Low-Moderate
Noise	Low	Very Low	Low	Very Low
Waste	Very Low	Very Low	Low	Very Low
Visual & Aesthetics	Low-Moderate	Very Low	Low-Moderate	Very Low
Traffic	Low	Very Low	Low	Very Low
Socio-Economic	Very Low (+)	Very Low (+)	Low (+)	Low-Moderate (+)
Heritage / Archaeology	Low	Low	Very Low	Insignificant

MANAGEMENT OBJECTIVES

TOPOGRAPHY

Objective:

- Ensure the site blends well with the surrounding farming area.

Actions / Management Measures:

- Clearing of vegetation must follow the same incline as the natural environment as far as possible.

Monitoring Responsibility:

- During the clearing of vegetation or harvesting, site inspections should be conducted by the Applicant and the Contractor (daily), or the responsible Farm Manager to ensure the site layout is followed.

Objective:

- Prevent erosion and sedimentation in the riparian areas.
- Prevent soil pollution and degradation.

Actions / Management Measures:

Geology and Palaeonology

Construction Phase:

- Potential archaeological structures such as stone-build enclosures, buildings or graves must be avoided by a no-go buffer zone until further confirmation by the archaeologist.
- Smaller in situ material must be kept in place and protected from further damage by covering it with light but rigid objects like a box, bucket or metal sheet.
- If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit must be alerted immediately. A professional archaeologist must be contracted as soon as possible to inspect the findings.
- If newly discovered heritage resources prove to be of archaeological significance, a Phase 2 rescue operation may be required, subject to permits issued by SAHRA

Soil Management

- In terms of vineyard fields:
    - For vineyards to be successful a soil depth of between 600 mm and 800 mm is required.
    - Dryland vineyards will not be suitable and drip irrigation must be applied.
    - The more alkaline soils (Red apedal horizon of profiles 75 and Orthic of 88) require a reduction in pH, while the rest of the area has a suitable pH for vineyards. It is recommended that acidifying fertilizers be used on the soils to lower the pH.
    - Liming is not required.
    - Calcuim carbonate (found in Coega and Brandvlei and soils with Neocarbonate horizons) exerts a major influence on phosphorous fixation. The phosphorous within the soil (6-8 mg/kg) is below the required rate of 40 mg/kg and it is recommended phosphate be applied to prevent plant deficiencies.
    - Phosphate availability is largely dependent on the pH: soil pH values below 5.5 and between 7.5 and 8.5 limit phosphate availability to plants due to phosphorous being highly fixated and at very low pH soils pH 3-4 P is not available. P is moderately fixated at pH 7.5-9.
    - Therefore, regular soil sampling will inform the farmer of best management practices concerning alkalinity/acidity and application of P.

- In terms of pecan nut tree crops:
    - Soils with a freely drained, sandy loam texture with a depth >1000 mm is considered adequate for pecan nut trees.
    - More acidifying fertilizers should be applied in the alkaline soils (Red apedal of profile 75 and Orthic of profile 88).
    - Liming is not required. Soils that are more alkaline could lead to micro-nutrient deficiencies.
    - Calcuim carbonate (found in Coega and Brandvlei and soils with Neocarbonate horizons) exerts a major influence on phosphorous fixation. The phosphorous within the soil (6-8 mg/kg) is below the required rate of 40 mg/kg and it is recommended phosphate be applied to prevent plant deficiencies.
    - Phosphorous recommendation for Pecan-nut trees was specify in the soil report and must be followed (see Table 7 of the Soil Report).
    - Zinc requirements within areas where pH is higher than 7 (Red apedal of profile 75 and Orthic of Profile 88) are especially at risk for zinc deficiencies. The pH can be decreased and thereby increasing zinc uptake in the roots or apply the zinc for foliage uptake. It is recommended to pursue lowing the pH, since the good drainage of the soils allows leaching which, with chemical amendments, can lower pH effectively.
    - Regular soil sampling will inform the farmer of best management practices concerning alkalinity/acidity.
- Annual crops should be rotated, alternating every year between crops or lucerne.
- No additional land should be cleared.
- The 98.7 Ha area between pivots and crops areas must be excluded from the clearing of vegetation and will be used as a nursery.
- A soil scientist design the irrigation scheduling, which must be implemented.
- All topsoil must be preserved.
- Follow the pivot and crop layout plan as provided by the Soil Report.
- Monitor and maintain the drainage and pH of the soil.
- Keep record of the irrigation and adjust the scheduling if required.

Erosion control:

- If possible, apply cropping techniques that leave large clods on the soil surface or ridges perpendicular to the direction of the prevailing wind (although the ridges must not be more than 40cm high, or the wind will lop off their tops and enhance erosion.
- Alternatively, leave crop residue in the fields, as it increases roughness and protects the soil, and also can trap a large amount of dust.
- If erosion occurs within the cleared area, then any erosion gullies on the study area that might develop over time must be filled in and compacted and an erosion-monitoring programme will be implemented as a cradle to grave process.
- Should erosion become problematic:

1. Any erosion rills or gullies that develop will be filled in with subsoil, compacted but upper layer to be scarified to bind with topsoil, top dressed with soil, fertilized and seeded.
2. Such areas will be provided with a mulch/manure layer of at least 5cm thick.
3. Trunks/branches of trees removed (non seed-bearing alien trees) will be placed in rows along the contour 5m apart and pegged to the ground to reduce water speed and curb erosion.
4. In the worst-case scenario, geofabric or Soil Saver (natural organic sheet material with seeds) will be pegged onto the slopes after the spreading of topsoil and seeding was affected. A soil conservation officer or expert will be appointed to oversee the process.

- Disturbance of the soil and vegetation zones around the study area will be prohibited.

Pollution control:

- No fuel, oil and lubricants will be stored onsite.
- Emergency repairs will be done over drip pans.
- Maintenance of vehicles will be done at the offsite workshop in a leak-free condition.
- Hydrocarbons shall not be drained into the soils nor shall used filters and hydrocarbon-contaminated parts be buried at the site, but will be removed to an approved waste site or recycling facility.
- Making use of bio-remediation facilitated by a specialist company will negate larger spills whilst smaller spills could be treated with fertilizer to break it down or be scooped up by a front-end loader to a hazardous waste site.
- Peatsorb or sawdust will be used to contain larger spills and some of this material must be on site as a contingency measure.
- No other hazardous chemicals will be used at the site.
- The chemical toilet will be maintained according to Municipal bylaws or specifications issued by a local Health Inspector. One toilet should be provided for every 10 people onsite working (this is especially applicable during harvest time).
- In case of emergencies used oils and lubricants will be siphoned in receptacles with proper lids and be disposed of at a registered recycling facility immediately.
- For emergency cases, a receptacle will be provided for used filters and oil-contaminated vehicle parts and will be respectively disposed of at a registered waste facility and scrap yard immediately.
- The application of pesticide must be preferably applied on days where the wind is in a consistent direction and 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).
- No application of pesticides should take place on days during northerlies or easterlies.
- Follow the instruction on pesticide use:
    - Using the spraying equipment correctly to ensure that the best possible coverage is obtained with the minimum amount of pesticides and that applications are not repeated to reduce the risk of pollution and pest resistance or pest resurgence;

- Check the weather before spraying to reduce the risk of suspended droplets or drift and missing the target canopy.
- Choose the right pesticide based on the disease and pest susceptibility and the required product mode of action.

- Occupational health and safety guidelines to be applied when pesticides are handled.

Monitoring Responsibility:

- Site inspections should be conducted by the Applicant (monthly) and or the responsible Farm Manager to detect signs of erosion or drainage problems.
- It must be ensured that the erosion minimization measures installed, are effective.
- The Applicant, or the responsible Farm Manager must inspect the site and downstream (or receiving end in the environment, which would be the closest drainage lines outside of the irrigated areas) area every term, to ensure stormwater management systems are effective and no downstream sedimentation is occurring.
- Visual inspection must be conducted by the Applicant, or the responsible Farm Manager to detect any source of drainage issues, erosion or soil pollution regularly.
- The Applicant is ultimately responsible for the transformation of grazing land into a crop area without resulting in sediment loss and/or erosion.

LANDUSE

Objective:

- Ensure the site blends is well with the surrounding area.

Actions / Management Measures:

- The clearing of vegetation will be restricted to the approved area.
- The development will be done according to the site layout plan (Figure 9, Figure 10, Figure 11, & Figure 12Error! Reference source not found.).
- The 98.7 Ha area between irrigated land that is unsuitable for development must be used as a nursery for the transfer of protected plant species as recommendations of the botanical survey and report. The objective will be to save the species due to the clearance.
- In circumstances where species cannot be transferred, the offset area identified should be seeded with similar species.

Monitoring Responsibility:

- Site inspections should be conducted by the Applicant and Contractor, or the responsible Farm Manager regularly to ensure the development is restricted to the approved area.
- The Applicant is responsible for the application for cultivating virgin land.

ECOLOGICALLY SENSITIVE & FLORA MANAGEMENT

Objective:

- To minimize damage to indigenous flora and fauna utilizing the surrounding areas.
- To control and prevent alien vegetation growth.

Actions / Management Measures:

Recommendations listed by Dimela Eco Consulting:

Planning and clearing/construction:

- Keep the vegetation clearing in Medium Site Ecological Importance (SEI) categories as small as possible and align with already modified areas.
- Endeavour to utilise as much Low and Very low SEI as possible and the areas of Medium SEI bordering it.
- Only clear the footprint needed for cultivation and associated activities.
- Maintain riparian areas and allow for naturally vegetated corridors through the cultivated areas.
- Narrow slithers of vegetation in-between cultivated areas play a role in ecological processes; however, these areas are prone to edge effects and low in species diversity. Therefore, open spaces should be as large as possible and preferably connected by the narrower vegetation in between crop areas.
- Prevent vehicular access into natural areas beyond the demarcated area to be cleared.
- Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.
- Apply for permits for the removal of protected tree species prior to clearing of the land. The final proposed footprint of clearing must be walked to determine whether *Boscia albitrunca* or *Harpagophytum procumbens* subsp *procumbens* (devil's claw) will be affected. If so, apply for permits for their removal (or relocation of *H procumbens)* prior to vegetation clearing.
- Contractors / clearing team should familiarize themselves with the protected species and the Rare *Tridentia virescens,* including the *Ammocharis carinica* that is a provincially protected plant (see below). If found during clearing, the species should be relocated to outside of the proposed clearing footprint and monitored for survival for at least two years.


Tridentia virescens


Ammocharis carinica *Boscia albitrunca*


Harpagophytum procumbens subsp *procumbens* (devil's claw)

- Limit fragmentation by roads and other linear developments etc. in conserved open space.
- Alien invasive species, in particular category 1b species that were identified within the study area, should be removed from the development footprint and immediate surrounds, prior to clearing or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation.
- All alien seedlings and saplings must be removed as they become evident for the duration of clearing
- All vehicles and equipment that enters the site must be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the areas to be cleared.

Operational:

- After clearing, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land must be left in a condition as close as possible to that prior to clearing.

- Prevent operational activities from impacting on adjacent vegetation e.g. harvester and other machinery may not turn or park in naturally vegetated areas, prevent drift from chemical herbicides and pesticides.
- Irrigated areas should be kept to a minimum and should not extent to beyond the cultivated areas.
- Do not infringe into natural areas beyond the proposed cultivated areas and prevent the unnecessary removal and trampling of vegetation.
- Leave as much natural vegetation intact as possible.
- Ensure that areas outside of the operational footprint that were disturbed, are adequately rehabilitated and prevent dense stands of encroacher species.
- Continuously monitor the emergence of alien invasive plant species on the site and remove such species as soon as they become apparent.
- No operational activities may directly impact on the watercourses or veer from dedicated roads.
- Limit the use of chemicals (pesticides and herbicides) and do not spray in windy conditions. Pesticides may impact on pollinators and lead to a decline in species diversity and densities.
- Do not prevent the movement of mammals and insects, except to safeguard crops (e.g. grazing kudu's).
- Monitor the establishment of dense stands of encroacher species and remove or thin as soon as detected.
- If game or grazers will be excluded from the natural vegetation, a management plan to prevent densification or a shift in species composition should be implemented to maintain the vegetation in a natural to near-natural state.

Generall:

- Veld fires should be controlled.
- Alien control, with specific reference to:
  Argemone mexicana
  Eucalyptus camaldulensis
  Opuntia ficus-indica
  Salsola kalii
  Xanthium spinosum

***Argemone Mexicana*:**

Mechanical control: It is best to treat the weed infestations when they are small to prevent them from establishing (early detection and rapid response). Controlling the weed before it seeds will reduce future problems. Control is generally best applied to the least infested areas before dense infestations are tackled. Consistent follow-up work is required for sustainable management. Hand weeding of *A. Mexicana* is possible but it can be painful. Weeding should be carried out before the plant has set seed. Light tillage can destroy seedlings.

Chemical control Plants of *A. mexicana* should be destroyed or removed before they produce seeds. Seedlings are readily controlled by light tillage. Long cultivated fallow or vigorous perennial pastures will control large infestations (Parsons and Cuthbertson, 1992). Herbicides which control *A. mexicana* include 2,4-D, 2,4-DB, dicamba, diuron, fluroxypyr, hexazinone, isoproturon, karbutilate, MCPA, metribuzin, oxadiazon, picloram and terbutryn.

Biological control: A biological control programme of *A. mexicana* and the closely related *A. ochroleuca* has been initiated in Australia. This native of Mexico is naturalized in most warm countries of the world in sub-humid as well as semiarid regions. This project sought natural enemies in Mexico and identified several predatory insects including an extremely damaging species of root-breeding and leaf-feeding weevil (CSIRO, 1999; Julien, 2002).

Eucalyptus camaldulensis

E. camaldulensis is a vigorous resprouter, so felled trees will coppice unless the stump is treated or the entire plant is removed. The best methods for removing gums include:

- Uproot young gum trees with a basal stem less than 45mm in diameter;
- Ringbark large trees by removing a ring of bark 25cm wide. Peel the bark to just below ground level. Dead trees fall over. Remove them before they are dangerous;
- Knock off any coppices that appear on stumps before they shoot;
- Avoid the use of herbicides wherever possible;
- Note that biological control is not an option for gum trees, due to their importance to bees. (South Africa's honey bees are under threat. They face diminishing habitat and forage resources, attack by the *Varroa* mite pest and American Foulbrood disease, pollution from pesticides, and stress from being worked hard to provide a pollination service. For honey bee populations to withstand these stresses, a healthy diet is critical for a fully-functioning immune system.)

Opuntia spp.

Opuntia species can form thick, homogenous impenetrable stands that invade savanna, grassland and karoo biomes. Being able to survive in arid to moist environments, they can replace indigenous habitats and severely deplete natural biodiversity and pose a serious threat to the biomes of South Africa.

Animals disperse seeds widely and vegetative propagation has made this species difficult to eradicate through mechanical and chemical means. Mechanical eradication has been proven to be mostly unsuccessful and could even contribute to the further spreading of *Opuntia* species if care is not taken. Chemical methods have been used to control *Opuntia* species but are more successful on isolated stands.

Two stem-injected chemicals are registered for use as herbicides against *Opuntia* species and more specifically the prickly pear, in South Africa. Monosodium methanearsonate (MSMA) and glyphosate can be injected into the stems of the plants as concentrated solutions. If chemical control is going to be used, it is very important to read the herbicide label carefully and follow the directions.

Biological control is a more economical and environmentally-friendly option, than chemical method. Various species of biocontrol agents for prickly pear are present in South Africa. Host-specific cochineal species include: *Cochineal* species, *Dactylopius opuntiae,* the cactus moth, *Cactoblastis cactorum* and a stem boring weevil, *Metamasius spinolae.* Together, these insects are keeping prickly pear populations at relatively low levels.

CONTROL OF PRICKLY PEAR

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(Replaces B.1.1/1982)

The spiny prickly pear (*Opuntia ficus-indica*) can become a troublesome weed in some parts of the Republic. In some cases chemical control is the appropriate method to control infestations.

Chemical control

Monosodium methanearsonate (MSMA) and glyphosate are currently registered for the control of prickly pear. Both these herbicides must be injected into the stems of plants as concentrated solutions.

The Department of Agriculture and Water Supply assists farmers who wish to control the weed by supplying them with MSMA (720 g/ℓ) concentrate at a subsidised price. Before application the MSMA is diluted with an equal volume of water, i.e. 1 part MSMA and 1 part water. This solution is then injected into holes which are punched in the main stems of prickly pear plants.

The recommended rate for glyphosate is 1 part glyphosate (359 g/ℓ) in 2 parts water. The use of glyphosate for prickly pear control is, however, not subsidised by the Department of Agriculture and Water Supply.

Method of stem application

Any sharp metal plunger can be used to make the necessary holes in the prickly pear stems as illustrated in Fig. 1.

The MSMA solution is then injected into these holes. The holes must be at an angle and big enough to hold 2 mℓ of the solution; too small holes will cause spillage. An ordinary, inexpensive sheep-dose applicator with a rucksack reservoir is ideal for application (Fig. 2).

A rucksack spray pump can also be used provided the nozzle is replaced with a thin pipe with a small orifice which fits into the hole. To avoid spillage, the herbicide should be transferred into the hole by gravitation flow.

The number of injections needed to kill a plant will depend on its size, as illustrated in Fig. 3. Small trees with 15 to 50 leaf pads will require one (= 2 mℓ

FIG. 1 - A sharp metal plunger is used to make holes in prickly pear stems

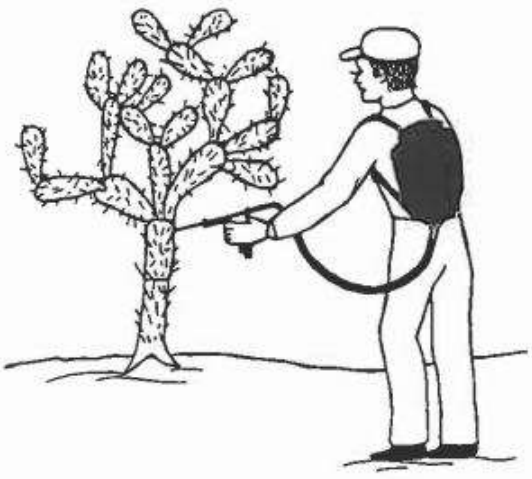

FIG. 2 - Sheep dose applicators are ideal to inject the herbicide into the holes

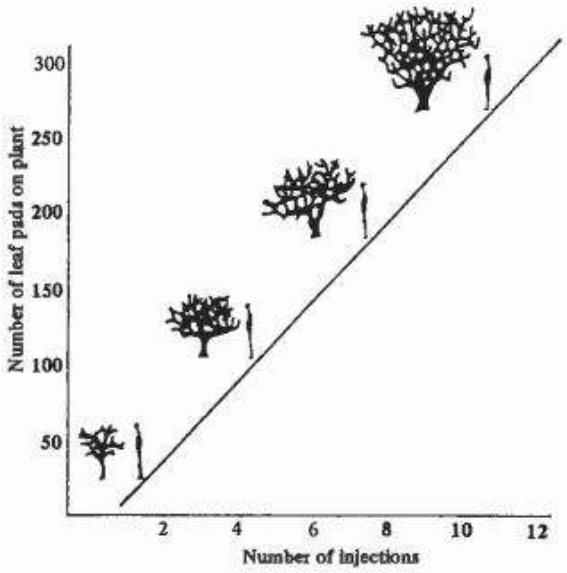

FIG. 3 - The number of injections necessary to kill prickly pear plants of various sizes

FIG. 4 - Injecting terminal leaf pads of prickly pear

solution) or two (= 4 m*l* solution) injections to kill them, while large plants with about 250 leaf pads will require approximately 10 injections (= 20 m*l* solution).

It is important that the injections are spaced evenly over the entire surface area of the lower stem or stems. Only the main stem and, if necessary, the primary branches should be treated. Where the injections are placed too high, the plants may break apart and scatter their leaf pads over a large area and these may then root and grow.

Where the main stems of plants are totally inaccessible, the injections may be administered to some terminal leaf pads (Fig. 4).

Treat one leaf pad on each of the main branches of the plants. This method will not kill the entire plant, but will cause abscission of most of the leaf pads, eventually exposing the main stem. These plants can then be treated according to the normal, recommended stem injection method, as described above.

First symptoms become visible a few weeks after the plants have been injected, when the terminal leaf pads turn brown and start falling off. Treated plants may take from 2 to 8 months to die, depending on their size.

Farmers who wish to control prickly pear with MSMA should contact their nearest agricultural extension officer or weed inspector for details on the subsidy scheme available to them.

Precautions

MSMA is corrosive on metals and all application equipment should therefore be dismantled and thoroughly rinsed in clean water after use. Although MSMA has a relatively low mammalian toxicity, it can nevertheless be harmful, or even fatal, to animals if swallowed. Keep all MSMA containers closed and out of the reach of children and animals. It is also advisable to withdraw all stock from treated areas for a period of 3 months. Fruit from treated plants may not be consumed.

Biological control

The prickly pear moth *Cactoblastis cactorum* together with the cochineal *Dactylopius opuntiae* remain very efficient enemies of, mainly, small prickly pear plants (14 leaf pads and less). Once plants have outgrown the 14 leaf pad size the insects find it increasingly difficult to destroy the plants. Chemical control should therefore be concentrated on plants of this size, and larger, leaving smaller plants to the insects.

Salsola kalii

Young *S. kalii* can be pulled or uprooted or dugout just below ground level before the seed set. Curring flowers before maturity has worked for some stewards on preserves. Mowing/cutting and grazing *S. kalii* tend to cause the plant to grow low but repeated mowing may provide control.

In terms of chemical control, some are resistant to sulfonylurea herbicides such as Glean, Finesse, Ally, Amber, Express and Harmony Extra. Resistance to the trazine herbicides has also been observed.

A non-selective broadleaf herbicide such as glyphosate can provide control of *Salsola kali*. Apply the herbicide before the seed set. An application of 2,4-D may cause *S. kali* to become tough and leathery, producing a plant that is more difficult to manage.

Xanthium spinosum

It competes with crop plants and indigenous species along riverbanks. Its spiny burs adhere to the wool of sheep wool and become entwined in tails, manes and coats of domestic livestock, causing the animals much discomfort. The seedlings are particularly toxic to domestic livestock. It readily invades overgrazed pastures and spreads at the expense of the indigenous species.

Because *X. spinosum* growth is apical (grows from the tip), "knocking the top off" of the vegetation will stop growth. After the first mowing, any new germination can again be mowed before flowering to increase the impact.

Cultivation: Shallow cultivation after the emergence of seedlings can give effective control.

Chemical: Although several pre-emergence herbicides are registered for control of cocklebur, control is erratic. Post-emergence herbicides give more effective control. The effectivity of herbicides decreases as the plants grow bigger and the time of application is therefore crucial. Strictly follow the specific instructions and dosages on the label of each product.

Always contact a reliable chemical advisor before using any chemicals to ensure the correct dosage and specifications on the label are adhered to.

General alien control of other species

- Juvenile alien trees will be pulled and removed to an area cleared for crop production where it will be burnt when it is dry.
- Any poisonous alien plants (if any) must be removed to a registered waste facility and may not be given to workers or the community.
- Once the area has been developed, a continuous alien control programme will be implemented by pulling any seedlings on a quarterly or annual basis. Specific attention will be directed to those plants listed above. No tree/plant will be left until it reaches seed-bearing age.
- All juvenile alien plants will be pulled and removed and burnt when it is dry.
- Mechanical control will involve hand-pulling seeding plants. Immature plants should either be ring-barked, dug out, or the stems should be cut as near as possible to the ground. The bark on the remaining stem stub must be peeled off into the ground, once the stem has been cut.
- Chemical control involves the stems to be cut as low as practical, whereafter herbicides are applied in diesel or water as recommended for the herbicide. Applications in diesel should be to the whole

stump and exposed roots and in water to the cut area as recommended on the label of the herbicide.

- There will also be no interference with any biological control and the insects must be left to continue to invade alien trees.
- Herbicides may be used with high caution.
- No tree will be left until it reaches seed-bearing age.

Monitoring Responsibility:

- A list of plants that are relocated must be kept by the Applicant, the Contractor, or the Farm Manager.
- The Applicant, the Contractor, or representative Farm Manager must check for alien invasive vegetation and removal thereof as the development progress.
- The Applicant or Farm Manager is responsible to identify/allocate appropriate areas in the surrounding 98.7 Ha outside of the irrigated areas to be used for the relocation of species where possible, before the removal of plant species.
- The Contractor is responsible for the behavior of his staff with specific reference to environmental management until the construction is completed.

FAUNA MANAGEMENT

Objective:

- To minimize damage to indigenous fauna utilizing the surrounding areas.

Actions / Management Measures:

Should fauna species be encountered within the development footprint during the construction or operational phase the following should be ensured:

- No vegetation may be removed outside the approved pivot areas.
- Vehicles will not display fuel, oil or lubricant leaks and will be maintained to an acceptable standard.
- Any fuel spills will be cleaned up immediately and contaminated soil or used spill absorbing material will be removed to an approved waste facility.
- Handling of hydrocarbons will be done in accordance with all applicable legislation to prevent pollution incidents.
- The movement of vehicles will be restricted to the authorized development area and haul roads.

- Attention must be given to reptiles and slow-moving animals (tortoises) that might occur in the study area. Before the vegetation is removed in a certain phase someone must walk through the site to ensure that there are no animals that could be harmed by the bulldozer. Reptiles that occur in the proposed study area should be chased away and tortoises should be appropriately captured and relocated to abutting areas or 98.7 Ha area surrounding the irrigation areas.
- No animals entering or settling in the study area will be trapped or killed and this requirement will be included in the environmental awareness programme, which has to be discussed with workers on an annual basis and presented by the applicant or any competent ECO (if one is appointed).
- No hunting or snaring would be allowed outside or inside the study area and the applicant should implement a severe penalty system for people transgressing this requirement.
- The applicant will implement a proper supervision mechanism to ensure that poaching is not taking place.
- No person may carry out a restricted activity in terms of the List of Threatened or Protected Species (TOPS) regulations i.e. killing, catching, hunting by any method or device including searching, injuring with intent to hunt, catch or kill any such specimen involving a TOPS specimen without a TOPS permit. The applicant will take full responsibility for any animals that are proved to be killed by a member of the construction staff. The applicant will implement an environmental awareness programme and ensure all employees are coherent in the above regard.
- The study area will be developed as per the site layout (Figure 9, Figure 10, Figure 11, & Figure 12) and clearing of vegetation will be restricted to the minimum area required for optimal construction activities.
- Informal cooking fires by construction personnel will not be allowed on-site, only designated areas will be used. No burning of waste will be allowed at the site.
- The irrigation areas will be demarcated and areas outside of it will be out of bounds for workers.
- Proper housekeeping with an emphasis on waste management should be applied. Plastic and wire could be lethal to cattle and other animals and should therefore be controlled. Household waste disposal will be through depositing waste in strategically positioned containers fitted with scavenger-proof lids.
- Pesticides must be used as previously discussed under the heading ‘Soil’.
- Some bird species might build a nest of grass and twigs on the ground or construct a nest between grass tufts. Some of these nests may contain chicks or eggs, therefore care must be taken to carefully relocate the nests to areas outside the study area before vegetation clearing commences or if possible to relocate chicks or eggs to bird sanctuaries.
- Some animals take shelter and live in burrows. Burrowing animals can detect prey items using seismic cues and therefore these animals would be able to use the vibrations of vehicles and bulldozer to realize their potential vulnerability. Care must be taken not to injure these burrowing animals when the bulldozer is used in the proposed study area.
- An expert who holds a Competency Certificate to handle dangerous and venomous reptiles should be contracted to remove any animals that may cause harm to employees at the study site. A declaration/ testimonial must be provided to prove prior experience in this regard. Appropriate permits are required to move animals.

- This potential impact should be addressed in an environmental awareness programme.
- The Applicant should remove any of the staff caught interfering with wildlife from the site immediately.
- Control of pests/fungus/diseases must be conducted without impacting surrounding fauna, other farmers and crops, and within the restrictions of the law.
    - As far as possible use resistant crops
    - Apply pesticides and fungicides according to the labelling instructions
    - Conduct drip irrigation at the vineyard and manage soil as recommended by the soil scientist
    - Ensure good air circulation at the pecan nut orchard
    - Sanitize pruning and cutting equipment after use
    - Remove infected plant debris from the site and do not use it for compost
    - Maintain healthy crops and prune the parasitic plants

Monitoring Responsibility:

- A list of animals that are relocated must be kept by the Applicant, the Contractor, or the Farm Manager.
- The Applicant, the Contractor, or representative Farm Manager must check for snaring devices, traces of poison, and removal thereof every week.
- The Applicant or Farm Manager is responsible to identify/allocate appropriate areas in the surrounding area to be used for the relocation of species where possible, before the removal of such an animal.
- The Contractor is responsible for the behaviour of his staff with specific reference to environmental management for the duration of construction.
- The Contractor or representative Farm Manager must report all animal mortalities to the Applicant on the same day as mortality has been identified. Such mortalities should be recorded.
- If any carcasses are collected for monitoring purposes, a permit is needed in terms of the Provincial Nature and Conservation Ordinance. The Applicant is responsible for obtaining such a permit.
- A list of animals that are relocated must be kept by the Applicant, or Farm Manager.
- The Applicant or Farm Manager is responsible for good farming practices which include responsibilities to control pests/bacterial infections/fungus/parasitic plants on crops, that will not negatively impact neighbouring farms.

Objective:

- To minimize cumulative impact on sensitive areas in the region.

Actions / Management Measures:

- Those mitigation measures that are listed under the headings 'Fauna' and 'Flora'.
- As a biodiversity offset plan, the remaining 98.7 Ha between the irrigated areas will be used as a nursery for the transplant of the species identified in the above table under the heading "Flora".
    - An alien control plan is implemented on the study area.

Monitoring Responsibility:

- A list of animals that are relocated must be kept by the Applicant, the Contractor, or the Farm Manager.
- The Applicant, the Contractor, or representative Farm Manager must check for snaring devices, and traces of poison, and removal thereof on a weekly basis.
- The Applicant or Farm Manager is responsible to identify/allocate appropriate areas in the surrounding area to be used for the relocation of species where possible, prior to the removal of such an animal.
- The Contractor is responsible for the behaviour of his staff with specific reference to environmental management for the duration of construction.
- The Contractor, or representative Farm Manager must report all animal mortalities to the Applicant on the same day as mortality has been identified. Such mortalities should be recorded.
- If any carcasses are collected for monitoring purposes, a permit is needed in terms of the Provincial Nature and Conservation Ordinance. The Applicant is responsible for obtaining such a permit.
- A list of animals that are relocated must be kept by the Applicant, or Farm Manager.

WATER

Objective:

- Prevent silt transport into the drainage lines.
- Prevent pollution into the Orange River system.

Actions / Management Measures:

- All mitigation measures as listed under the heading 'Soil' must be implemented.
- Clearing of vegetation should be restricted to the proposed footprint and site layout plan.
- 100m buffer zone must be kept from the Orange River bank (with specific reference to Blocks A, N, O, & S, and 32m from any drainage lines, except for Blocks J & F.
- Drinking water will be brought to site on a daily basis.
- Water for establishing the crops will be obtained as per the Water Use Right.
- No foreign or unapproved material/substance should be dumped or stored within the footprint of the study area.
- Refuelling of vehicles (such as the bulldozer) will be done by fuel browser and all vehicles/equipment shall be maintained to a high standard off-site and shall not display any major leaks. Vehicle/machinery inspection should be done regularly, and emphasis should be on checking hydraulic hoses and couplings.
- In case of an emergency, repairs on site must be done over a drip pan and at least 100m away from the drainage lines.
- In case of large, critical spills the Departments of Water Affairs and the Department of Environmental Affairs in the Northern Cape will be informed immediately for assistance and advice and a competent company conversant with bio-remediation will be appointed immediately to address the possible impacts of such spill. All costs would be for the account of the applicant.
- The applicant accepts the principle of 'polluter pays'.

Monitoring Responsibility:

- Site inspections should be conducted by the Contractor, and/or Applicant regularly, or the responsible Farm Manager to establish if drainage that is received from the abutting farms is problematic. If so, the Contractor, and/or Applicant must decide on a constructing a drainage line or consult a soil scientist or the Department of Agriculture.
- The Contractor, Applicant or the responsible Farm Manager must inspect the site and downstream area to ensure drainage management systems are effective and no downstream sedimentation and vegetation die-out is occurring every month.
- Visual inspection must be conducted by the Contractor, Applicant or the responsible Farm Manager to detect any source of degradation regularly.
- The Applicant is ultimately responsible for any action that will lead to the destruction of riparian vegetation or neighbouring crops due to this development.

Objective:

- Prevent excessive dust generation and emissions within the site and surrounding area.
- Prevent incorrect use of pesticides

Actions / Management Measures:

- All mitigation measures as listed under the heading 'Soil' must be implemented.
- Vehicles to be maintained properly and fitted with standard exhaust systems and will not be left idling unnecessarily.
- Vehicle trips must be restricted to what is essential.
- No burring of waste will be allowed on the property.
- No cooking fires will be allowed.
- No burning of waste will be allowed at the site, except for the occasional burning of alien vegetation within a cleared area and during wind still days.
- Cigarette butts might not be disposed of in the veldt, but must be put out and disposed of in the waste bins provided in vehicles.
- If dust levels in the process area necessitate, 3m high shade cloth windbreaks could be established along the site boundary, opposite from prevailing wind direction.
- Farming activities shall not impose dust counts of more than 80 mg/m^2/per day at any residence or more than 40 mg/m^2/per day during normal operations.
- Speed of vehicles will be restricted to 20-30km/h, especially when travelling along the farm road.
- This potential impact should be addressed in an environmental awareness programme.

Monitoring Responsibility:

- The Contractor (daily), Applicant (monthly), or representative Farm Manager must monitor and manage the dust generation during the construction phase or harvest seasons.
- The Farm Manager must communicate with the Applicant and Contractor immediately once a complaint regarding dust is received and attempt to resolve the issue within a week after the complaint.
- The DAEARDLR is responsible for compliance monitoring.
- Visual inspection must be conducted by the Contractor, Engineer, Applicant or representative Farm Manager to detect any source of dust pollution regularly.
- The Applicant and Farm Manager must research the correct pesticides to be used, and consult with Soil Scientists about the use of pesticides.
- The Applicant and Farm Manager must log and record the use of pesticides (dates, climate conditions, volumes applied, areas applied, etc.).
- The Applicant, and Farm Manager must log and record complaints received from abutting residents or workers when pesticides are applied.

- The Farm Manager must communicate with the Applicant and Contractor immediately once a complaint regarding the use of pesticides, is received and attempt to resolve the issue within a week after the complaint.
- The Applicant is ultimately responsible for any action that will lead to the destruction of crops on the neighbouring farm or the occupational health of workers, due to negligent application of pesticides.

NOISE

Objective:

- Prevent excessive noise generation within the site and surrounding area.

Actions / Management Measures:

- All equipment and activities to comply with noise regulations.
- All vehicles will be fitted with standard exhaust systems and will be serviced regularly.
- Silencer units in vehicles and equipment to be maintained in good working order.
- Unnecessary hooting, shouting, flapping of tailgates, and excessive use of exhaust brakes will be discouraged.
- Unnecessary idling of vehicles will be discouraged during the construction phase.
- Travelling speed onsite will be reduced to 20-30 km/h.
- Moving parts of vehicles will be regularly lubricated, replaced, and serviced.
- Repair work that involves using grinders and hammers on steel or any other steel-on-steel activity will not be performed early morning or early evening.
- The workforce and contractors will be managed correctly in terms of noise generation and be sensitized to dignified human behaviour.
- All Health and Safety guidelines must be complied with.
- Workers working in areas where the 8-hour ambient noise levels exceed 85dB must have the appropriate Personal Protective Equipment (PPE).

Monitoring Responsibility:

- The Contractor (daily), Applicant, or representative Farm Manager must monitor and manage the noise generated during the construction phase.

- The Applicant or Farm Manager must log and record complaints received from abutting residents due to noise.
- The Farm Manager must communicate with the Applicant and Contractor immediately once a complaint is received and attempt to resolve the issue within a week after the complaint.
- The DAEARDLR is responsible for compliance monitoring.

WASTE

Objective:

- Ensure that appropriate waste management strategies are adhered to at all times.

Actions / Management Measures

- Staff would be trained to distinguish between various types of waste (domestic and system structure, etc.).
- Residue in the form of oversize stones should be removed from the site or used to control erosion gullies on the farm.
- Vegetation that will not be transplanted can be ploughed into the topsoil to increase the humus content of the soil. Likewise with crop residue.
- Trimmed and pruned vegetation infested with a plant disease will be disposed of or burnt and must not be used as compost.
- Waste will not be burnt or buried on site.
- The odd tyre casings and dysfunctional equipment that could be generated will be disposed of immediately at the nearest registered waste facility.
- Any waste produced will be removed from the development area continuously to the Hopetown waste facility with specific emphasis on household waste, plastics, unusable scrap metal, and tire casings, if any. The activity should not contribute to any surrounding windblown litter.
- A skip with a proper cover will be positioned in areas easily accessible for use. Large refuse bins fitted with a proper lid will be positioned at the various work stations in the development area, and be emptied regularly in the skip.
- Earthmoving vehicles may not leak any fuel, oil, or lubricants and will be maintained to an acceptable standard.
- Any fuel spills will be cleaned up immediately and the soil from spill areas to be removed to a registered waste disposal site.
- The salvage yard will be neat and all usable material will be placed in rows and separated into applicable categories.
- Unusable scrap metal or dysfunctional machinery will be positioned on one side and removed every month to a recycling facility.

- No day-to-day repairs or servicing of vehicles or equipment will take place on-site.
- No washing of vehicles will take place on the property.
- None of these wastes will be buried/drained into the soil.
- The chemical toilets (one per every 10 people on site) will be maintained according to Municipal specifications and as discussed under the heading "Water". If it produces foul odours, it shall be remedied according to available guidelines. Where necessary components of it will be regularly disinfected.
- Proper care will be taken that the surroundings are not used for ablutions and the necessary penalty system will be imposed for such offences.
- Domestic waste generated ancillary to the development process will be deposited in containers with scavenger-proof lids placed at the site. It will be regularly removed from the site to the nearest waste site and not dumped in the veld nor burnt nor buried on site. Containers will be marked to ensure that they are used for the right purpose. Management will provide clear management guidelines and this aspect will be included in the environmental awareness programme.
- Any foul smells will be treated with the necessary disinfectants or lime can be introduced to the bottom of the receptacle.

Waste Management:

- The Contractor, Applicant or representative Farm Manager must ensure that chemical toilets are provided, one toilet for every 10 people, and can be removed from the site once the harvest season is over.
- The Contractor and the Applicant or representative Farm Manager must ensure that receptacles with scavenger-proof lids are provided and placed at easily accessible points and must be emptied regularly and removed from the site.
- The Contractor, Applicant or representative Farm Manager must ensure that the bins shall be emptied regularly and the accumulated waste disposed of at an appropriately permitted disposal site.
- The Contractor, Applicant or representative Farm Manager must ensure that the site is to be checked for litter daily. All litter should be collected regularly and deposited in the waste bins.

VISUAL

Objective:

- Ensure that appropriate management strategies are adhered to minimize the visual impact.
- To receive no complaints regarding impacts on visual quality.

Actions / Management Measures

- No vegetation clearing should take place outside the proposed study area in accordance with the site layout plan and the visual impact will be reduced through the establishment of crops and an alien control programme.
- To reduce the visual impact caused by dust plumes, the clearing of vegetation and ploughing should, as far as possible, not take place on windy days.
- The proposed area and surroundings must be kept clean and free of litter continuously. A weekly cleanup of the entire site must be done.
- No dumping of waste in unauthorized areas around the site must be permitted.
- Dust plumes on haul road will be reduced by reducing vehicle speed.
- No erosion that could lead to head-cuts, gullies or slumping will be allowed on the site and disturbed areas would be made stable as soon as possible.

Monitoring Responsibility:

- The Contractor (daily), Applicant (monthly), or representative Farm Manager must monitor and manage the personal onsite and maintain ongoing housekeeping to keep the construction site tidy.
- The Applicant and Farm Manager must keep a complaint register and log any complaints received regarding visual impacts.
- The Farm Manager must communicate with the Applicant and Contractor immediately once a complaint is received and attempt to resolve the issue within a week after the complaint.
- The DAEARDLR is responsible for compliance monitoring.
- The Contractor or Applicant must implement management actions.

TRAFFIC

Objective:

- Ensure that appropriate management strategies are adhered to minimize the impact on traffic.
- Ensure that construction vehicles have access to dedicated sites and routes.
- To ensure that there is no transporting of overload material and no speeding.

Actions / Management Measures

- All vehicles visiting the site shall be roadworthy and will be included in the agreement with contractors.
- All drivers must dispose of applicable driver's licenses.
- All vehicles and earthmoving machinery would be properly maintained
- Traffic should be observed and necessary road etiquette enforced and this aspect will be included in the environmental awareness programme.
- The appropriate road signage (W107 & W108 –1,2m size) should be erected on both sides of the farm entrance to Muishoek gravel road and if needed, a flagman will be appointed at the access point to increase road safety during harvest periods when an increase in trucks is expected on the farm.
- Vehicles entering any other public road will come to a complete stop before entering the road and any transgressions in this regard will be heavily penalized.
- The farm road to the site must be maintained and kept in good working condition.
- Overloading will not be permitted. Speeding will be prohibited and drivers will be penalized should it be proved that this requirement is contravened.
- Driving speed on the farm will be reduced to 30-20km/h for safety reasons and to reduce dust generation.
- During harvest time, the hauling of heavy vehicles will mostly commence at 07:00 to 17:00 during the week (winter) and 6:00 to 19:00 (summer) but may result in the need to cart crops on Saturday mornings and should avoid at all costs transporting harvest material at night.
- The applicant must appoint a traffic marshal/s or flagman for situations where harvest trucks may impede normal traffic flows or in poor visibility events along the Muishoek road at the entrances to the farm.
- A breathalyzer can be used to ensure that no member of the workforce is permitted to work or drive a vehicle under the influence of alcohol. This also includes the use of narcotic substances.

Monitoring Responsibility:

- The Contractor, Applicant or representative Farm Manager must monitor and ensure that the correct signage is displayed, at the correct place, and are visible on a monthly basis.
- The Contractor must ensure that all vehicles operating on the construction site are properly maintained and serviced and road-worthy on a daily basis.
- The Applicant and Farm Manager must keep a complaint register and log any complaints received regarding trucks and earthmoving machinery.
- The Farm Manager must communicate with the Applicant and Contractor immediately once a complaint is received and attempt to resolve the issue within a week after the complaint.
- The DAEARDLR is responsible for compliance monitoring.
- The Contractor or Applicant must implement management actions.

Objective:

- To ensure that abutting neighbours are not negatively impacted by nuisance factors such as dust and noise.
- To ensure that local people are employed.
- To ensure the safety of the community through proper access control, registration of workers, and community watch-dogs.

Actions / Management Measures

- Those described under previous headings plus establishing regular meetings with nearby neighbours.
- Farmworkers may not wander in any area outside the farm.
- Farmworkers to be employed must be registered as per the Labour law specifications.
- No stock theft and poaching will be tolerated. Any farm worker/contract worker found guilty of these transgressions should be removed from the property, dismissed, and handed over to the police for sentencing.
- No wood should be gathered from outside the study area and no plant or crop should be removed by the workforce.
- Landowners will be fully compensated for stock or crop loss.

Monitoring Responsibility:

- The Applicant or representative Farm Manager must monitor and ensure that the site is fenced with correct warning signage that is displayed and visible before construction and must inspect the site regularly to re-erect fence or signage that might have been removed.
- The Applicant must ensure that a Farm Manager is employed and that access to the Farm Manager is easily accessible for community members before construction commences.
- The Farm Manager must keep a complaint register and log any complaints received and report to the Contractor and Applicant.
- The Applicant and Contractor to ensure priory/preference is given to local people for employment.

Objective:

- To ensure that any archaeological and historical material of interest that might be found, is reported to SAHRA.
- To ensure that if any human remains are found, are reported to the local police, and SAHRA.
- To ensure that contractors and personnel on site are aware of the responsibilities (preservation and appropriate management of new findings) and chain of command should any archaeological and historical material of interest or human remains, be found onsite.

Actions / Management Measures

- Any subsurface evidence of archaeological sites or remains, e.g. stone tool artifacts, bone or ostrich eggshell fragments, charcoal and ash heaps, or remnants of stone-made structures or unmarked graves found during the construction phase of the development, must be reported to SAHRA APM Unit (Tel. 021 462 5402).
- Potential archaeological structures such as stone-build enclosures, buildings or graves must be avoided by a no-go buffer zone until further confirmation by the archaeologist. Smaller *in situ* material must be kept in place and protected from further damage by covering it with light but rigid object like a box, bucket, or metal sheet.
- If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit must be alerted immediately. A professional archaeologist must be contracted as soon as possible to inspect the findings. In such a case, all operations would be suspended immediately in such a particular area.
- If any human remains may be uncovered during the development, such material must be reported to the local Police, and the SAHRA Burial Grounds and Graves (BGG) Unit, if exposed so that a systematic and professional investigation can be undertaken. In such a case, all operations would be suspended immediately in such a particular area.
- If newly discovered heritage resources prove to be of archaeological significance, a Phase 2 rescue operation may be required, subject to permits issued by SAHRA.
- Sufficient time should be allowed to removed/collect such material and this must be negotiated between the authority and the applicant.
- Operators of earthmoving equipment will be informed of the applicant's obligation in this regard and they must be instructed to inform management when anything of interest is noted on the site.
- The applicant must be present when a new area is cleared.
- Any found will be fenced off immediately.

Monitoring Responsibility:

- Should it be required, the Applicant is responsible for acquiring any permits.

- The Contractor, Applicant or representative Farm Manager must report any new findings if anything is unearthed during construction immediately.
- The Contractor, Applicant or representative Farm Manager must ensure the operators of earthmoving equipment are informed of the process to be followed should new findings be unearthed during construction before construction.
- The Applicant and Contractor must ensure that construction around the new findings site ceases and sufficient time is provided for removal/collections of such material, should it be unearthed.
- The Contractor, Applicant or representative Farm Manager must be present when a new area is cleared.

DECOMMISSIONING PHASE

Should the activity be authorized, this is a permanent change from grazing to crop production. Should the activity be authorized, it is highly unlikely that the proposed development will be decommissioned. However, should crop production cease, the site will be used for pasture.

Therefore a decommissioning Phase for the EMP is not included in this management plan, since an EMP is a living document and would need to be amended and adopted as the years' progress. This is normally the function of an Environmental Audit, which should take place once every 5 years, at least.

Also, it is most likely that environmental laws and local municipal laws would be amended and requirements might change over the years. Due to the uncertainty of the laws few years from now, it is proposed that if the result is the removal of the crops and termination of the pivot areas, then a closure plan be submitted and approved by the relevant authority/ties before closure commence. Therefore at this stage, the decommissioning phase will not be discussed.

If for whatever reason the crops fails, the Applicant is responsible for the rehabilitation of the site back to a functional grazing unit and the necessary authorization must be obtained and the correct decommissioning protocol must be followed. The relevant State Departments (e.g. the DAEARDLR, (if applicable at the time of decommissioning) and an environmental consultant should be consulted before decommissioning.

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

ENVIRONMENTAL TRAINING

The goal of an environmental training or environmental awareness plan is to prescribe how the Applicant intends to inform all of his employees of all the possible environmental risks resulting from their particular line/function of work within the structures of the organization. This plan will also prescribe how the identified risks will be dealt with to avoid pollution and environmental degradation.

All personnel associated with the project must understand the purpose and benefits of the EMP.

The appropriate training must occur as part of an induction program and should include:

ENVIRONMENTAL MANAGEMENT INTRODUCTION TO ALL PERSONNEL:

General environmental information session/s to ensure that employees at each relevant function and level receive environmental information and are aware of the environmental management objectives.

It is also the responsibility of the Applicant or the ECO (if one is appointed) or the Farm Manager to conduct basic training with less literate employees describing the listed environmental impacts and the mitigation measures to be followed more practically. The Applicant may choose to employ an independent consultant (ECO) to conduct such training. Such training is best done in the employee's home language, onsite as it is more useful and visual. As a minimum the Basic Environmental Awareness Plan must address the following:

- The need for training
- General discussion on what is the environment
- Why must the environment be protected
- Types of environmental impacts
- Mitigation measures and Basic Rules to comply with
- Fines and Penalties
- Questions and Answers

JOB-SPECIFIC TRAINING

Employees whose function of work can cause significant environmental impacts must be trained, educated, and afforded the experience to ensure that their tasks are performed to the best of their ability to minimize environmental degradation on the site, with specific reference to the receiving environment.

The spinoff of Environmental training will produce a group of people being equipped and enriched with the knowledge to implement the main principles that were taught to them, outside of the workplace

as well. It will enable them to put into practice their knowledge at home or other workplaces, should they one day leave the site.

The Applicant/ECO is responsible to provide training annually (or more regularly if the need should arise) to employees on:

- The importance of compliance with the objectives of the EMP and procedures to achieve the objectives of the EMP.
- Identifying the significant environmental impacts: actual or potential impacts and how employees' activities might influence the impacts.
- Benefits for improved personal performance with regards to environmental awareness.
- Their roles and responsibilities in achieving compliance with the objectives of the EMP and procedures to achieve the objectives of the EMP, including emergency preparedness and response requirements.
- The potential consequences of departure from specified operating procedures.

In terms of job-specific training, the Applicant, Farm Manager, or ECO, and Contractor must identify relevant personnel and training courses for employees performing tasks, which can cause significant environmental impacts. They must become competent based on appropriate education, training, and/or experience.

Comprehension training must include:

- Emergency preparedness and response, including an incident report.
- Soil stability and erosion control.
- Drainage management.
- Water conservation and water quality protection.
- Fire evacuations and risk control.
- Pesticide application.
- Poaching.
- Faunal incidences – prevention of disturbance to fauna, reporting any faunal mortalities.
- Alien vegetation identification and control.
- Waste management.
- Ability to recognize archaeological and palaeontological artefacts.
- Incentives and rewards for good environmental practice.

This list is not intended to be exclusive or exhaustive.

After training needs have been identified, it is the responsibility of the Applicant and ECO to ensure that employees attend the relevant identified training and attendance must be documented. The Applicant must decide on the appropriate time to conduct environmental training.

As an incentive to motivate employees, progress in compliance with the training programme can be recorded and evaluated to nominate and elect the best candidate who has improved personal performance with regard to environmental awareness. Such an employee may be rewarded at the discretion of the Applicant. This can be done through the following method:

- By Management through task observation;
- During internal and external audits, when the effectiveness of the EMP is evaluated;
- Own initiatives that are taken by employees to improve the environment.

The Environmental Awareness Plan must apply to the specific task and the level of understanding of the employee. Open communication between the employees and the Farm Manager, or ECO, the Contractor, and Applicant must be established and in the event of an environmental emergency, the Applicant, Farm Manager, and ECO must have process steps in place to ensure that the situation is contained and the correct procedure is followed to ensure that pollution and degradation do not occur.

Mitigation measures listed in this document must be used as a guideline to conduct such training and to establish the rules for operation. After such training, each employee may receive a certificate for completing the training. The Applicant, Farm Manager, or ECO may also have a checklist available onsite to ensure that employees are constantly aware of the mitigation measures.

DESCRIPTIONS OF SOLUTIONS TO RISKS

The following risks have been identified:

- Soil management and stability and erosion after heavy rains.
- Unauthorized clearing of natural vegetation.
- Correct irrigation to protect the water resource.
- Alien vegetation infestation.
- Waste management.
- Dust control.
- Pesticide control.
- Safety and security management.

The following procedures must be brought to the attention of all staff and suitable material/equipment provided to deal with them.

SOIL STABILITY AND EROSION DURING HEAVY RAINS

- Assess the site and downstream area of drainage and inform the responsible person (s) accordingly.
- Assess the potential hazard and inform the responsible person(s) accordingly.

- Ensure that the soil structure is functional and does not result in being washed away after heavy rains; inform the responsible person (s) accordingly.
- Ensure that erosion rills are not left to deteriorate but removed/filled in and seeded as soon as possible.

UNAUTHORIZED CLEARING OF NATURAL VEGETATION

- Stop the operator of heavy equipment immediately carrying on with such activity and request him to vacate the site.
- Determine if any plants can be saved and place them in the soil and water.
- Assess the potential hazard and inform the responsible person(s) accordingly.

CORRECT IRRIGATION TO PROTECT THE WATER RESOURCE.

- Consult the Soil Scientist regularly regarding irrigation scheduling.
- Assess the site after irrigation for signs of soil degradation.
- Assess the crop after irrigation for signs of over or under irrigation.
- Log and register meter readings of water abstracted and used for irrigation.

ALIEN VEGETATION INFESTATION

- Assess the level/scope of degradation caused by infestation and inform the responsible person(s) accordingly.
- Identify the alien plants establishing and the best method to remove such plants.
- Ensure that procedures are handled as prescribed in the EMP.
- Ensure that the areas cleared from alien vegetation be re-established with plant species natural to this area.

WASTE MANAGEMENT

- Minimize environmental impacts associated with waste.
- Apply waste management principles of preventing, minimize, recycle, or re-use, with disposal as the last option.
- No littering on the site.
- Maintain a clean and tidy site.

DUST CONTROL

- Ensure that appropriate dust suppression measures or temporary stabilizing mechanisms are used when dust generation is unavoidable (e.g. dampening with water, chemical soil binders, etc.), particularly during prolonged periods of dry weather.
- Identify when dust suppression has to be undertaken.

- Ensure that speed limits are strictly adhered to.

PESTICIDE CONTROL

- Assess protective clothing and equipment before handling or applying pesticides to ensure there is no tears/lack/faulty clothing or equipment.
- Ensure exposure time is reduced to what is necessary, to reduce the risk of poisoning.
- Ensure correct pesticides are used and instructions according to the labels are followed.
- Ensure an emergency kit is available at the site and contact details of health professionals are known to workers.
- If animals are found dead at the site, try to establish if it is due to pesticide poisoning.
- Inform abutting neighbours of the time and date of pesticide application and monitor crops.

SAFETY & SECURITY MANAGEMENT

- Ensure that construction workers and farmworkers are managed and informed of the consequences if trespassing occurs.
- Ensure suitable management of the labour force to prevent security-related issues.
- All requirements according to the OHS Act be followed and implemented.

ENVIRONMENTAL AWARENESS TRAINING

The following environmental training and training on dealing with emergencies and remediation measures for such emergencies:

ENVIRONMENTAL TRAINING

1. The Applicant, Farm Manager or ECO will have one-on-one information sessions with employees working in specific sections of the site.
2. Once a semester all employees should participate in a walkthrough of the specific site area and be requested to highlight unattended environmental impacts to increase their assessment ability and focus on potential impacts in the entire area.
3. Unattended impacts identified will be discussed and employees will be requested to provide solutions to such impacts. These solutions will be discussed and corrected if not in line with general environmental policies.
4. Employees should attend a 6 monthly or annual meeting to discuss any environmental aspect of concern and mechanisms to avoid such scenarios.
5. Employees will attend one course/seminar/presentation on environmental awareness.

TRAINING ON DEALING WITH EMERGENCIES AND REMEDIATION MEASURES FOR SUCH EMERGENCIES

- An emergency protocol will be established and documented and will deal specifically with the line of authority and responsibility and contact details of dedicated persons, including that of the landowner/abutting landowner.
- Potential emergencies will be determined and documented for each section of the site and will be discussed with individuals/groups. Emergencies identified at the site are erosion after heavy precipitation, unauthorized clearing of land, degradation of soil, pesticide poisoning, and alien vegetation infestation.
- Remediation measures, provisional and/or permanent, which are aligned with the conditions of the EMP will be documented for identified emergencies and will be discussed with employees. Each employee will be provided with a short manual on how to deal with identified emergencies.
- The Applicant or Farm Manager will provide an information session on dealing with emergencies and remediation of such emergencies once every two or five years by a recognized environmental practitioner (ECO).
- Employees will be informed on suitable material/equipment available to deal with emergencies and the functions of this material/equipment.

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IRRIGATION SUITABILITY FOR THE FARM ZWEMKUIL

FEBRUARY 2022

PREPARED FOR JURY LOOTS

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EXECUTIVE SUMMARY

A soil survey was conducted at Zwemkuil on approximately 448 ha of land near Prieska in the Northern Cape to determine whether the land would be suitable for irrigation. The soil forms observed included the Augrabies, Addo, Hutton, Vaalbos, Glenrosa, Plooysburg, Prieska, Brandvlei and Coega. The Augrabies, Hutton, Addo, Prieska, and parts of the Vaalbos, Glenrosa, and Plooysburg soil forms were considered suitable for irrigation and therefore suitable for vineyards, while the Coega and parts of the Glenrosa soil forms were not suitable for irrigation or vineyard production due to root restriction caused by limiting layers and shallow soil depths. The chemical results indicated that only a few horizons were alkaline, while one was slightly acidic and the rest neutral. Approximately 330 ha of the 448 ha survey area is suitable for irrigation, while approximately 76 ha were suitable for vineyard production.

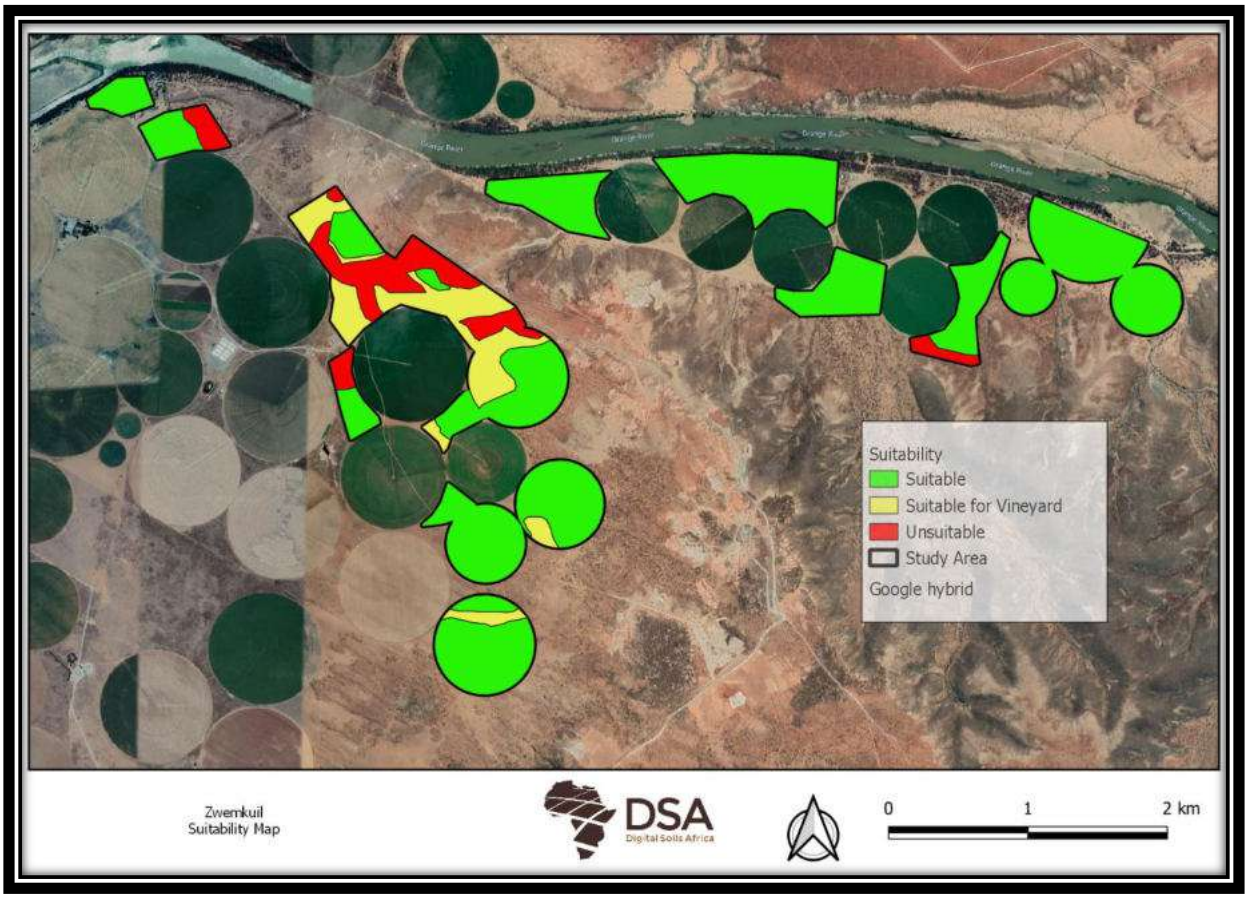

FIGURE 1: SUITABILITY OF THE STUDY AREA.

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INTRODUCTION

Digital Soils Africa (Pty) LTD (DSA) was tasked by Jurie Loots to conduct irrigation suitability and soil survey to comply with the Northern Cape Department of Agriculture ploughing certificate. A soil survey was conducted on approximately 448 ha. The survey aimed to determine which areas would be suitable for traditional irrigation and vineyards.

Irrigated lands are prone to salinization and water-logging because of added salts brought in by irrigation water. Salinization is the accumulation of salts within the soil, causing a white salt crust at the soil surface. Insufficient rainfall is the main cause as rainfall is not able to flush out salts from the crop root zone. The water is applied faster than it can be drained, thus causing salinization to increase. If this is not negated by proper management, the soil could reach the extent where it cannot be vegetated anymore.

The Department of Agriculture, Northern Cape has provided guidelines to which the properties of soil must adhere before a ploughing license can be granted. The adherence of properties refers to the infiltration of water through the soil as well as the built-up of sodium and salt. The focus site was thus investigated for the sustainability of the soil properties as well as areas where irrigation would be manageable whilst being sustainable (Gupta, et al., 2008).

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LOCATION

The farm Zwemkuil, is situated approximately 50 km outside of Prieska on the R357 road to Douglas (Figure 2). The coordinates of the study area are presented in Table 1.

TABLE 1: COORDINATES OF SELECTED POINTS ON THE PERIMETER OF THE STUDIED AREA

id	x	y	id	x	y
1	23.0188511977	-29.4183826390	21	23.0529887140	-29.4414570668
2	23.0238151732	-29.4186782712	22	23.0485961086	-29.4232248248
3	23.0229505615	-29.4203765743	23	23.0577216078	-29.4268401245
4	23.0295517510	-29.4212637935	24	23.0608106672	-29.4215801431
5	23.0339359633	-29.4257430283	25	23.0744633461	-29.4215489671
6	23.0412391075	-29.4280801458	26	23.0684163612	-29.4260655396
7	23.0508228876	-29.4313428096	27	23.0744466500	-29.4271512012
8	23.0457509419	-29.4320228319	28	23.0767776724	-29.4312979284
9	23.0385073258	-29.4340342115	29	23.0700728856	-29.4305002324
10	23.0371373935	-29.4351457427	30	23.0865895451	-29.4259346570
11	23.0409647272	-29.4390159546	31	23.0846089816	-29.4346073306
12	23.0459726744	-29.4405109444	32	23.0828410243	-29.4282114248
13	23.0476291965	-29.4369844418	33	23.0907145579	-29.4299267621
14	23.0547595115	-29.4361698346	34	23.0867346081	-29.4289960588
15	23.0460454069	-29.4427331733	35	23.0932554200	-29.4251163984
16	23.0458288510	-29.4454379627	36	23.0941786894	-29.4289984610
17	23.0518114444	-29.4471109781	37	23.0999550172	-29.4309395956
18	23.0480228345	-29.4501111456			
19	23.0486563328	-29.4564335713			
20	23.0576124980	-29.4437848694			

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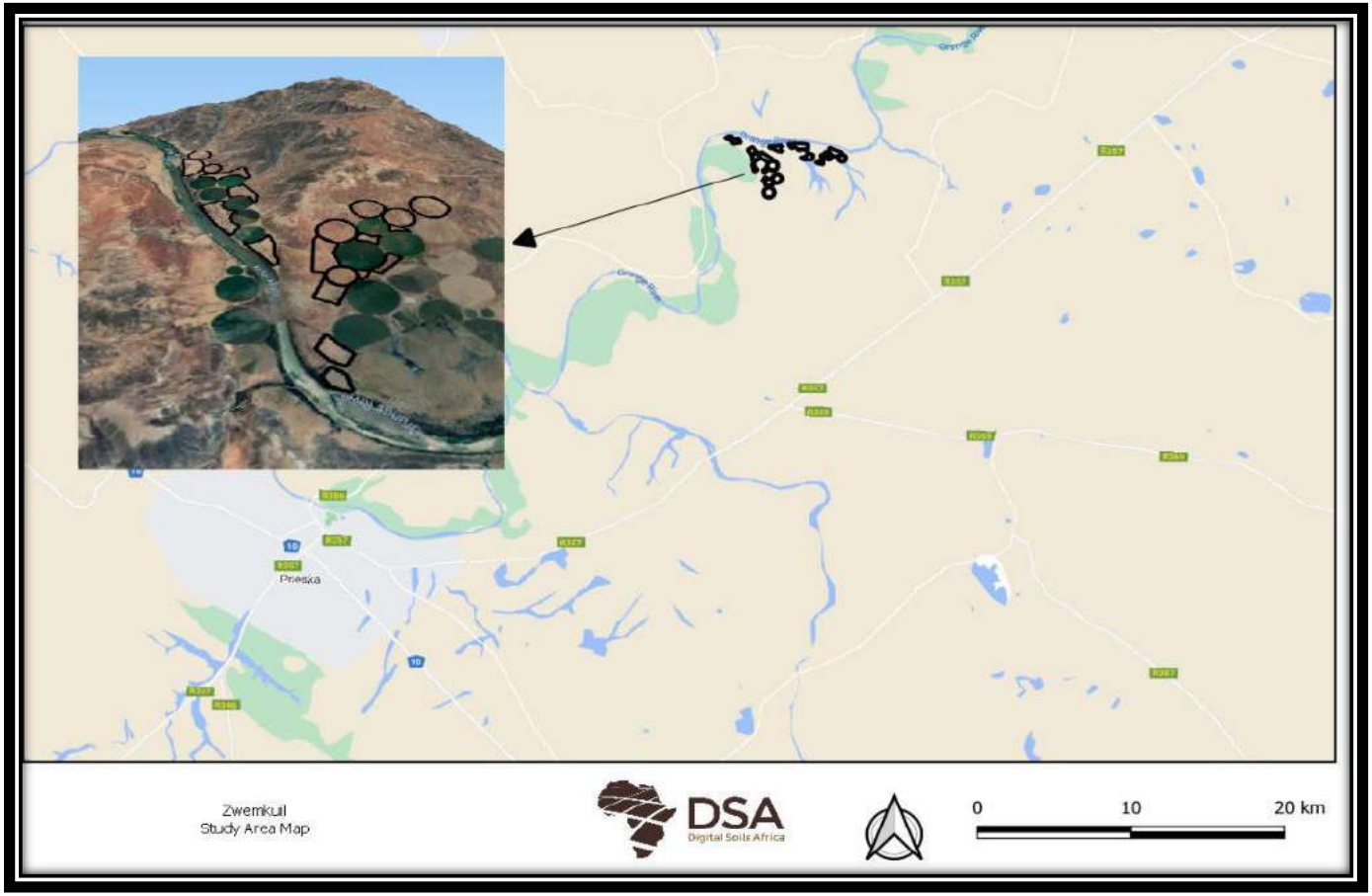

FIGURE 2: THE FARM ZWEMKUIL NEAR PRIESKA.

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METHODOLOGICAL APPROACH

DESKTOP SURVEY

A field visit was conducted from the 17th to the 19th of January 2022. A total of 113 profiles were made by a TLB. Soils were classified according to Soil Classification: A Natural and Anthropogenic System for South Africa (2018) which is now the officially recognized classification system for South African soils. Soil depth, freely drainable depth, and limiting material were noted and mapped. Samples were taken at 4 profiles, one for every horizon. The profiles sampled were 36A and B, 59, 75A and B, 88A and 103A. A total of 4 topsoil horizons (0-300 mm) and 3 subsoil horizons (300-1000) were analyzed. The texture was measured with the pipette method, basic cations from a 1:10 NH4OAc extract (White 2006), and soil pH in a 1:2.5 KCl extract. Phosphorus was measured with Bray I method.

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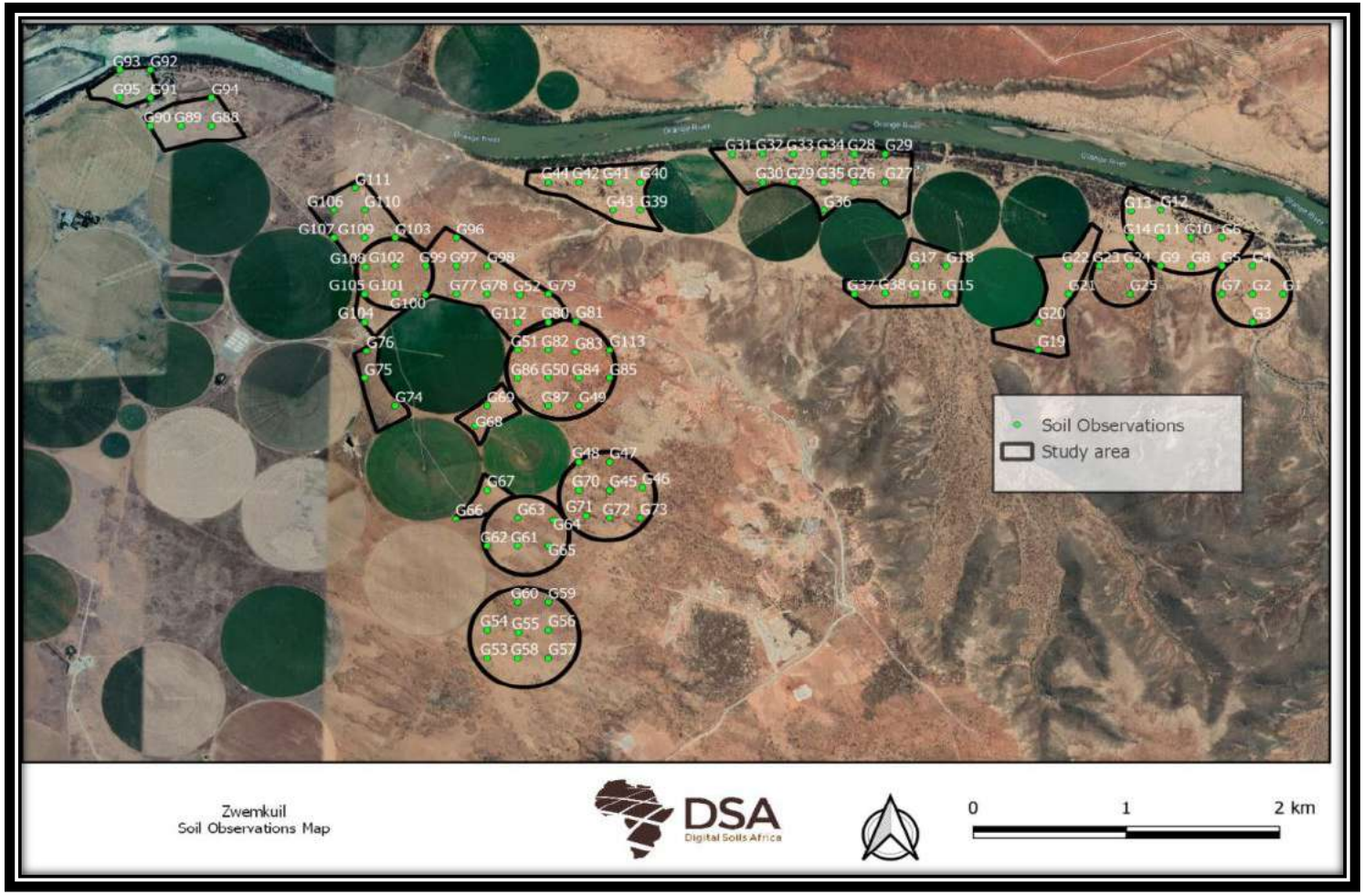

FIGURE 3: THE LOCATION OF THE OBSERVATIONS.

RESULTS

SOIL FORMS

The Augrabies (214 ha) soil form is the dominant soil form in the study area (Figure 4). The Hutton soil form was found in the southern parts of the study area and covered 37 ha. The Coega soil form (31.5 ha) was found in the north western areas and was characteristically shallow. The Addo soil form was found near the Augrabies soil forms in the eastern side of the study area and covered approximately 36 ha. The Glenrosa soil form (23.6 ha) was found throughout the study area, while the Vaalbos soil form (25 ha) was found near the Plooysburg soil form in the centre of the study area. The Prieska and Brandvlei soil form were only found in a small area of the study area and covered approximately 18 and 16 ha of the study area.

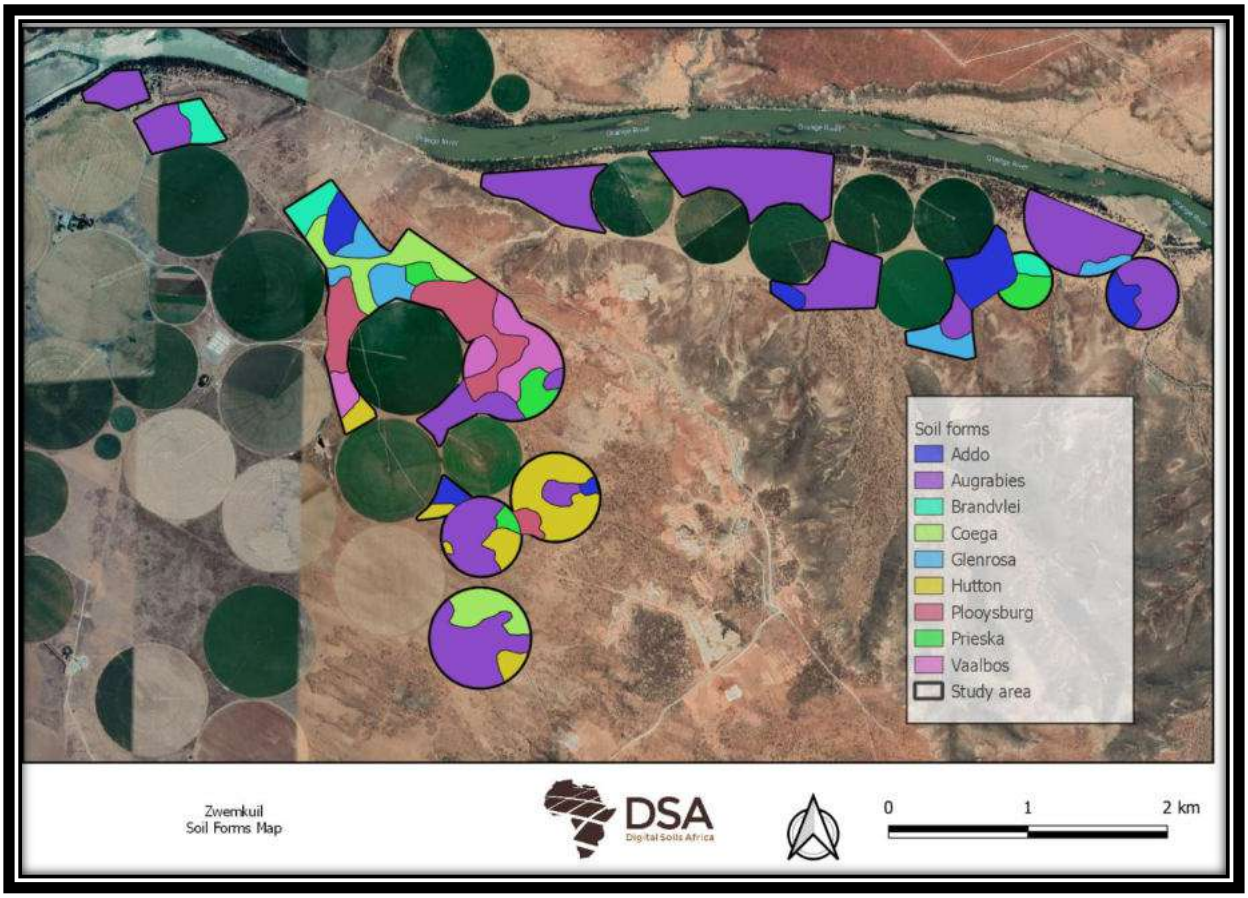

FIGURE 4: SOIL FORMS IN THE STUDY SITE.

AUGRABIES 3110

The Augrabies soil form consists of an Orthic A (200 mm for the study area) overlying a Neocarbonate horizon. The Augrabies soil form covered the majority of the study area. The thickness of the Neocarbonate ranged between 1600- 1800 mm. The 3110 soil family has a bleached topsoil horizon overlying a brown, aluvic, neocarbonate horizon. No restriction on root growth was observed (Figure 5A). The soil form was highly suitable for irrigation due to the depth, absence of restricting layers and absence of hydromorphic properties.

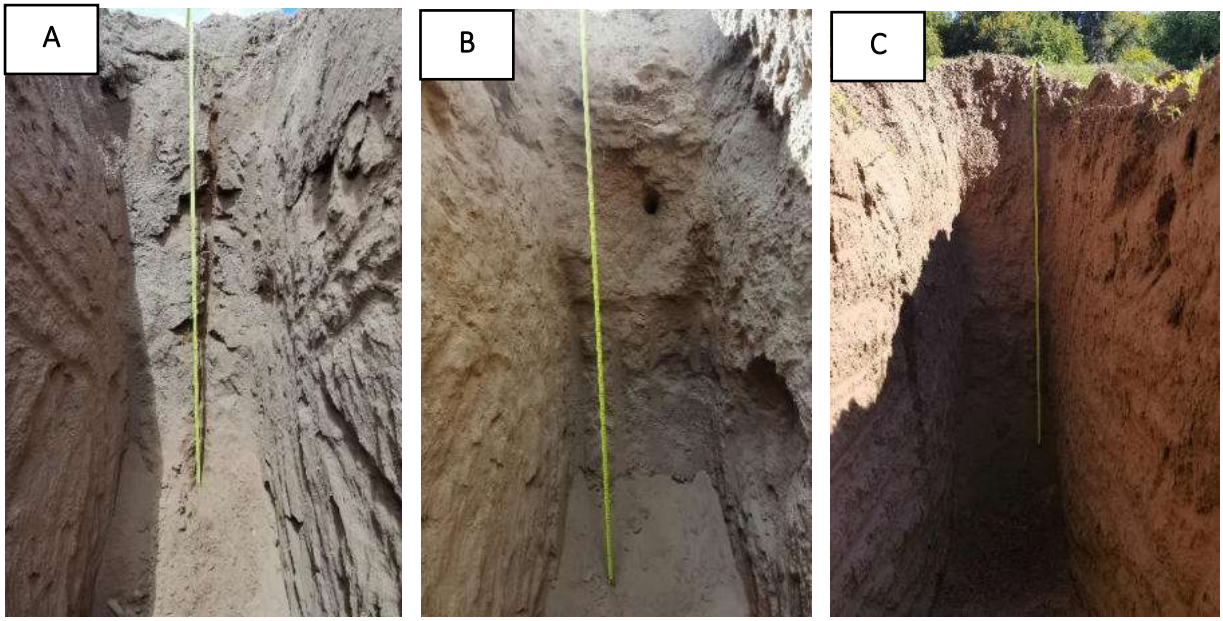

FIGURE 5: AUGRABIES SOIL FORM.

PLOOYSBURG 2100

The Plooysburg soil form consists of an Orthic A, overlaying a Red Apedal horizon on Hard Carbonate. The Orthic A thickness ranged from 200-300 mm and the Red Apedal ranged from 400-1500 mm. The 2100 family consists of a chromic topsoil horizon normally overlaying a eutrophic, aluvic, Red Apedal horizon on Hard Carbonate. The depth of the hard carbonate at certain profiles was the factor for the soils not being suitable as root depth did not meet requirements (Figure 6 A). Root penetration did not exceed through the Hard Carbonate layer and was only suitable for irrigation where depths exceeded 1000 mm as seen in Figure 6 B.

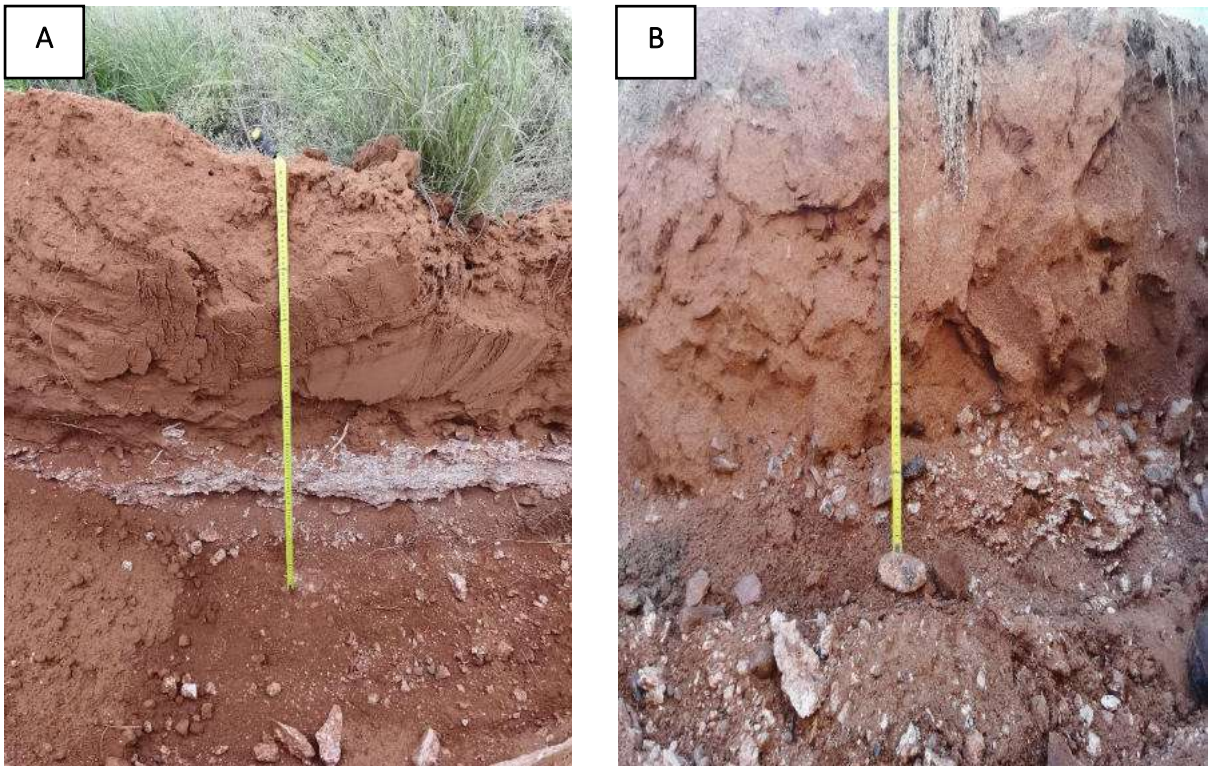

FIGURE 6: PLOOYSBURG SOIL FORM.

COEGA 2100

The Coega soil form consists of an Orthic A underlying a Hard Carbonate. The Coega soils found on site had a maximum depth of 700 mm. Sepiolite was not present within the hard carbonate. Hard carbonate is massive, vesicular, or platy and has a hard to extremely hard consistency. It was observed that certain parts of the hard carbonate of the Coega's could be broken (Figure 7 A) and that root growth in only one profile exceeded 700 mm (Figure 7 B). Only one area of the Coega soil form was suitable for a vineyard as the depth of the profile exceeded 700 mm and the restrictive layer could be broken.

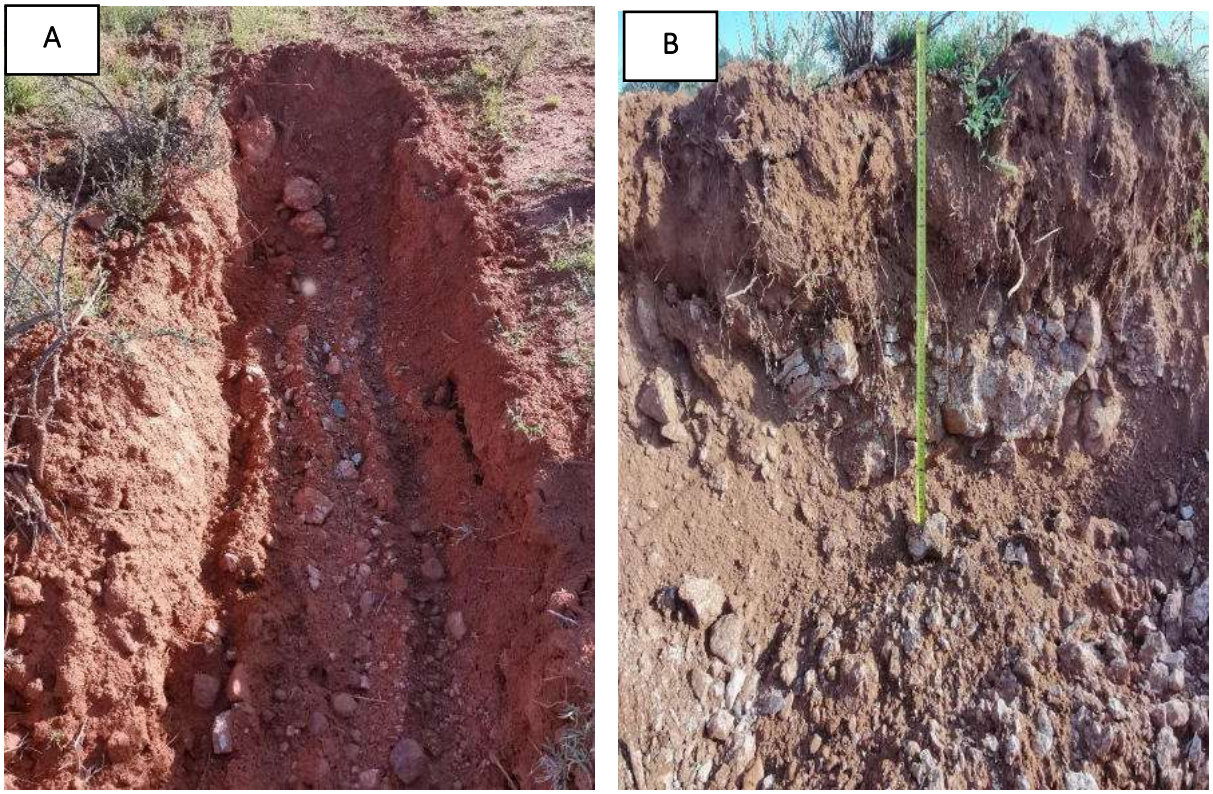

FIGURE 7: COEGA SOIL FORM

GLENROSA 2210

The Glenrosa soil consists of an Orthic A horizon on a Lithic horizon. The Lithic horizon was classified as calcareous and Saprolithic, which is a highly weathered rock material with a friable to slightly hard consistence. The Glenrosa was only found on a small part of the study area and had a maximum depth of 1600 mm. Calcareous layers were present over the Lithic horizon (Figure 8 A). Glenrosa soils are characterized by Alluvial stone deposits. If the material is soft, weathered, and/or layering is vertically positioned, it will favour root penetration to greater depths. The study area had roots at depths of 1600 mm, which indicates that root penetration within the Glenrosa soil form is possible. The Glenrosa soil form is thus suitable for irrigation where profiles exceeded 1000 mm and root penetration was visible as seen in Figure 8 B.

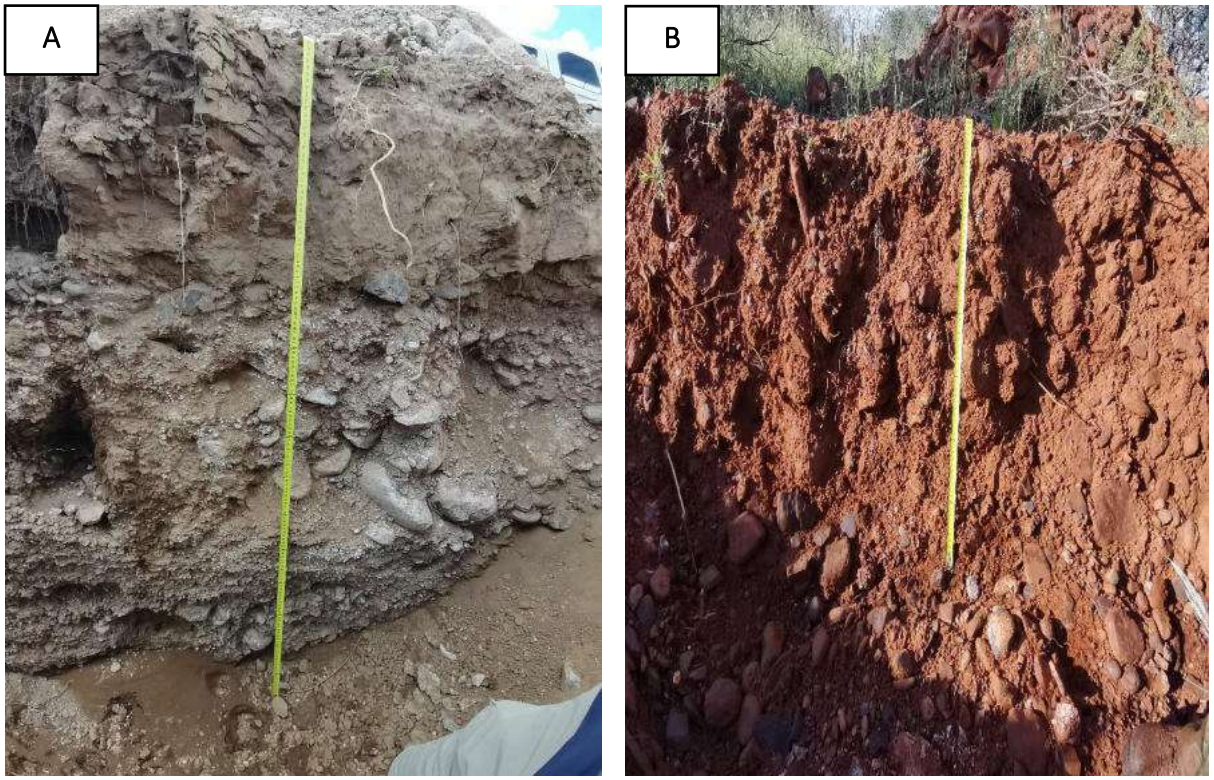

FIGURE 8: GLENROSA SOIL FORM

ADDO 3110

The Addo soil form consists of an Orthic A on top of a Neocarbonate horizon. The Neocarbonate has a Soft Carbonate horizon underlying it. The 3110 soil family has a bleached Orthic horizon and a brown, aluvic Neocarbonate horizon. Root penetration went through the soft carbonate indicating that the horizon is friable and that macropores are present to assist with drainage.. Good management should be taken as salinization could become a problem due to the Soft Carbonate horizon.

FIGURE 9: ADDO SOIL FORM.

VAALBOS 2111

The Vaalbos soil form consists of an Orthic A overlying a Red Apedal horizon with fractured rock being the restricting layer under the Red Apedal. The Vaalbos was found on various occasions in the study area and had a calcareous layer covering the fractured rock. The Vaalbos soil form was suitable if Red Apedal had depth of >1000 mm. Root growth was restricted by the fractured rock Figure 10 A.

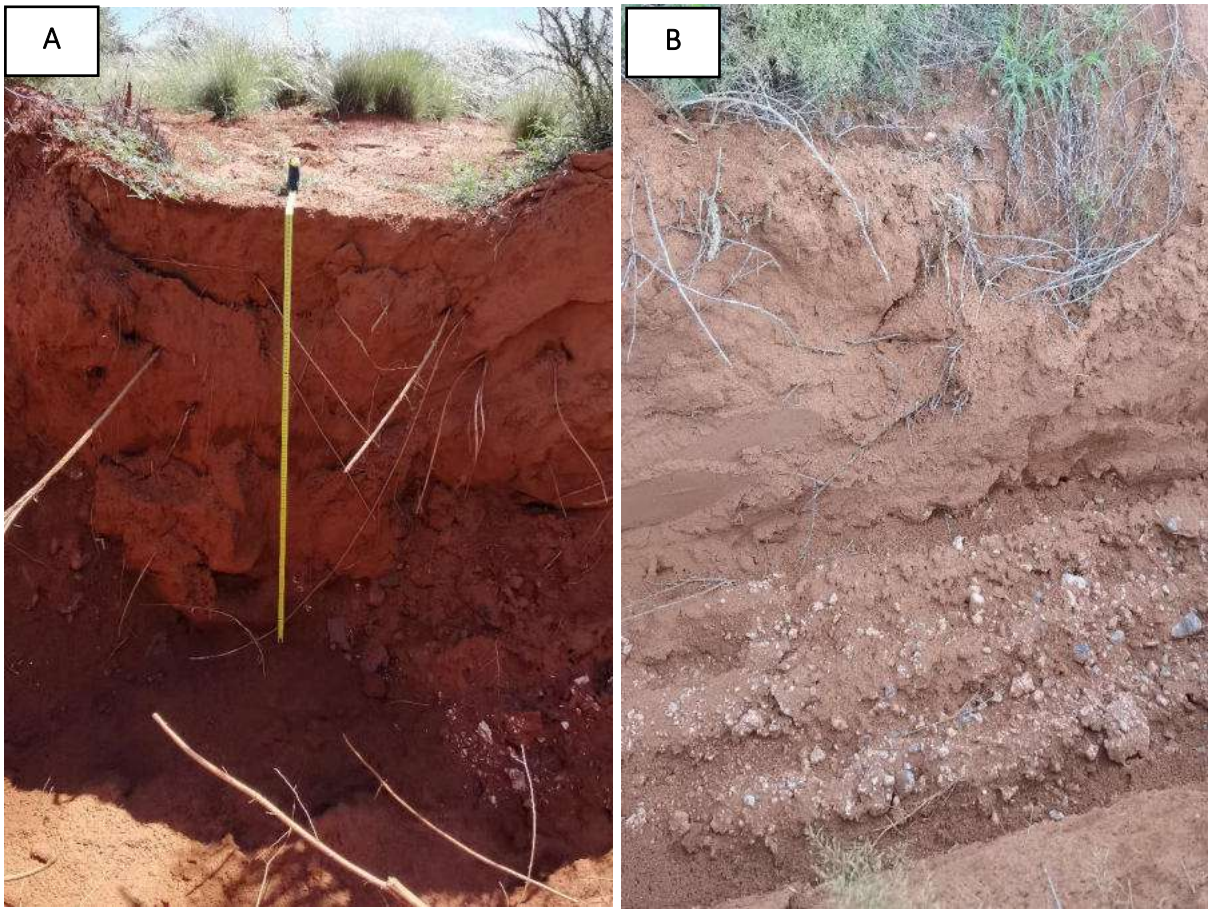

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FIGURE 10: VAALBOS SOIL FORM.

HUTTON 2110

The Hutton soil form consists of an Orthic A overlying a Red Apedal horizon. The Hutton soil form was very deep with the profile depths reaching 2000 mm (Figure 11 A and B). The Hutton soil is suitable for irrigation. The red colour (5yr 5/4), together with the Apedal structure, indicated good drainage throughout the profiles. Additionally, no restrictive layers occurred, further supporting suitability for irrigation.

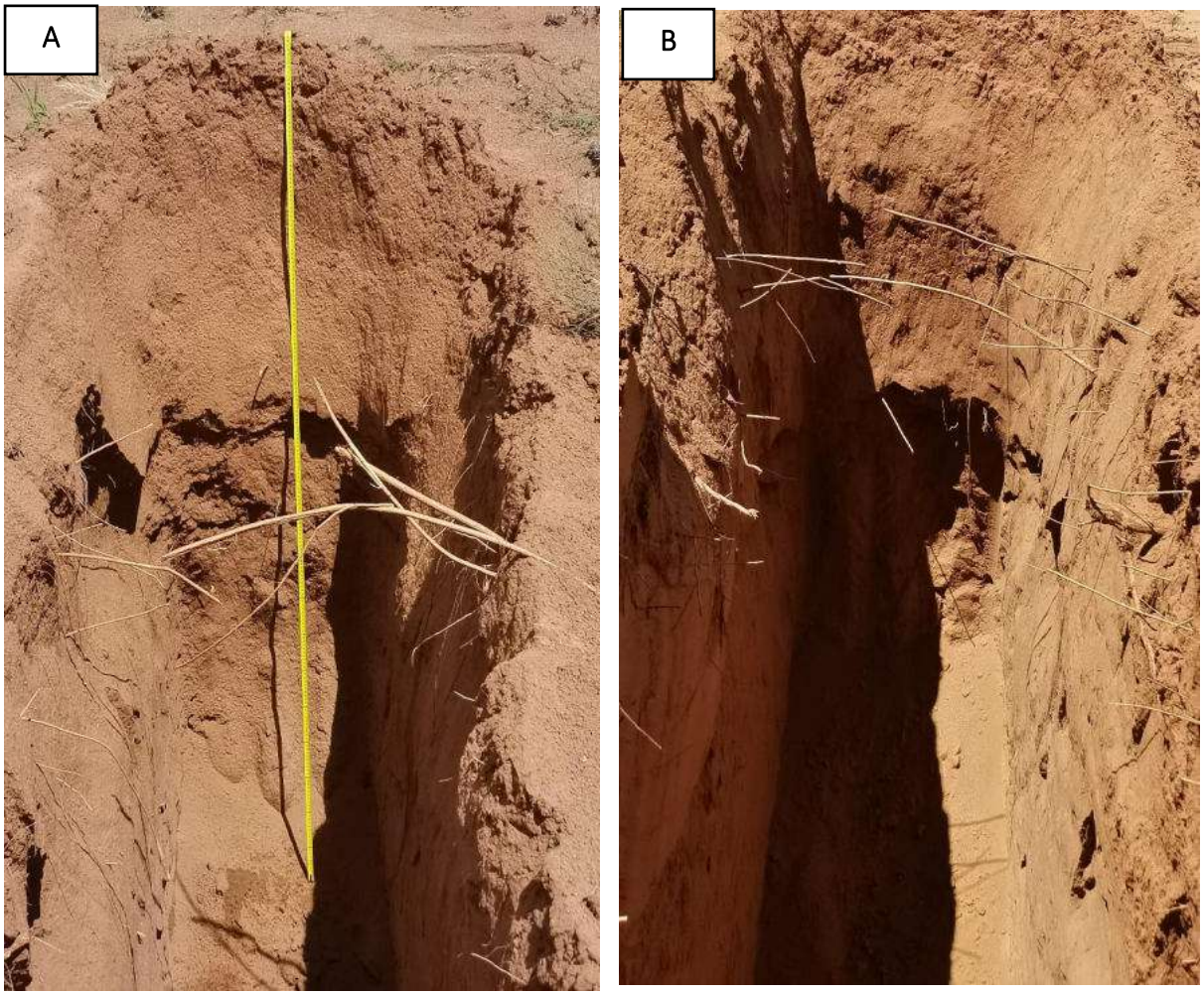

FIGURE 11: HUTTON SOIL FORM.

PRIESKA 2110

The Prieska soil form consists of an Orthic A overlying a Neocarbonate horizon on a Hard Carbonate horizon. Roots were restricted by the Hard Carbonate layer (Figure 12 A), which was the limiting layer by which suitability for irrigation was determined. The Prieska soil form had a maximum depth of 1600 mm. The Neocarbonate reached depths of 1000 mm after which the Hard Carbonate was broken to depths between 1000-1600 mm (Figure 12 B). The Prieska soil form was suitable for irrigation as the freely drainable depth was between 1000-1600 mm. This was supported by root penetration that reached 1000-1600mm.

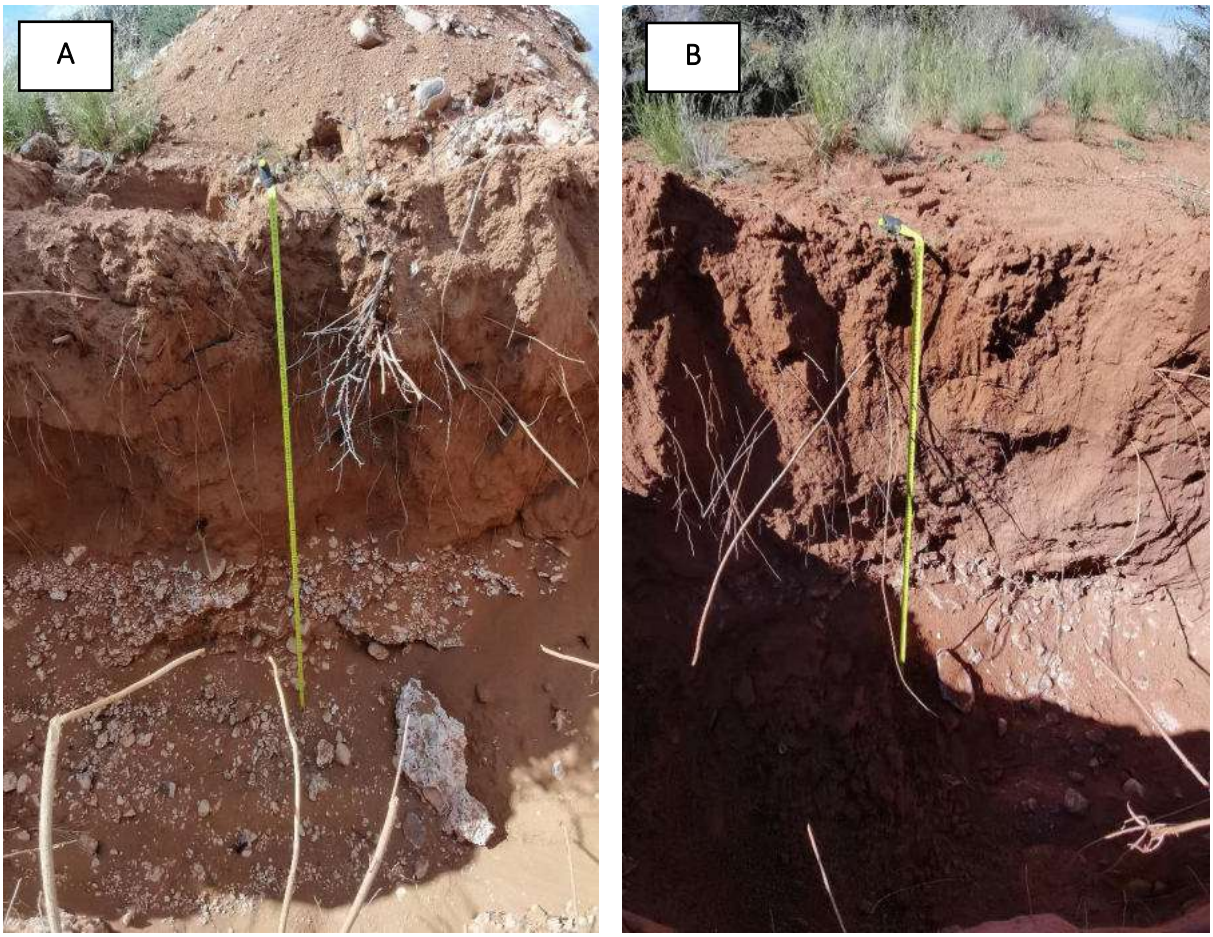

FIGURE 11: PRIESKA SOIL FORM.

BRANDVLEI 2200 &3200

The Brandvlei soil form consists of an Orthic A overlying a Soft Carbonate horizon. Roots weren't always restricted by the Soft Carbonate and reached depths of 1500 mm in certain profiles (Figure 13 B). The 2200 soil family has a chromic Orthic horizon (Figure 13 B), while the 3200 family has a bleached Orthic horizon (Figure 12A). The Brandvlei soil form is not suitable for irrigation due to the high risk of salinization through irrigation water on an already high salt content soil. The soil could well be cultivated with vineyard as the Soft Carbonate horizon can be broken. The risk of salinization within vineyards is lowered by drip irrigation. For vineyards to be profitable under drip irrigation, salinity should be controlled by means of adequate leaching called localized leaching. Localized leaching will decrease the risk of salinization (Hanson, 2011).

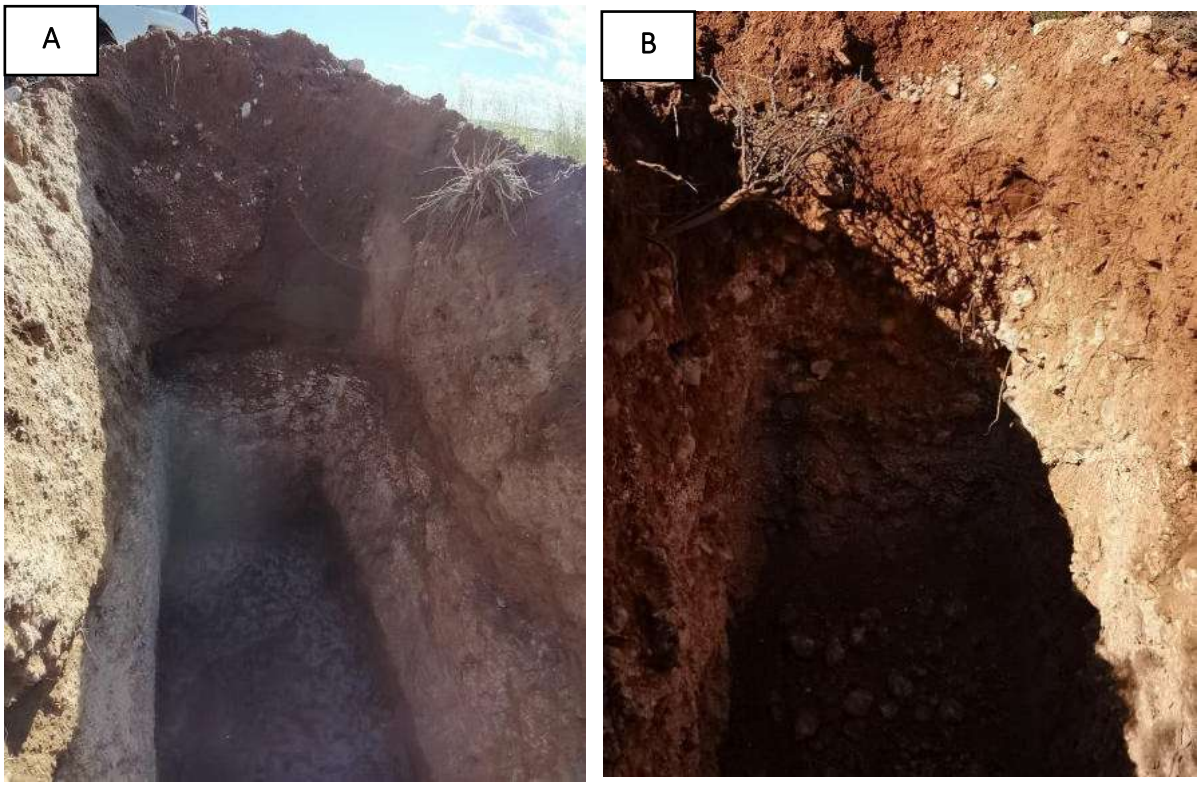

FIGURE 13: BRANDVLEI SOIL FORM.

SOIL DEPTHS

Two soil depth maps were created, namely, the total soil depth (Figure 14) and the freely drainable depth (Figure 15). The total soil depth of the area is determined by the depth of each observation up to the restrictive layer, while the freely drainable depth is determined as the depth considered to drain without restriction. The total and freely drainable soils depths of the study area are moderate to deep with most of the soils ranging from 1.51-2.00 mm in depth. A small portion of the area had depths shallower than 500 mm. The Coega and parts of the Glenrosa soils were associated with the 0-0.50 m soil depths. The restricting layers encountered were Hard Carbonate, Fractured rock, Soft Carbonate, and Lithic horizons. The Fractured rock was found within the Vaalbos soil form, while the Lithic occurred in the Glenrosa soil forms. Soft Carbonate was found in the Addo and Brandvlei soil forms, while Hard Carbonate was found in the Coega and Plooysburg soil forms. The Lithic horizon had a restricting layer at 300-1600 mm depths for the Glenrosa. Fractured rock was found at between 500 and 1000 mm. Soil depths not exceeding 700 mm were deemed not suitable for irrigation or vineyard cultivation.

1 Kemsley street
Port Elizabeth
6001

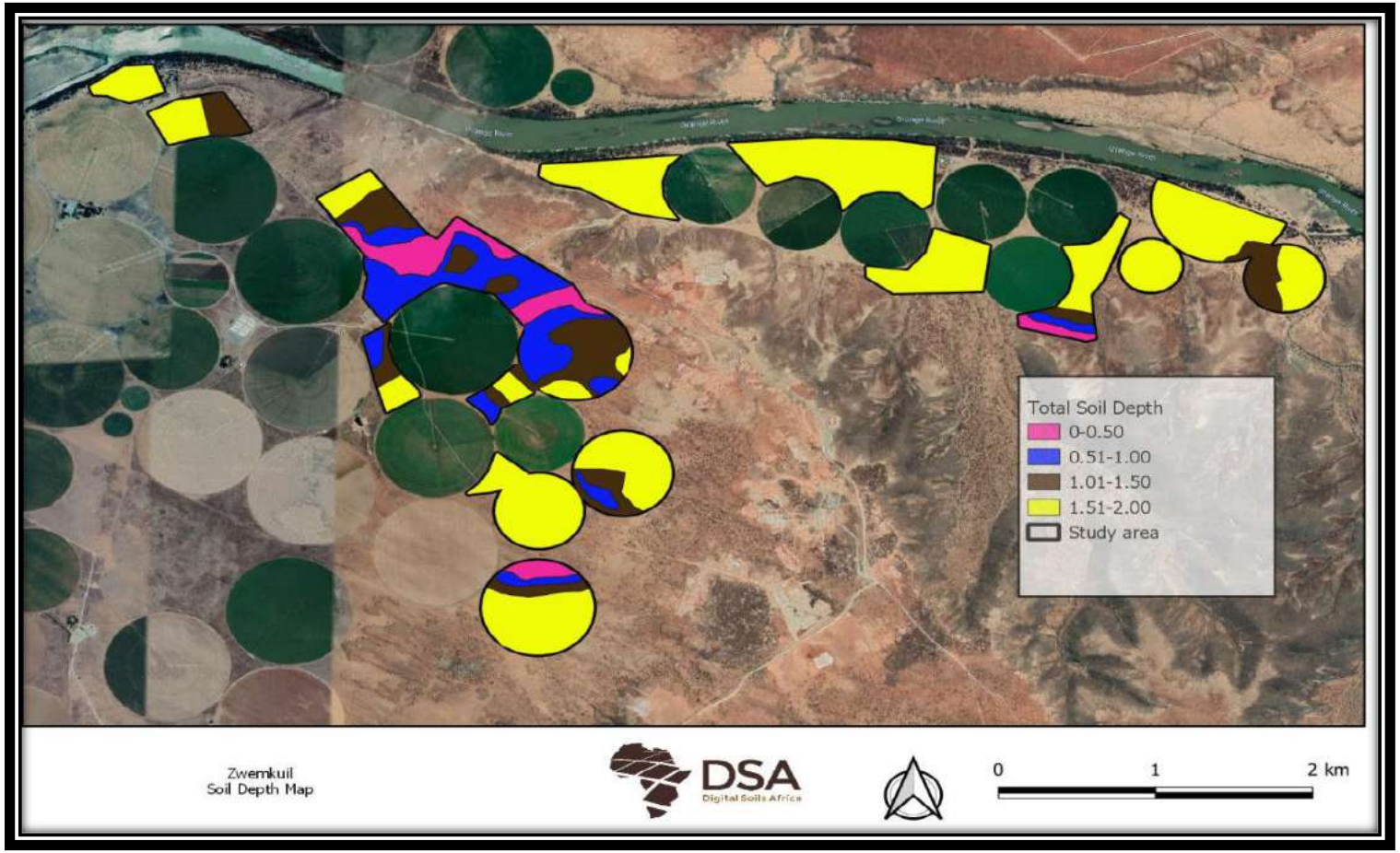

FIGURE 14: TOTAL SOIL DEPTHS.

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Port Elizabeth
6001

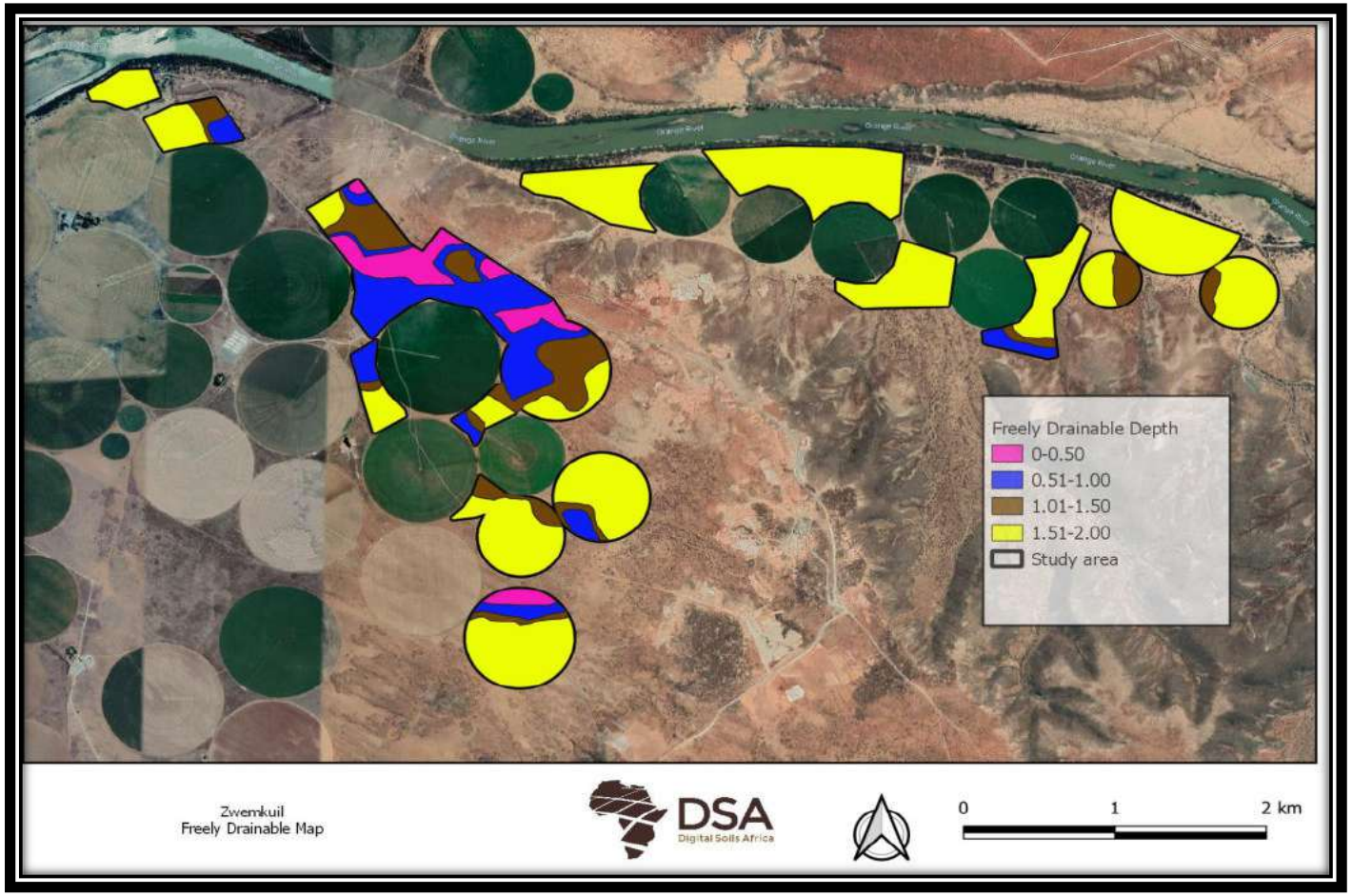

FIGURE 15: FREELY DRAINED DEPTH FOR STUDY AREA.

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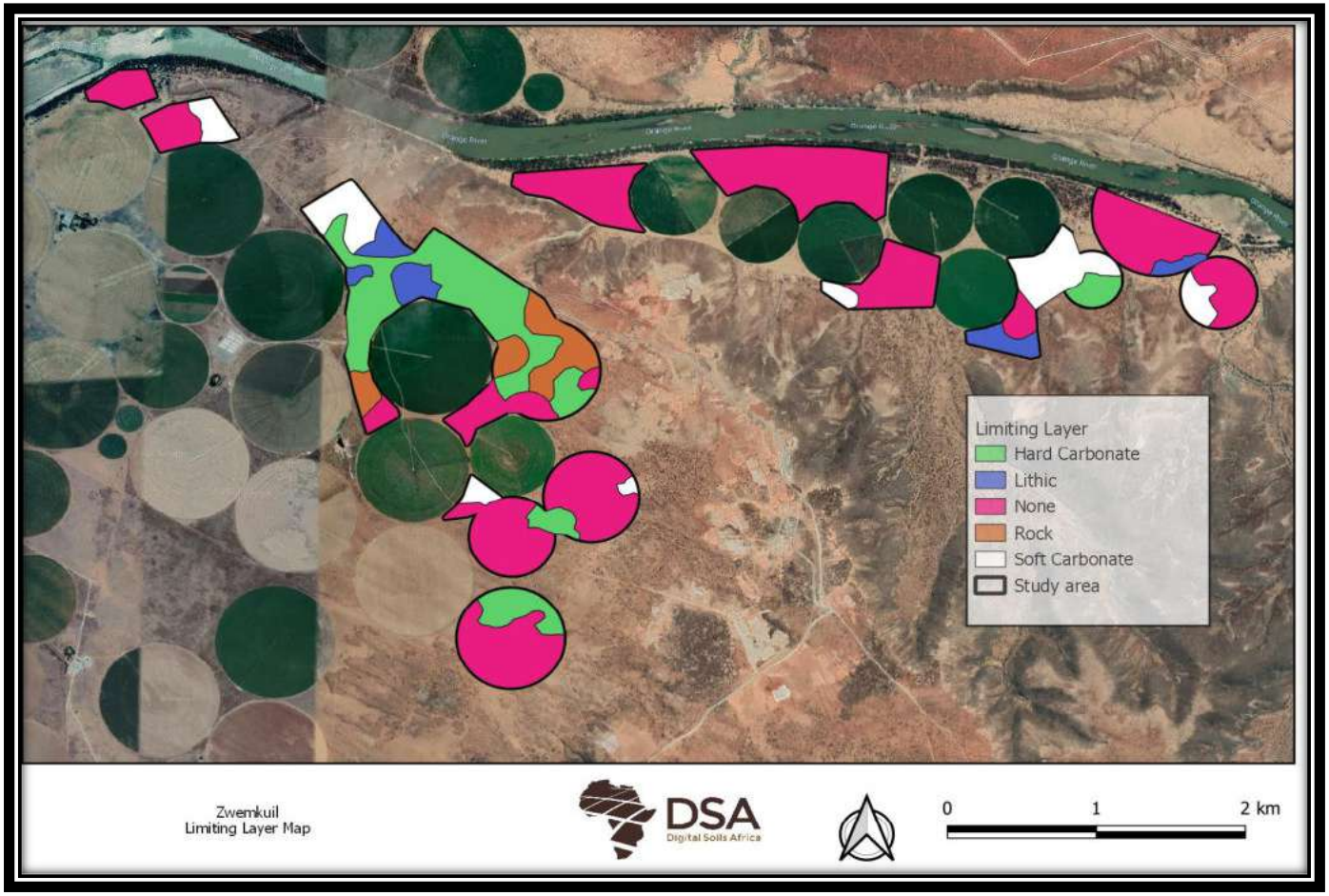

FIGURE 16: LIMITING LAYERS.

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Port Elizabeth
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SLOPE

The topography of the area was flat with the majority of the area having a slope less than 0.8°. The area is situated in a valley and is surrounded by hills with slopes between 0.8 and 2.6°. Drainage would occur in a northern, direction leading to the orange river as it flows from the hills.

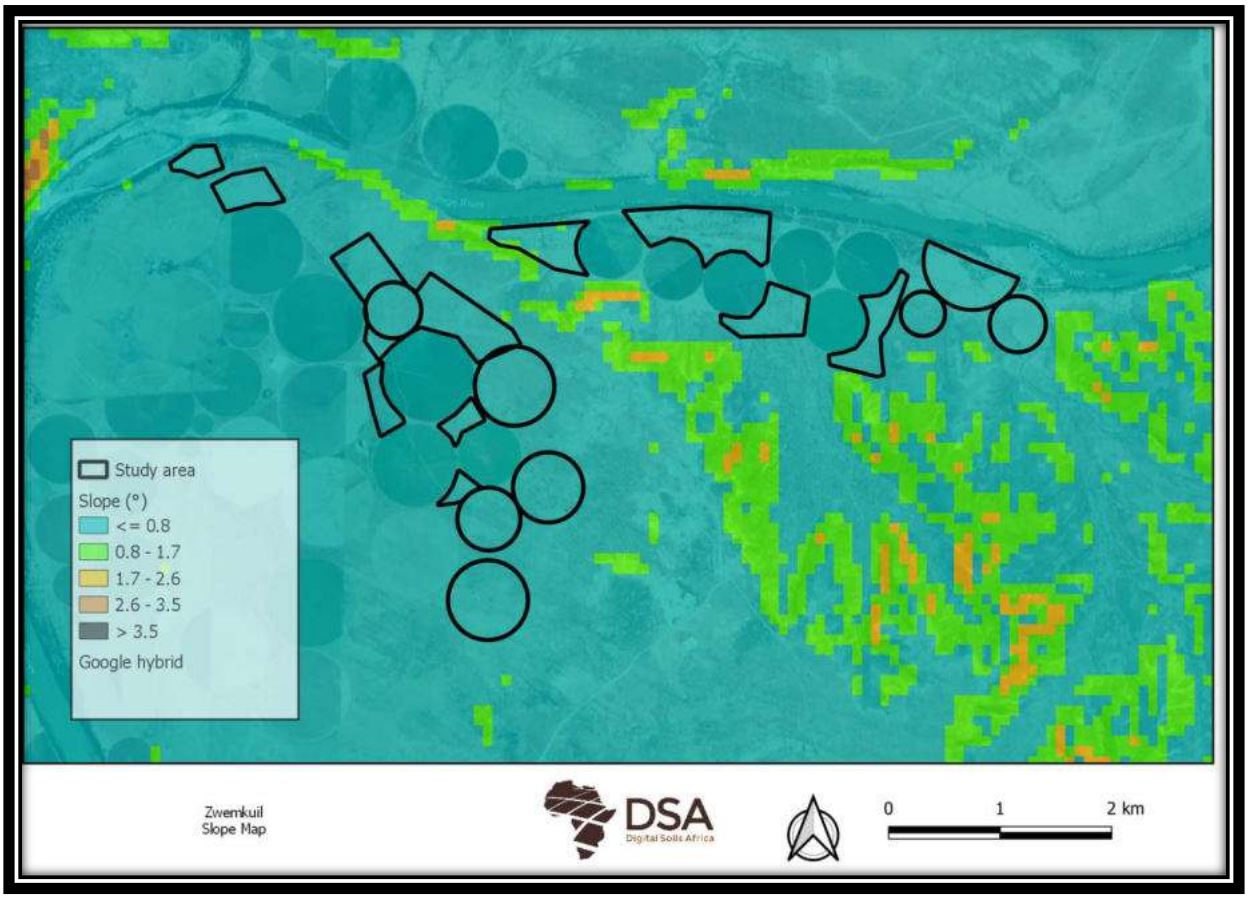

FIGURE 17: SLOPE OF THE STUDY AREA.

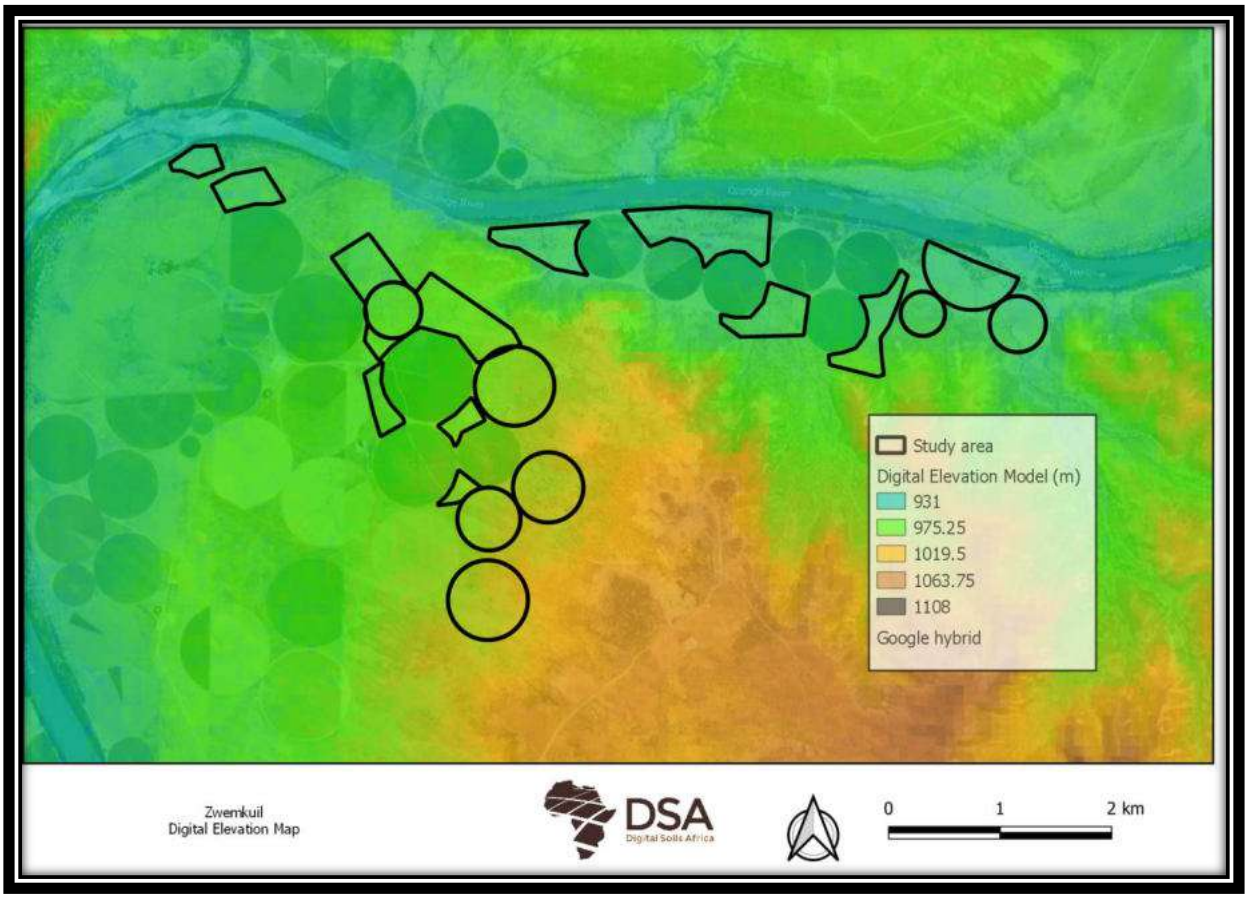

FIGURE 18: DIGITAL ELEVATION MAP.

CHEMICAL AND TEXTURAL ANALYSIS

The chemical properties (Table 2) of the soils vary over the study area. The A and B horizons are chemically different with pH ranging from 5.7 to 7.4. The Orthic horizon of profile 36 is slightly acidic while the Red Apedal and Orthic horizons of profiles 75 and 88 were alkaline, all the other profiles had a relatively neutral pH.

TABLE 2: SELECTED CHEMICAL PROPERTIES FOR MODAL SOIL PROFILES

Observation	Soil Form	Diagnostic Horizon	pH	CEC	ESP	ECe
			KCl	cmol(+)/kg	%	mS/m
G36A	Augrabies	Orthic	5,78	16,3	<1%	32,9
G36B		Neocarbonate	6,88	25,0	<1%	32,6
G59	Coega	Orthic	6,71	10,6	<1%	39,3
G75A	Vaalbos	Orthic	6,89	9,9	<1%	47,7
G75B		Red Apedal	7,43	16,5	<1%	36,4
G88A	Brandvlei	Orthic	7,38	30,0	<1%	40,1
G103A	Glenrosa	Orthic	6,58	7,2	<1%	50,6

The Cation Exchange Capacity (CEC) for the A-horizons of profile 59, 75 and 103 were low (7.2, 9.9, and 10.6 cmol(+)/kg). The other horizons had a moderate CEC and profiles 88 and 36B have a high CEC. The high CEC could be attributed to the high pH levels, which could stimulate high levels of pH-dependent charges on the soil colloids of profiles 88 and 36B and be correlated to increase in clay. Fertility for soils with a lower CEC should be managed with an adequate fertilization plan to ensure optimal production. The exchangeable sodium percentage (ESP) was low in all horizons and indicate non-sodic soils (Table 3). The irrigation threshold of EC for water is 400 mS/m and the soils observed are all below the threshold.

TABLE 3: GENERAL CLASSIFICATION OF SALINE AND SODIC SOILS (CHHABRA, 1996)

Classification	pH_w	EC (mS m^{-1})	SAR	ESP (%)
Slightly saline	< 8.5	200 – 400	< 13	< 15
Saline	< 8.5	> 400	< 13	< 15
Sodic	> 8.5	< 400	> 13	> 15
Saline-Sodic	< 8.5	> 400	> 13	> 15

Clay percentages range from very sandy to moderate. Most soils will have good drainage, but soil water holding capacity and fertility in some areas are low and would require good management. Since the soils are generally sandy, the soil depth would be the biggest contributing factor to drainage.

TABLE 4: PARTICLE SIZE DISTRIBUTION OF MODAL SOIL PROFILES

Observation	Soil Form	Diagnostic Horizon	% Clay	% Silt	% Sand
G36A	Augrabies	Orthic	20,7	11,6	68,6
G36B		Neocarbonate	25,5	11,3	64,0
G59	Coega	Orthic	11,6	4,7	84,5
G75A	Vaalbos	Orthic	9,5	4,8	86,3
G75B		Red Apedal	9,2	4,4	87,0
G88A	Brandvlei	Orthic	14,8	7,0	78,6
G103A	Glenrosa	Orthic	8,8	4,6	87,0

The laboratory results indicate that the chemical parameters are manageable, it is expected that irrigation with high-quality irrigation water will leach some of the base-forming cations out of the soil profiles and thereby lower the pH. Salinity is of low risk within all areas except the Brandvlei soil area where salinity could be of risk. The ESP and EC for the rest of the areas are low and the soils have good drainage. The texture results show that in general, the soils do have sufficient drainage.

SUITABILITY

The suitability of the area (Figure 18) was defined into 3 categories namely, Suitable, Suitable for vineyard, and Unsuitable. Soils not suitable for irrigation, but which had freely drainable depths of at least 700 mm, i.e., soils with a depth of 700 – 1000 mm, would be suitable for vineyard production, with the prevision that the soils are broken, and deep ripping is done.

Approximately 330 ha of the 448 ha survey area is suitable for irrigation. Soils with a freely drainable depth of 1000 mm, which included the Hutton, Augrabies, Prieska, Addo, and sections of the Plooysburg, Prieska, Glenrosa and Vaalbos soil forms were suitable for irrigation. The soil forms not suitable for irrigation (Sections of the Plooysburg, Vaalbos, Brandvlei, Prieska, and Glenrosa) were suitable for vineyards under drip irrigation as the soil could be mechanically altered to accommodate vineyards. The area for vineyard production was approximately 76 ha. The areas not suitable for irrigation or vineyard production were the Coega and parts of the Glenrosa, Vaalbos, Plooysburg, and Brandvlei soil forms. Soil which had a freely drainable depth of <700 was unsuitable for irrigation and vineyard production. The area suitability for vineyards perimeter points is given in Table 5 and the areas suitable for irrigation in Table 6.

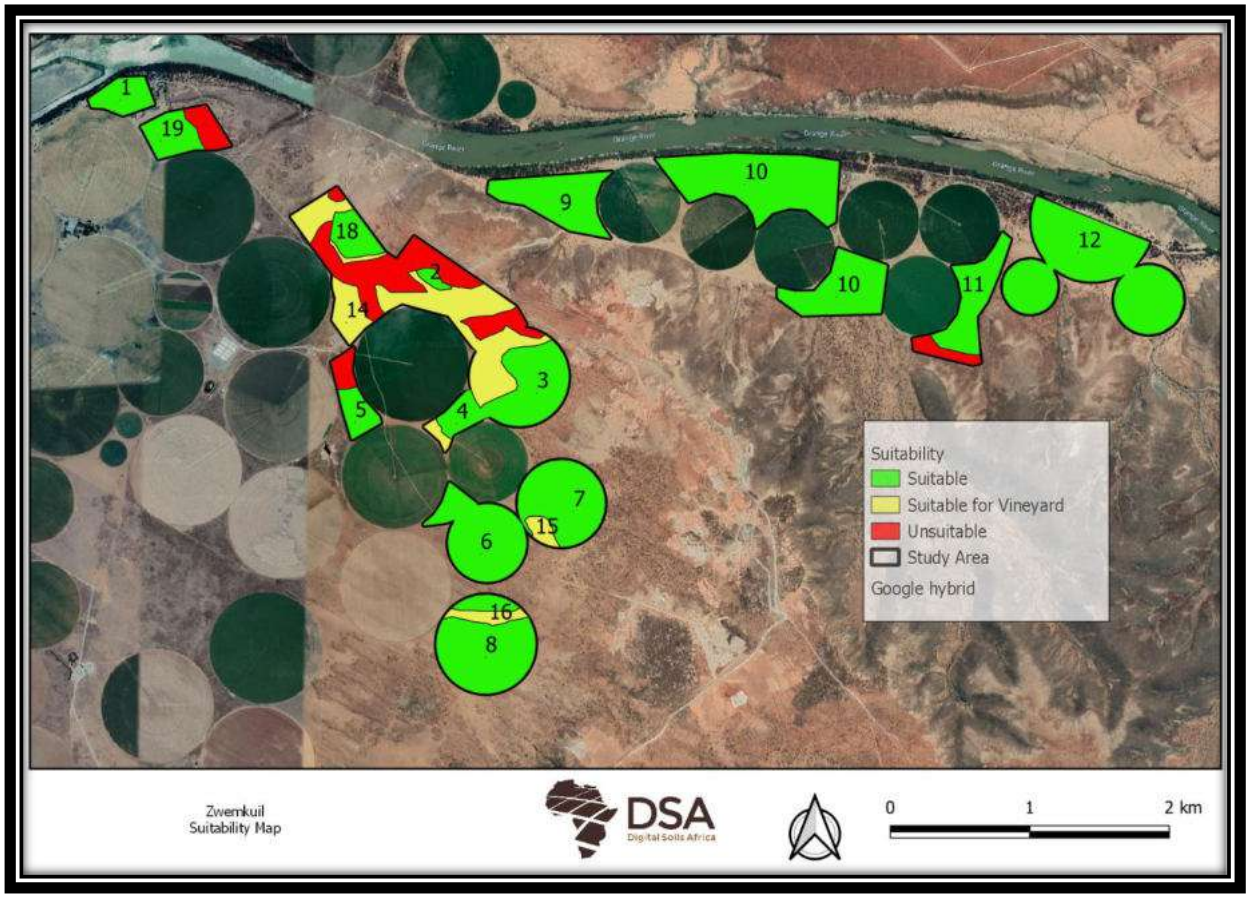

FIGURE 19: IRRIGATION SUITABILITY OF THE AREA.

TABLE 5: THE COORDINATES OF THE CORNERS OF THE PERIMETER OF SUITABLE AREA FOR VINEYARD

Area	X	Y
19	23.0814171323	-29.4327079138
	23.0846089816	-29.4346073306
	23.0801975147	-29.4337232751
14	23.0474073469	-29.4358871201
	23.0457509419	-29.4320228319
	23.0457509419	-29.4320228319
	23.0396485144	-29.4328858518
	23.0373959332	-29.4310085190
	23.0421910347	-29.4307156799
	23.0488908959	-29.4304035627
15	23.0533956683	-29.4450650644
	23.0529871926	-29.4466028649
16	23.0487200414	-29.4510941691

	23.0459485810	-29.4513747572
	23.0515969427	-29.4509468316
	23.0295517510	-29.4212637935

TABLE 6: THE COORDINATES OF THE CORNERS OF THE PERIMETER OF SUITABLE AREA FOR IRRIGATION

Area	X	Y
1	23.0188511977	-29.4183826390
	23.0230037978	-29.4168703526
	23.0214882181	-29.4194505797
2	23.0240942779	-29.4222203770
3	23.0498098755	-29.4345374926
	23.0544274756	-29.4372458576
4	23.0484369229	-29.4387004908
	23.0450707177	-29.4386016565
5	23.0387811559	-29.4401672646
	23.0386144924	-29.4368210256
6	23.0460454069	-29.4427331733
	23.0508137928	-29.4447191320
	23.0476993348	-29.4489731871
7	23.0552103477	-29.4412887356
	23.0568603568	-29.4458567294
8	23.0452926060	-29.4535038089
	23.0510986474	-29.4558647614
	23.0526233991	-29.4526664926
9	23.0484826604	-29.4240027324
	23.0577661692	-29.4224634928
	23.0577216078	-29.4268401245
10	23.0608106672	-29.4215801431
	23.0744633461	-29.4215489671
	23.0736704247	-29.4258206031
	23.0667786976	-29.4239528948
11	23.0744466500	-29.4271512012
	23.0777505729	-29.4313668860
	23.0700728856	-29.4305002324
12	23.0865895451	-29.4259346570
	23.0828410243	-29.4282114248
	23.0848468030	-29.4314730896
	23.0899074563	-29.4279915598

	23.0932554200	-29.4251163984
	23.0977385349	-29.4279053151
	23.0962092661	-29.4321254742
18	23.0339359633	-29.4257430283
	23.0386517529	-29.4252301990
	23.0373140342	-29.4274808713
	23.0406359629	-29.4278063195

1. General soil requirements for Vineyard Production

Vineyards are best suitable for soil that has a pH between 5.5 and 6.5 and has a required phosphorus between 40 to 50 ppm. Additionally, for vineyards to be successful a depth of between 600 mm and 800 mm is required. By breaking up the soil, deep ripping can allow roots to penetrate the soil and access water and nutrients. Soil texture is one of the most important components regarding vineyards, a sandy soil will require intensive irrigation in order to achieve production goals, while a clay soil struggles with cultivation and cracks that disrupts water and nutrient movement. (B. Oberholzer– Personal communication, 2013).

2. Specific Zwemkuil situation

a. Soil depth

Vineyard production requires less soil depth than traditional agricultural produce. The area shown as suitable for vineyard has sufficient depth for vineyard roots to develop and is suitable for production. On the unsuitable area, vineyard roots will be restricted, and the available water and nutrients will be limited.

b. Soil texture

The soil texture is generally very sandy, with clay percentages generally under 20%. Dryland vineyard will not be suitable for these soil types as no water would be retained, while drip irrigation would be better suited for the soil type.

c. pH

The $pH_{(KCl)}$ of the soil samples is between 5.7 and 7.4. The more alkaline soils (Red apedal horizon of profiles 75 and Orthic of 88) require a reduction in pH, while the rest of the area has a suitable pH for vineyards. It is recommended that acidifying fertilizers be used on the soils to lower the pH. Liming is not required. Regular soil sampling will inform the farmer of best management practices concerning alkalinity/acidity.

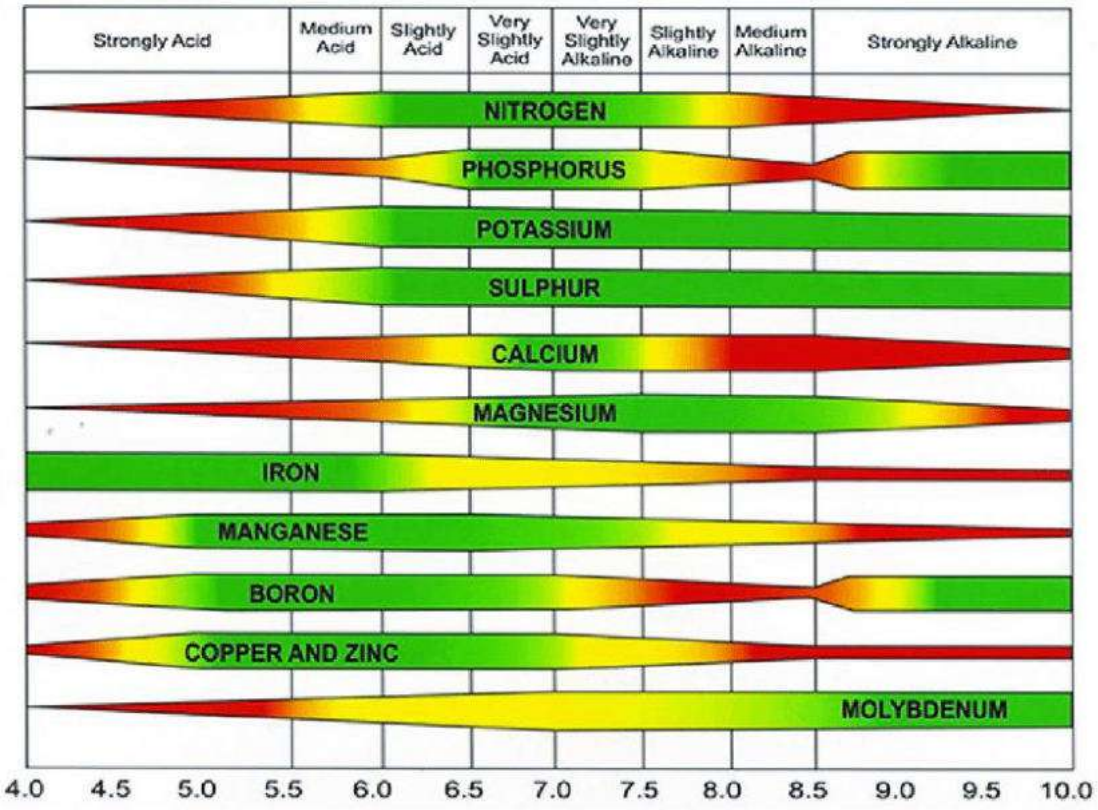

FIGURE 20: AVAILABILITY OF PLANT NUTRIENTS AT DIFFERENT PH RANGES.

d. Phosphorous

Calcuim carbonate (Found in Coega and Brandvlei and soils with Neocarbonate horizons) exerts a major influence on P fixation. The phosphorous within the soil (6-8 mg/kg) is below the required rate of 40 mg/kg. and it is recommended phosphate be applied to prevent plant deficiencies. Phosphate availability is largely dependent on the pH. Soil pH values below 5.5 and between 7.5 and 8.5 limit phosphate availability to plants due to phosphorous being highly fixated at very low pH soils (pH 3-4) and moderately fixated at pH 7.5-9 (USDA, 2001). Therefore, the more alkaline soils of Zwemkuil could experience P deficiency.

3. Conclusion

The soils indicated as suitable for vineyards in Figure 19 are generally suitable for vineyard production. The pH is not within the optimal range and acidic fertilization should be applied; it

is also expected that soil pH will decrease with continued cultivation. The texture is suitable for vineyards under drip irrigation. It is recommended that phosphate be applied to prevent plant deficiencies.

4. General soil requirements for Pecan nut Production

Pecan nut trees perform best in fertile, well- drained, deep soil which consists of a medium texture. The soil depth should at least be 2 m deep. The soil should not be calcareous as calcareous soil causes deficiencies in micro-nutrients, especially zinc. The pH recommendation for pecan-nut trees is 6.5 to 7. Suitability for pecan-nut trees were defined as suitable (depths of 1000 mm and non-calcareous) and moderately suitable (depths of 1000 mm and calcareous).

5. Specific Zwemkuil situation

a. Soil depth

Soils with a freely drained depth >1000 mm were considered to have sufficient depth for pecans, which is a large portion of Zwemkuil farm

b. Soil texture

The soil texture is generally very sandy, with clay percentages under 20%. Pecan-nut trees prefer soil that are freely drained and has sandy loam texture. All the soils meet the textures requirements.

c. pH

The $pH_{(KCl)}$ of the soil samples is between 5.7 and 7.4. More acidifying fertilizers should be applied in the alkaline soils (Red apedal of profile 75 and Orthic of profile 88). A slightly acidic pH was found for the rest of the area. Liming is not required on the alkaline soils as it is anticipated that the pH will lower with continued cultivation and irrigation. Soils that are more alkaline could lead to micro-nutrient deficiencies. Regular soil sampling will inform the farmer of best management practices concerning alkalinity/acidity.

d. Phosphorous

Calcuim carbonate exerts a major influence on P fixation as discussed with vineyard. The phosphorous within the soil (6-8 mg/kg) is low. The recommendations for pecan-nut tres are provided in Table 7.

Table 7: Phosphorous recommendation for Pecan-nut trees

Plant nutrient	Year fertilizer application for trees during years			
Phosphorous	1	2	3	4
(g per tree)	34	68	102	136

e. Zinc

Zinc requirements within areas where pH is higher than 7 (Red apedal of profile 75 and Orthic of Profile 88) are especially at risk for zinc deficiencies. The pH can be decreased and thereby increasing zinc uptake in the roots or apply the zinc for foliage uptake. It is recommended to pursue lowing the pH, since the good drainage of the soils allows leaching which, with chemical amendments, can lower pH effectively.

6. Conclusion

The soils indicated as suitable for pecan-nut trees in Figure 21 are both physically (depth and texture) and chemically suitable for Pecan-nut trees production. The pH is not within the optimal range and acidic fertilization as well as Zn should be applied; it is also expected that soil pH will decrease with continued cultivation.

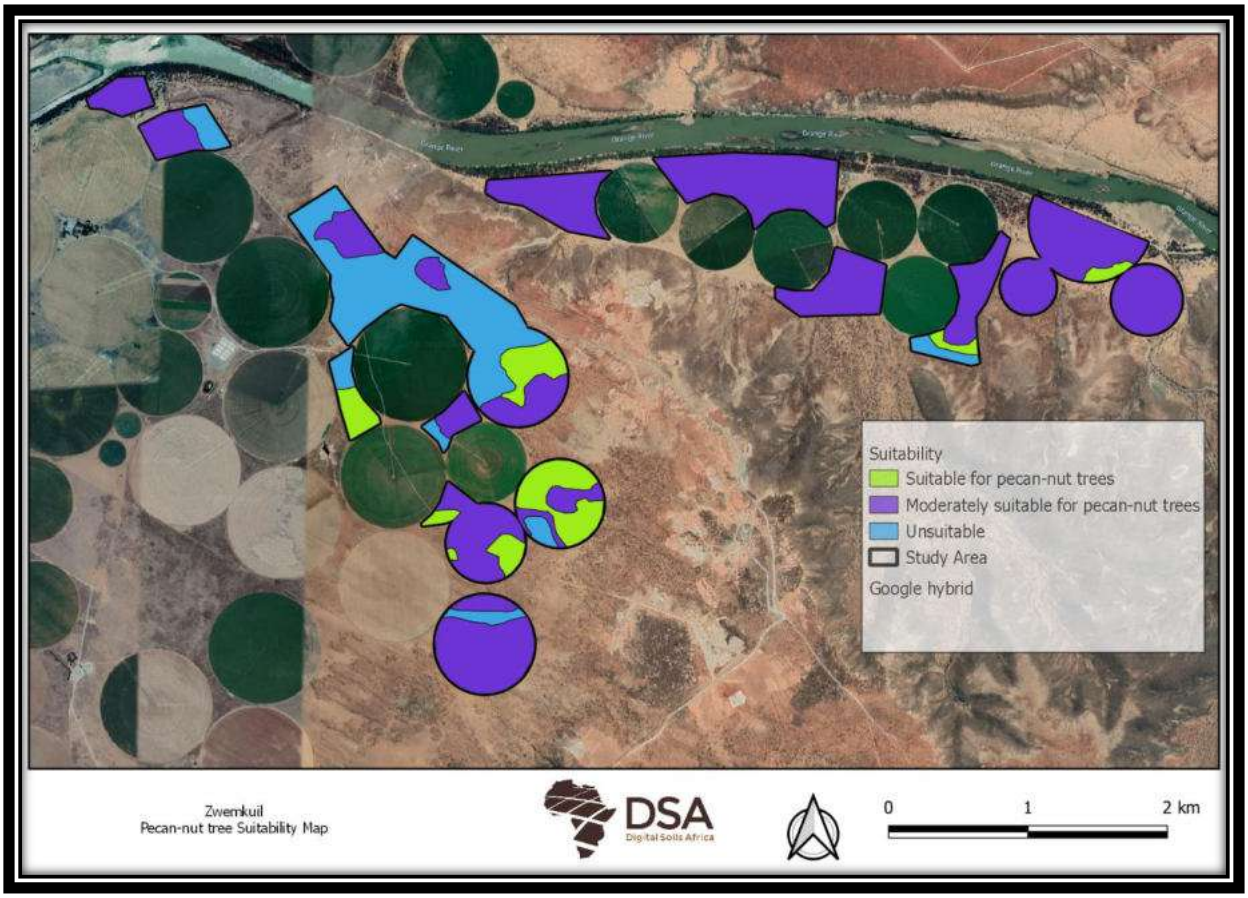

FIGURE 21: SUITABILITY FOR PECAN-NUT TREES.

RECOMMENDATION

It is recommended that the pivot placement does not exceed more than 10% of unsuitable soil. Areas with a freely drainable depth >1000 mm is suitable for irrigation with no restrictions, while soils with a depth of 700 - 1000 mm could be used for vineyard production under drip irrigation. Areas with a depth of less than 700 mm are considered not suitable for irrigation or vineyard.

CONCLUSIONS

The A and B horizons are characteristically sandy and therefore will facilitate good drainage. The drainage restricting layers were the major determining factor for suitability. Approximately 5% of the area has a shallow depth and is not suitable for irrigation or vineyard, while essentially 15% is suitable for vineyard production under drip irrigation. The rest of the area is suitable for all irrigation.

The soil texture results confirm the morphological interpretations and good drainage is expected on the soils where restricting layers are not present.

The laboratory results indicate that the chemical parameters are manageable. The exchangeable sodium percentage (ESP) values are low and the pH values indicate that salinity is not a major risk. The study area (excluding the Brandvlei soil areas) is of low risk to salinization, with low ESP and EC together with good drainage. A fertilization plan on soils with low CEC should be implemented to ensure maximum crop production.

REFERENCE

Briers-Louw, J., 2016 Dryland viticulture: an overview of the South African situation. Dissertation. Thesis. Cape Wine Academy.

Brown, B., 2013. *Soil sampling vineyards and guidelines for interpreting the soil test results.* [Online]
Available at: https://www.canr.msu.edu/news/soil_sampling_vineyards_and_guidelines_for_interpreting_the_soil_test_resul
[Accessed 26 February 2021].

Gupta, R. K., Abrol, I. & Finkl, C. W., 2008. Soil salinity and salinization. In: W. Chesworth, ed. *Encyclopedia of Soil Science.* Chesworth, Ward ed. Dordrecht: Springer, pp. 611-613.

Hanson, B. M. D., 2011. Drip irrigation Salinity Managemanent for Row Crops, California: ANR.

Industries, N. D. o. P., 2022. *Cation Exchange Capacity.* [Online] Available at: https://www.dpi.nsw.gov.au/agriculture/soils/guides/soil-nutrients-and-fertilisers/cec
[Accessed 12 February 2022].

Overheu, T. L. J. H. D., 2021. *Identifying dispersive (sodic) soils.* [Online] Available at: https://www.agric.wa.gov.au/dispersive-and-sodic-soils/identifying-dispersive-sodic-soils
[Accessed 15 December 2021].

Rajakaruna, N. B. R., 2008. Edaphic Factor. In: B. D. F. Sven Erik Jørgensen, ed. *Encyclopedia of Ecology.* USA: Academic Press, pp. 1201-1207.

Soil Classification Working Group, 2018. Soil classification – a Taxonomical System for South Africa.

USDA, 2001. *Soil Phosphorous,* United States: USDA.

White R E, 2006. Principles and Practice of Soil Science: The Soil as a Natural Resource. 4th ed. Blackwell Science, Oxford, UK.

DISCLAIMER

Digital Soils Africa cannot be held responsible for any advice given based on incorrect laboratory analysis given by our providers. Although all care is taken to ensure that the results reported are correct, we are dependent on services from other companies.

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APPENDIX 1: MODAL PROFILES

General Information

Site:	ZWEMKUIL					Soil form:	Augrabies
Map/Photo example: GPS	Figure 4					Soil family:	2110
Position:	23.036438	-29.421823				Colour	Brown
Surface stones:	5%					Occurrence of flooding:	Medium
Altitude:	947 m					Wind erosion potential:	Medium
Terrain unit:	Valley					Water erosion potential:	High
Slope:	0.28%					Vegetation/Land use:	Lucerne
Slope shape:	Planform		Straight	Profile	Straight	Water table:	None
Aspect:	None						
Micro-relief:	None					Described by:	JD Marx
Parent material solum:	Dolomite					Date described:	2022-01-24
Geological group:	Dwyka Grp, Karoo Spgrp					Weathering of underlying material:	low

Profile Information

Horizon Depth (mm)	*Diagnostic Horizon*	*Colour*	*Structure*	*Redoximorphic features*	*Lime*	*Transition*
A 200	Orthic A	Brown	Moderate, medium, SANBL	None	Present	Clear
B 2000	Neocarbonate	Brown	Moderate, weak, SANBL	None	Present	Clear

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General Information

Site:	ZWEMKUIL					Soil form:	Plooysburg
Map/Photo example:	Figure 5					Soil family:	2100
GPS Position:	23.05021	-29.434673				Colour	Red/Brown
Surface stones:	5%					Occurrence of flooding:	Low
Altitude:	989 m					Wind erosion potential:	low
Terrain unit:	Upper slope					Water erosion potential:	moderate
Slope:	0.4 %					Vegetation/Land use:	Grasses
Slope shape:	Planform		Straight	Profile	Straight	Water table:	600-800 mm
Aspect:	None						
Micro-relief:	None					Described by:	JD Marx
Parent material solum:	Dolomite					Date described:	2021-11-15
Geological group:	Dwyka Grp, Karoo Spgrp					Weathering of underlying material:	low

Profile Information

Horizon Depth (mm)	*Diagnostic Horizon*	*Colour*	*Structure*	*Redoximorphic features*	*Lime*	*Transition*
A 200	Orthic A	Brown	Moderate, medium, SANBL	None	None	Clear
B 800	Red apedal	Red/Brown	Moderate, medium, SANBL	None	None	Clear
C 1200	Hard Carbonate	White	Strong	None	Present	Clear

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General Information

Site:	ZWEMKUIL				Soil form:	Coega
Map/Photo example:	Figure 6				Soil family:	2100
GPS Position:	23.039805	-29.429419			Colour	Red /Brown
Surface stones:	2%				Occurrence of flooding:	Low
Altitude:	970 m				Wind erosion potential:	Medium
Terrain unit:	Foot slope				Water erosion potential:	Medium
Slope:	0.26 %				Vegetation/Land use:	Grasses
Slope shape:	Planform	Straight	Profile	Straight	Water table:	None
Aspect:	None					
Micro-relief:	None				Described by:	JD Marx
Parent material solum:	Dolomite				Date described:	2022-01-24
Geological group:	Dwyka Grp, Karoo Spgrp				Weathering of underlying material:	Moderate

Profile Information

Horizon Depth (mm)	*Diagnostic Horizon*	*Colour*	*Structure*	*Redoximorphic features*	*Lime*	*Transition*
A 300	Orthic A	Red	Moderate, medium, SANBL	None	Present	Clear
B 400	Hard Carbonate	White	Strong, SANBL	None	Present	Clear

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APPENDIX 2: SOIL OBSERVATIONS

Name	x	y	Soil Form	Limiting layer	Soil Depth	Freely Drainable Depth
G1	23.0995998243	-29.4302948649	Augrabies	None	1.51-2.00	1.51-2.00
G2	23.0975392250	-29.4303273440	Augrabies	None	1.51-2.00	1.51-2.00
G3	23.0975763102	-29.4321312072	Augrabies	None	1.51-2.00	1.51-2.00
G4	23.0975021431	-29.4285234803	Augrabies	None	1.51-2.00	1.51-2.00
G5	23.0954415767	-29.4285559252	Glenrosa	Lithic	1.01-1.50	1.01-1.50
G6	23.0954045345	-29.4267520586	Augrabies	None	1.51-2.00	1.51-2.00
G7	23.0954786222	-29.4303597913	Addo	Soft Carbonate	1.01-1.50	1.01-1.50
G8	23.0933810069	-29.4285883383	Glenrosa	Lithic	1.51-2.00	1.51-2.00
G9	23.0913204338	-29.4286207195	Augrabies	None	1.51-2.00	1.51-2.00
G10	23.0933440011	-29.4267844693	Augrabies	None	1.51-2.00	1.51-2.00
G11	23.0912834643	-29.4268168482	Augrabies	None	1.51-2.00	1.51-2.00
G12	23.0912464982	-29.4250129763	Augrabies	None	1.51-2.00	1.51-2.00
G13	23.0892546342	-29.4251240372	Augrabies	None	1.51-2.00	1.51-2.00
G14	23.0892229242	-29.4268491952	Augrabies	None	1.51-2.00	1.51-2.00
G15	23.0769330458	-29.4306503839	Augrabies	None	1.51-2.00	1.51-2.00
G16	23.0748724095	-29.4306825127	Augrabies	None	1.51-2.00	1.51-2.00
G17	23.0748357276	-29.4288786230	Augrabies	None	1.51-2.00	1.51-2.00
G18	23.0768963276	-29.4288464965	Augrabies	None	1.51-2.00	1.51-2.00
G19	23.0831885996	-29.4341615653	Glenrosa	Lithic	0-0.50	0-0.50
G20	23.0831517656	-29.4323576861	Augrabies	None	1.51-2.00	1.51-2.00
G21	23.0851755578	-29.4305215501	Addo	Soft Carbonate	1.51-2.00	1.51-2.00
G22	23.0851386941	-29.4287176722	Addo	Soft Carbonate	1.51-2.00	1.51-2.00
G23	23.0871992774	-29.4286853864	Addo	Soft Carbonate	1.51-2.00	1.51-2.00
G24	23.0892598572	-29.4286530689	Brandvlei	Soft Carbonate	1.51-2.00	1.01-1.50

G25	23.0892967937	-29.4304569421	Prieska	Hard Carbonate	1.51-2.00	1.01-1.50
G26	23.0706047101	-29.4235310940	Augrabies	None	1.51-2.00	1.51-2.00
G27	23.0726652077	-29.4234990383	Augrabies	None	1.51-2.00	1.51-2.00
G28	23.0705681143	-29.4217271975	Augrabies	None	1.51-2.00	1.51-2.00
G29	23.0726285756	-29.4216951441	Augrabies	None	1.51-2.00	1.51-2.00
G29	23.0664837049	-29.4235951100	Augrabies	None	1.51-2.00	1.51-2.00
G30	23.0644231973	-29.4236270702	Augrabies	None	1.51-2.00	1.51-2.00
G31	23.0623262359	-29.4218550927	Augrabies	None	1.51-2.00	1.51-2.00
G32	23.0643867105	-29.4218231667	Augrabies	None	1.51-2.00	1.51-2.00
G33	23.0664471818	-29.4217912088	Augrabies	None	1.51-2.00	1.51-2.00
G34	23.0685076497	-29.4217592191	Augrabies	None	1.51-2.00	1.51-2.00
G35	23.0685442092	-29.4235631179	Augrabies	None	1.51-2.00	1.51-2.00
G36	23.0685807719	-29.4253670163	Augrabies	None	1.51-2.00	1.51-2.00
G37	23.0707511267	-29.4307466748	Addo	Soft Carbonate	1.51-2.00	1.51-2.00
G38	23.0728232920	-29.4306538090	Augrabies	None	1.51-2.00	1.51-2.00
G39	23.0562174782	-29.4255585051	Augrabies	None	1.51-2.00	1.51-2.00
G40	23.0561811336	-29.4237545928	Augrabies	None	1.51-2.00	1.51-2.00
G41	23.0541206094	-29.4237863938	Augrabies	None	1.51-2.00	1.51-2.00
G42	23.0520600819	-29.4238181630	Augrabies	None	1.51-2.00	1.51-2.00
G43	23.0543943407	-29.4255931217	Augrabies	None	1.51-2.00	1.51-2.00
G44	23.0499995511	-29.4238499004	Augrabies	None	1.51-2.00	1.51-2.00
G45	23.0545201825	-29.4436294263	Augrabies	None	1.51-2.00	1.51-2.00
G46	23.0567134833	-29.4434347855	Addo	Soft Carbonate	1.51-2.00	1.51-2.00
G47	23.0544838411	-29.4418255169	Hutton	None	1.51-2.00	1.51-2.00
G48	23.0524229499	-29.4418573093	Hutton	None	1.51-2.00	1.51-2.00
G49	23.0523503498	-29.4382494843	Prieska	Hard Carbonate	0.51-1.00	1.01-1.50

G50	23.0502532693	-29.4364773246	Vaalbos	Rock	0.51-1.00	0.51-1.00
G51	23.0481562616	-29.4347051279	Vaalbos	Rock	0.51-1.00	0.51-1.00
G52	23.0482376431	-29.4311481095	Plooysburg	Hard Carbonate	0.51-1.00	0.51-1.00
G53	23.0464936963	-29.4545799152	Augrabies	None	1.51-2.00	1.51-2.00
G54	23.0464574807	-29.4527759997	Augrabies	None	1.51-2.00	1.51-2.00
G55	23.0485812713	-29.4528981947	Augrabies	None	1.51-2.00	1.51-2.00
G56	23.0505797165	-29.4527125463	Augrabies	None	1.51-2.00	1.51-2.00
G57	23.0506160050	-29.4545164571	Hutton	None	1.51-2.00	1.51-2.00
G58	23.0485548523	-29.4545482021	Augrabies	None	1.51-2.00	1.51-2.00
G59	23.0505434314	-29.4509086349	Coega	Hard Carbonate	0-0.50	0-0.50
G60	23.0484823515	-29.4509403752	Coega	Hard Carbonate	0-0.50	0-0.50
G61	23.0484098640	-29.4473325462	Augrabies	None	1.51-2.00	1.51-2.00
G62	23.0463488536	-29.4473642500	Hutton	None	1.51-2.00	1.51-2.00
G63	23.0483736252	-29.4455286309	Augrabies	None	1.51-2.00	1.51-2.00
G64	23.0507725691	-29.4456394194	Prieska	Hard Carbonate	1.51-2.00	1.01-1.50
G65	23.0504708710	-29.4473008105	Hutton	None	1.51-2.00	1.51-2.00
G66	23.0441981159	-29.4456399273	Hutton	None	1.51-2.00	1.51-2.00
G67	23.0462764521	-29.4437564142	Addo	Soft Carbonate	1.51-2.00	1.01-1.50
G68	23.0454050396	-29.4396548910	Augrabies	None	0.51-1.00	0.51-1.00
G69	23.0461678745	-29.4383446566	Augrabies	None	1.51-2.00	1.51-2.00
G70	23.0524592549	-29.4436612211	Hutton	None	1.51-2.00	1.51-2.00
G71	23.0529749029	-29.4452837997	Plooysburg	Hard Carbonate	0.51-1.00	0.51-1.00
G72	23.0545565272	-29.4454333351	Hutton	None	1.51-2.00	1.51-2.00
G73	23.0566174880	-29.4454015061	Hutton	None	1.51-2.00	1.51-2.00
G74	23.0399853696	-29.4384395421	Hutton	None	1.51-2.00	1.51-2.00
G75	23.0378884876	-29.4366671774	Vaalbos	Rock	0.51-1.00	0.51-1.00

G76	23.0379811761	-29.4349201290	Plooysburg	Hard Carbonate	0.51-1.00	0.51-1.00
G77	23.0439624645	-29.4311606234	Plooysburg	Hard Carbonate	0.51-1.00	0.51-1.00
G78	23.0460231506	-29.4311289723	Plooysburg	Hard Carbonate	1.01-1.50	0.51-1.00
G79	23.0501445131	-29.4310655746	Vaalbos	Rock	0.51-1.00	0.51-1.00
G80	23.0501807619	-29.4328694918	Vaalbos	Rock	0.51-1.00	0.51-1.00
G81	23.0520456729	-29.4327899558	Vaalbos	Rock	0-0.50	0-0.50
G82	23.0502170140	-29.4346734085	Plooysburg	Hard Carbonate	1.01-1.50	1.01-1.50
G83	23.0520358484	-29.4347852082	Vaalbos	Rock	1.01-1.50	1.01-1.50
G84	23.0523140548	-29.4364455710	Prieska	Hard Carbonate	1.01-1.50	1.01-1.50
G85	23.0543748369	-29.4364137855	Augrabies	None	1.51-2.00	1.51-2.00
G86	23.0481924806	-29.4365090464	Plooysburg	Hard Carbonate	0.51-1.00	0.51-1.00
G87	23.0502895280	-29.4382812403	Augrabies	None	1.51-2.00	1.51-2.00
G88	23.0272618334	-29.4205890188	Brandvlei	Soft Carbonate	1.01-1.50	0.51-1.00
G89	23.0252013358	-29.4206203694	Augrabies	None	1.51-2.00	1.51-2.00
G90	23.0231408351	-29.4206516883	Augrabies	None	1.51-2.00	1.51-2.00
G91	23.0231050820	-29.4188477374	Augrabies	None	1.51-2.00	1.51-2.00
G92	23.0230693322	-29.4170437859	Brandvlei	Soft Carbonate	1.51-2.00	1.51-2.00
G93	23.0210089008	-29.4170750683	Augrabies	None	1.51-2.00	1.51-2.00
G94	23.0272260076	-29.4187850724	Brandvlei	Soft Carbonate	1.01-1.50	1.01-1.50
G95	23.0210446143	-29.4188790221	Augrabies	None	1.51-2.00	1.51-2.00
G96	23.0438901950	-29.4275527735	Coega	Hard Carbonate	0-0.50	0-0.50
G97	23.0439263281	-29.4293566987	Prieska	Hard Carbonate	1.01-1.50	1.01-1.50
G98	23.0459869779	-29.4293250499	Coega	Hard Carbonate	0-0.50	0-0.50
G99	23.0418656750	-29.4293883157	Glenrosa	Lithic	0-0.50	0-0.50
G100	23.0418764964	-29.4312409406	Glenrosa	Lithic	0.51-1.00	0.51-1.00
G101	23.0398410822	-29.4312238301	Coega	Hard Carbonate	0.51-1.00	0.51-1.00

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G102	23.0398050186	-29.4294199008	Coega	Hard Carbonate	0-0.50	0-0.50
G103	23.0397689583	-29.4276159709	Glenrosa	Lithic	1.01-1.50	1.01-1.50
G104	23.0378164167	-29.4330593168	Plooysburg	Hard Carbonate	0.51-1.00	0.51-1.00
G105	23.0377803862	-29.4312553856	Plooysburg	Hard Carbonate	0.51-1.00	0.51-1.00
G106	23.0356117240	-29.4258751059	Brandvlei	Soft Carbonate	1.51-2.00	1.51-2.00
G107	23.0356477084	-29.4276790409	Coega	Hard Carbonate	0-0.50	0-0.50
G108	23.0378016052	-29.4295262140	Glenrosa	Lithic	0-0.50	0-0.50
G109	23.0377083350	-29.4276475218	Addo	Soft Carbonate	1.01-1.50	1.01-1.50
G110	23.0376723143	-29.4258435891	Addo	Soft Carbonate	1.01-1.50	1.01-1.50
G111	23.0370083735	-29.4244285083	Brandvlei	Soft Carbonate	1.51-2.00	0-0.50
G112	23.0481200459	-29.4329012089	Plooysburg	Hard Carbonate	0-0.50	0-0.50
G113	23.0543385087	-29.4346098740	Vaalbos	Rock	1.01-1.50	1.01-1.50

APPENDIX 3: SPECIALIST CV

DR DARREN BOUWER

EDUCATION

PhD Soil Science	University of the Free State	2018
M.Sc. Soil Science	University of the Free State	2013
B.Sc. Soil Science (Hon)	University of the Free State	2009
B.Sc. Soil Science	University of the Free State	2008
Matric certificate	Queens College	2005

PROFESSIONAL AFFILIATIONS

- SACNASP- Pri Nat Sci 400081/16
- Member of the Soil Science Society of South Africa
- Member of the Soil Classification Work Group
- Member of South African Soil Surveyors Organisation

WORK EXPERIENCE

- **Digital Soils Africa** / Soil Scientist - May 2012 – Present
- **Ghent University** / Researcher- January 2016 - December 2016
- **University of the Free State**/ Assistant Researcher- January 2011- December 2015

PUBLICATIONS

Bouwer, D., Le Roux, P. A., van Tol, J. J., & van Huyssteen, C. W. (2015). Using ancient and recent soil properties to design a conceptual hydrological response model. Geoderma, 241, 1–11.

Van Zijl, G. M., Bouwer, D., van Tol, J. J., & le Roux, P.A.L. (2014). Functional digital soil mapping: A case study from Namarroi, Mozambique. Geoderma, 219-220, 155–161.

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JAN-DIRK MARX

EDUCATION

M.Sc. Soil Science	University of the Free State	2021
B.Sc. Soil Science	University of the Free State	2019
Matric certificate	Secunda High School	2015

PROFESSIONAL AFFILIATIONS

WORK EXPERIENCE

- **Digital Soils Africa** / Soil Scientist -January 2020– Present

SPECIALIST DECLARATION

I, Jan-Dirk Marx, declare that –

- I act as the independent specialist in this application;
- I regard the information contained in this report to be true and correct;
- I do not have a conflict of interest in this project;
- I will conduct the work relating to the project in an objective manner.

Jan-Dirk Marx

- Candidate SACNASP- 132344

Proposed clearing of indigenous vegetation on the farm, Zwem Kuil 37, north-east of Prieska, Northern Cape Province

Terrestrial Vegetation Compliance Report and Habitat Assessment

Date: April 2022

Report on behalf of:

Digital Soils Africa

Report drafted by:

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Indemnity

This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information at the time of study. Therefore, the author reserves the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although the author exercises due care and diligence in rendering services and preparing documents, she accepts no liability, and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of this document.

Expertise of author:

- Working in the field of ecology, and in specific vegetation related assessments, since 2007;
- Is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions in the field of ecology (Reg. No. 400019/11); and
- Has been working with plants indigenous to South Africa since 1997.

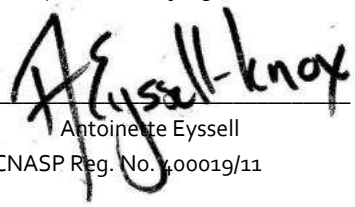
Declaration of independence:

Dimela Eco Consulting in an independent consultant and hereby declare that it does not have any financial or other vested interest in the undertaking of the proposed activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998). In addition, remuneration for services provided by Dimela Eco Consulting is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

Disclosure:

Dimela Eco Consulting undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and will provide the competent authority with access to all information at its disposal regarding the application, whether such information is favourable to the applicant or not.

Based on information provided to Dimela Eco Consulting by the client, and in addition to information obtained during the course of this study, Dimela Eco Consulting present the results and conclusion within the associated document to the best of the authors professional judgement and in accordance with best practise.



_____ ____2022.05.10_____

Antoinette Eyssell Date

SACNASP Reg. No. 400019/11

EXECUTIVE SUMMARY

Zwemkuil Gordonii CC proposes to clear vegetation for the establishment of crops on the farm Zwem Kuil 37 within the Siyathemba Local Municipality, Northern Cape Province. The property is approximately 450 hectares in extent and include historically cultivated land, as well as indigenous vegetation. For discussion purposes, the report named the 19 sites proposed for clearing from A – T.

The National Web-based Screening Tool classifies the site as very-high sensitivity for terrestrial biodiversity, as the site spans over Critical Biodiversity Areas. Furthermore, the area is ranked as low sensitivity for plant species, indicating that it is unlikely that suitable habitat for plant species of conservation concern is present.

Therefore, this report comprises a terrestrial vegetation assessment in line with the terrestrial biodiversity protocol as far as this pertains to terrestrial flora. In addition, general assessment will be undertaken for suitable habitat for plant species of conservation concern and the resulting Plant Species Compliance Statement are incorporated.

The following limitations are applicable, although not considered fatal flaws to the study:

- Vegetation studies should be conducted during the growing season of all plant species that may potentially occur. This may require more than one season's survey with two visits undertaken preferably during November and February. This report relied on a single site visit undertaken on the 16th and 17th of March 2022 after good summer rains.
- Due to good rains, the vegetation was lush and could have obscured smaller species

<u>Vegetation groups and Site Ecological Sensitivity</u>

An historic aerial image dated 1993 shows the project area, south of the Orange River, uncultivated. By the year 2005, several pivots were already established and by the year 2020 more recent pivots as well as mining to the east of the proposed sites for clearing can be noted.

The site visit found that the vegetation on the sites ranged from modified to natural vegetation. The grass layer displayed a patchy dominance of grass species (*Eragrostis, Enneapogon* and *Stipagrostis* species), while the tree layer was mostly dominated by *Senegalia melifera* (swart haak), except along the Orange River, where *Vachellia karroo* (sweet thorn) dominated. Dominance of species varied depending on soils substrate (e.g. sandy, red sandy and pebbly soils). Several ephemeral and dry drainage lines were recorded, characterised by a higher number of tree species.

Vegetation and its sensitivity were broadly delineated and discussed as per below. Note that a fine scale vegetation assessment was beyond the scope of this report and that variation exist within mapped units.

Broad vegetation community	Site Ecological Importance (SEI) – mitigation
Modified land: • Impacted land • *Tribulis terrestris* plains • *Eragrostis lehmaniana Enneapogon cenchroides* grasslands	**Very Low**
Modified land: • Artificial moist grassland	**Low**
***Rhigozum-Eragrostis* veld**	**Low**
***Senegalia melifera- Enneapogon* veld**	**Low**
***Searsia burchelii-Eragrostis* veld**	**Medium**
Ephemeral and dry drainage lines	**Medium**
***Vachellia karoo* woodland**	**Medium**

Concluding statement

Much of the vegetation on the sites were in a good ecological condition, and due to its size and limited disturbances, rates high in its functional integrity and scores a medium SEI. Most of this vegetation also falls within CBAs, which should ideally remain in natural state. However, areas that was historically cleared and highly disturbed rated as very low and low SEI. Also, most of the vegetation on the site is not unique and the Upper Nama Karoo vegetation is not considered threatened. Furthermore, no plant species of conservation concern were recorded or are expected to be present in these groups.

At the time of this assessment, only one (1) TOPS listed species was recorded within Site M. This species, *Harpagophytum procumbens* subsp *procumbens* (devil's claw) is listed as a Protected medicinal plant species and may not be traded. It is recommended that these species be replanted outside of the proposed clearing footprint. the national protected tree, *Boscia albitrunca*, occurred abundantly on the farm and specific Sites D, L, O, J and K, as well as around site A. These trees require a permit from the local Department of Environment, Forestry and Fisheries to be removed.

This report therefore has no objection to the clearing of the proposed sites, provided that mitigation measures as listed in this report be adhered to as a minimum.

Protocol summary

The following table summarises the results of the assessment as per the main requirements of the Protocols for Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial (Vegetation) Biodiversity as published on 20 March 2020.

Province	Northern Cape
Quarter Degree Grid Square	2923AC
Protected areas	No protected areas are present near the sites.

Topography and Hydrology:	The Orange River flows to the north of the sites. Several non-perennial drainage lines flow through the farm northwards towards the Orange River. Even though good summer rains preceded the site visit, all the drainage lines sampled at the time of this assessment was dry at the time.
Geology and soils:	Most of the sites fall on sediment and tillite. The sites comprise deeper soils, which have formed in alluvial deposits close to the Orange River and are suitable for irrigated cultivation (Land type Ia 124). The southern sites comprise tillite, mudstone, shale and sandstone of the Dwyka Formation, mostly covered in thin deposits of alluvium, sand and calcrete (Fc568). The Fc land types have on average a soil depth of less than 300mm
Strategic Water Source Areas (SWSA):	The site is not situated within a SWSA. The Southern Ghaap Plateau Ground Water Source Area is situated about 45km north of the sites.
Threatened ecosystem:	According to the 2011 Listed Ecosystems, the project area is not within a listed ecosystem (Government Gazette 34809, Government Notice 1002, and 9 December 2011). Although the National List of Threatened Terrestrial Ecosystems published in terms of the Biodiversity Act in 2011 remains in legal force, the data contained in the recent National Biodiversity Assessment (NBA) 2018 represents an update of the assessment of threat status for terrestrial ecosystems. The updated threatened ecosystems as per the recent NBA (2018) also lists the sites within a Least Concern ecosystem. These areas were the focus of the site verification. The proposed development will thus not impact on threatened ecosystems.
Northern Cape Critical Biodiversity Areas (CBA) Map:	Most of the sites fall within a Critical Biodiversity Area 1 (CBA1), while the southern CBA2, which is the best option for meeting biodiversity targets, while avoiding conflict with other land uses. According to the Northern Cape Critical Biodiversity Area Map, these areas should remain natural, with only low impact development considered. The CBA classification is largely based on suitable habitat for threatened bird species and the proposed clearing is unlikely to impact on sensitive vegetation. However, the clearing footprint must first make use of areas of low sensitivity rating (historically impacted areas), prior to utilizing medium Sei areas within the CBAs.
Ecological drivers and processes in savanna	Karoo vegetation comprise a mixture of grasses and dwarf shrubs, with grass abundance linked to the average annual rainfall. Higher rainfall usually results in higher grass abundance, while grazing also plays a role. Fire is not an important driver of the Karoo ecosystem as the rainfall is too low to support regular fire events. The establishment cultivated areas are unlikely to affect ecological processes, however, it is recommended that open spaces, or green stepping stopes should remain between cultivated areas.
Plant species of conservation concern: compliance statement	This report lists five (5) species that has been short-listed to have a possibility of occurring, and for which the habitat assessment was undertaken. None of these species were recorded in walked transects on the sites and the habitat assessment agrees with the screening tool report which indicates much of the site as being of low plant species sensitivity. Only one species, listed as Rare, has a likelihood of occurring: *Tridentia virescens* and the likelihood of occurring is considered medium

	to low (Appendix C). Appendix C provides an image of this species which should be relocated if found during clearing. No further plant species of conservation concern assessments are thought to be needed.
Main impacts:	The following impacts are expected, but can be mitigated: 1. Destruction of natural vegetation 2. Destruction of protected tree and plant species 3. Potential increase in invasive vegetation 4. Degradation of remaining natural vegetation 5. Bush densification 6. Potential pollution of the soil and water
Cumulative impacts:	Cumulative impacts are limited. The area that the site is situated in is located south of the Orange River. Several pivot systems, as well as mining is taking place along and around the river. Thus, clearing of additional vegetation on the sites will reduce the remaining Northern Upper Karoo vegetation in this area. however, currently, this vegetation is not threatened.
Residual impacts:	Soils pollution and edge effects from crop spraying

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1 INTRODUCTION

Zwemkuil Gordonii CC proposes to clear vegetation for the establishment of crops on the farm Zwem Kuil 37 within the Siyathemba Local Municipality, Northern Cape Province. The property is approximately 450 hectares in extent and include historically cultivated land as well as indigenous vegetation.

The National Web-based Screening Tool classifies the site as very-high sensitivity for terrestrial biodiversity, as the site spans over Critical Biodiversity Areas. Furthermore, the area is ranked as low sensitivity for plant species, indicating that it is unlikely that suitable habitat for plant species of conservation concern is present.

Therefore, this report comprises a terrestrial vegetation assessment in line with the terrestrial biodiversity protocol as far as this pertains to terrestrial flora. In addition, general assessment will be undertaken for suitable habitat for plant species of conservation concern and the resulting Plant Species Compliance Statement are incorporated.

1.1 Locality

The sites proposed for clearing are situated on the farm Zwem Kuil 37, about 40km north-east of the town of Prieska in the Siyathemba Local Municipality, Northern Cape Province (Figure 1). The sites include historically cultivated areas and degraded surrounds, remnant patches of natural veld in-between existing cultivated areas and natural veld. The sites fall within the quarter degree square (qds) 2923AC. For discussion purposes, the report named the 19 sites proposed for clearing from A – T.

1.2 Terms of reference

The terms of reference were as follows:

Complete a terrestrial vegetation assessment in line with the terrestrial biodiversity protocols, including

- Supply background information on the site relating to conservation plans, protected areas and threatened ecosystems;
- A rapid visual assessment of the vegetation on the site, to determine if natural vegetation / species of concern could be impacted on by the continuation of the project;
- Discussion of sensitive vegetation that could be impacted on;
- Mapping of vegetation communities and perceived sensitivity; and
- Management recommendations to limit or negate perceived impacts

Include in the above a plant species compliance report.

- Short list plant species of conservation concern that could be present around the site;

- Report and map the habitat for plant species of conservation concern for which suitable habitat is present on the site or were confirmed to occur, if present; and
- Write a compliance statement to verify the unlikely presence of plant species of conservation concern.

1.3 Assumptions and limitations

The following limitations are applicable, although not considered fatal flaws to the study:

- Vegetation studies should be conducted during the growing season of all plant species that may potentially occur. This may require more than one season's survey with two visits undertaken preferably during November and February. This report relied on a single site visit undertaken on the 16th and 17th of March 2022 after good summer rains.
- Due to good rains, the vegetation was lush and could have obscured smaller species.

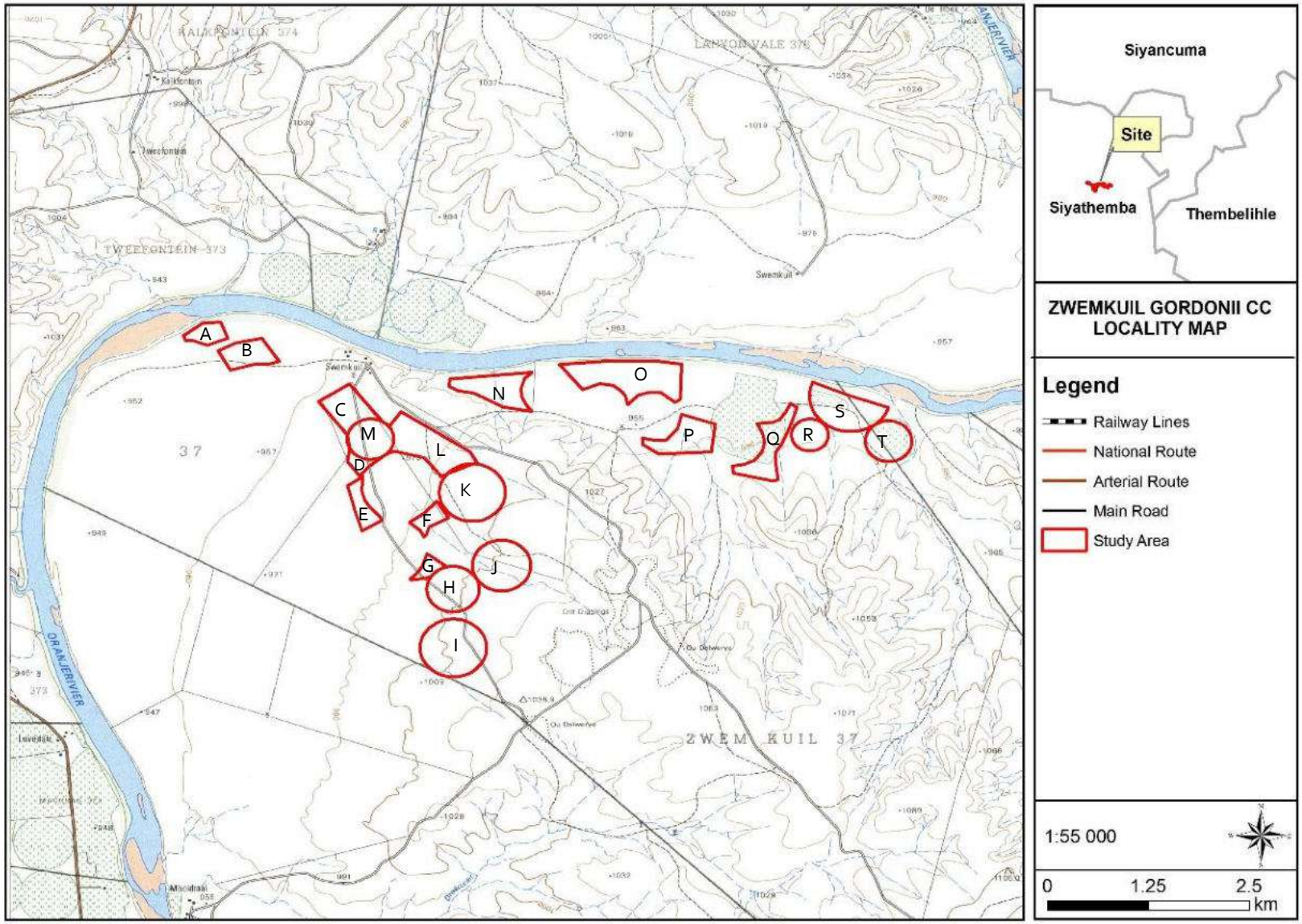

Figure 1: Locality of the proposed sites to be cleared. The 20 sites are numbered for discussion purposes only

2 METHODOLOGY

The assessment entailed a literature review, a site survey and reporting. The methodology used is shortly summarised below.

2.1 Literature and data review

The description of the regional vegetation relied on literature from Mucina & Rutherford (2006). Several field guides were used to identify plant species, including Van Wyk & Van Wyk (1997), Van Wyk & Malan (1997), Pooley (1998), Henderson (2001), Van Oudtshoorn (2002) and Bromilow (2010).

Data and literature consulted:

- The Northern Cape Critical Biodiversity Areas (CBA) Map.
- Information on plant species recorded for the Quarter Degree Square (QDS) that the site is situated in was extracted from the Botanical Database of Southern Africa hosted by SANBI on the new Plants of Southern Africa website (https://posa.sanbi.org). Additional info was sourced from Citizen Science websites such as iNaturalist.org.
- A short list of plant species of conservation concern was derived from the above and the Threatened Species Programme, Red List of South African Plants (Red List of South African plants version 2020 (http://redlist.sanbi.org/)).
- Threatened Ecosystem data was extracted from the NEM:BA listed ecosystems layer (SANBI 2008) and the most recent National Biodiversity Assessment (NBA) of 2018 (Skowno *et al*, 2019).
- Historical aerial imagery downloaded from Chief Directorate: National Geospatial Information Geospatial Portal (http://www.cdngiportal.co.za/cdngiportal).

2.2 Field survey

Timing and intensity

The site visit was undertaken on the 16th and 17th of March 2022, after good summer rainfall. A sampling and track map is given in Appendix A.

Method

Prior to the site visit, the vegetation was delineated into homogenous units using currently available Google Earth imagery. The field survey focussed on identifying natural and untransformed vegetation, unique features that could indicate local sensitivities such as threatened and protected plants, as well as sensitive ecological features such as wetlands and rocky areas. Transects were walked through the site. At several sites along the transects, a survey of total visible floristic composition was undertaken. Plant identification and vegetation description relied on species recorded in the sampling points along the walked transects.

2.3 Mapping

Mapping was done by comparing georeferenced ground survey data to the visual inspection of available Google-Earth Imagery and in that way extrapolating survey reference points to the entire

study area. Delineations are therefore approximate, and due to the intricate mosaics and often gradual mergers of vegetation associations, generalisations had to be made. Mapped associations will thus show where a certain vegetation unit is predominant, but smaller inclusions of another vegetation association in this area do exist but have not been mapped separately.

2.4 Project Area of Influence (PAOI)

The Project Area of Influence (PAOI) was defined as per the Species Environmental Assessment Guideline (SANBI, 2020) and was based on the development footprint and the potential extent of the impacts (e.g., edge effects) of the project activities.

Due to the nature of cultivation, it is unlikely that secondary impacts (edge effects) will extent further than a few meters from the proposed primary area of influence (sites). Also, cultivated land on the site was mostly fenced from larger herbivores (e.g. kudu). The fences assist in preventing edge effects from cultivation. Some tertiary effects may take place downstream of the river, although due to the dry climate, it is unlikely. The extent of impact will depend on the activity and waterflow at the time of the impact.

Figure 2: Primary project area of influence (PAOI). Surrounding areas were also sampled

2.5 Site Ecological Importance (sensitivity)

Supplementary to the exisitng vegetation sensitivity analysis of Eco Agent (2018), the Site Ecological Importance in terms of vegetation is discussed as per the requirements of the recent Species Environmental Assessment Guideline (SANBI, 2020). The assessment criteria and matrices are detailed in Table 1, Table 2, and Table 3.

SEI is a function of the Biodiversity Importance (BI) of the receptor (e.g., species of conservation concern, the vegetation/fauna community or habitat type present on the site and its resilience to impacts (Receptor Resilience) as follows:

SEI = BI + RR

BI in turn is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows:

BI = CI + FI

Conservation Importance (CI) is evaluated in accordance with recognised established internationally acceptable principles and criteria for the determination of biodiversity-related value, including the IUCN Red List of Species, Red List of Ecosystems and Key Biodiversity Areas (KBA; IUCN (2016)).

Table 1: Criteria for assessing CI, FI and RR

Classification	Conservation Importance	Functional Integrity	Receptor Resilience
Very high	• Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global Extent of Occurrence of < 10 km² • Any area of natural habitat of a CR ecosystem type or large area (> 0.1 % of the total ecosystem type extent) of natural habitat of an EN ecosystem type	• Very large (>100 ha) intact area for any conservation status of ecosystem type or >5 ha for CR ecosystem types • High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing)	• Habitat can recover rapidly (<5 years for >70% of the original species composition and functionality). • Species very highly likely to remain at a site during impact. • Species very highly likely to return once the impact ceases.
High	• Confirmed or highly likely CR, EN, VU species. IUCN threatened species must be listed under any criterion other than A, include if there are less than 10 locations or < 10 000 mature individuals remaining. • Small area (>0.01% but < 0.1 % of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1 %) of natural habitat of VU ecosystem type.	• Large (>20 ha but <100 ha) intact area for any conservation status of ecosystem type or >10 ha for EN ecosystem types Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g.	• Habitat can recover relatively quickly (5-10 years for >70% of the original species composition and functionality. • Species highly likely to remain at a site during impact. • Species highly likely to return to site once impact ceases.

Classification	Conservation Importance	Functional Integrity	Receptor Resilience
	• Presence of Rare species.	ploughing) and good rehabilitation potential	
Medium	• Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under A criterion only and which have more than 10 locations or more than 10 000 mature individuals. • Any area of natural habitat of threatened ecosystem type with status of VU • Presence of range-restricted species • More than 50 % of receptor contains natural habitat with potential to support SCC	• Medium (>5 ha but <20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types • Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches • Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance; moderate rehabilitation potential	• Recovers slowly (>10 years for >70 % of the original species composition and functionality • Species moderately likely to remain at site during impact. • Species moderately likely to return to site once impact ceases.
Low	• No confirmed or highly likely SCC. • No confirmed or highly likely range-restricted species. • Less than 50 % contains natural habitat with limited potential to support SCC.	• Small (1 – 5ha) area. • Almost no connectivity but migration still possible across transformed / degraded habitat; very busy surrounds. Low rehabilitation potential. • Several minor and major ecological impacts.	• Unlikely to recover fully (<50% restored) after >15 years. • Species have low likelihood of remaining at site during the impact. • Species have low likelihood of returning to site once impact ceases.
Very low	• No confirmed and highly unlikely populations of SCC. • No confirmed and highly unlikely populations of range-restricted species. • No natural habitat remaining.	• Very small (<1 ha) area. • No connectivity except for flying species. • Several major current ecological impacts.	• Unable to recover from major impacts. • Species unlikely to remain at site during the impact. • Species unlikely to return once impact ceases.

Table 2: Matrix for determining BI

Biodiversity Importance (BI)		Conservation Importance (CI)				
		Very High	High	Medium	Low	Very Low
Functional Integrity (FI)	Very High	**Very High**	**High**	**High**	**Medium**	**Low**
	High	**Very High**	**High**	**Medium**	**Medium**	**Low**
	Medium	**High**	**Medium**	**Medium**	**Low**	**Very Low**
	Low	**Medium**	**Medium**	**Low**	**Low**	**Very Low**
	Very Low	**Medium**	**Low**	**Very Low**	**Very Low**	**Very Low**

Table 3: Matrix for determining SEI

Site Ecological Importance (SEI) (Mitigation)		Biodiversity Importance (BI)				
		Very High	High	Medium	Low	Very Low
Receptor Resilience (RR)	Very Low	**Very High (Avoid)**	**Very High (Avoid)**	**High (Avoid & Minimise)**	**Medium (Minimise & Restore**	**Low (Minimise & Restore**
	Low	**Very High (Avoid)**	**Very High (Avoid)**	**High (Avoid & Minimise)**	**Medium (Minimise & Restore**	**Very Low (Minimise)**
	Medium	**Very High (Avoid)**	**High (Avoid & Minimise)**	**Medium (Minimise & Restore**	**Low (Minimise & Restore**	**Very Low (Minimise)**
	High	**High (Avoid & Minimise)**	**Medium (Minimise & Restore**	**Low (Minimise & Restore**	**Very Low (Minimise)**	**Very Low (Minimise)**
	Very High	**Medium (Minimise & Restore**	**Low (Minimise & Restore**	**Very Low (Minimise)**	**Very Low (Minimise)**	**Very Low (Minimise)**

The interpretation of the SEI ranks is described in Table 4 below. This table is a supplemented version of that which appears in the Species Environmental Assessment Guideline (SANBI, 2020).

Table 4: Guidelines for interpreting Site Ecological Importance (SEI) in the context of the proposed development activities.

SEI	Interpretation in relation to proposed development activities (SANBI, 2020), with *mitigation added by the specialist*
Very High	Avoidance mitigation - No destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages. Destructive impacts for species/ecosystems where persistence target remains. • *Development within these areas is not supported.*

SEI	Interpretation in relation to proposed development activities (SANBI, 2020), with ***mitigation added by the specialist***
	• *Impacts are difficult to mitigate, if at all* • *Such features usually protected by legislation or guiding policies*
High	Avoidance mitigation wherever possible. Minimization mitigation – Changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities. • *Development within these areas is undesirable and impacts are difficult to mitigate, if at all.* • *Impacts must be avoided or managed by an ecological management plan*
Medium	Minimization & restoration mitigation - Development activities of medium impact acceptable followed by appropriate restoration activities • *Development within these areas could proceed, limiting impact to sensitive vegetation, provided that appropriate mitigation measures are taken.* • *High impact developments should be considered with caution, if at all. Development must be restricted in footprint and impacts managed and mitigated by an approved management plan. Edge effects to higher sensitivity classes in its proximity must be mitigated / prevented.*
Low	Minimization & restoration mitigation - Development activities of medium to high impact acceptable followed by appropriate restoration activities • *Developable areas that are connected to sensitive features.* • *Edge effects must be prevented.*
Very Low	Minimization mitigation - Development activities of medium to high impact acceptable and restoration activities may not be required • *Most types of development can proceed within these areas with little to no impact on conservation worthy vegetation.* • *Edge effects to other proximate sensitivity classes must be mitigated / prevented.*

3 BASELINE DESCRIPTION OF THE SITE

The table below shortly summarises the background info to the site.

Table 5: Background information to the site

Province	Northern Cape
Quarter Degree Grid Square	2923AC
Protected areas	No protected areas are present near the sites.
Topography and Hydrology (Figure 3 & 4):	The Orange River flows to the north of the sites. Several non-perennial drainage lines flow through the farm northwards towards the Orange River. Even though good summer rains preceded the site visit, all the drainage lines sampled at the time of this assessment was dry at the time.
Geology and soils (Figures 5 and 6):	Most of the sites fall on sediment and tillite. The sites comprise deeper soils, which have formed in alluvial deposits close to the Orange River and are suitable for irrigated cultivation (Land type Ia 124). The southern sites comprise tillite, mudstone, shale and sandstone of the Dwyka Formation, mostly covered in thin deposits of alluvium, sand and calcrete (Fc568). The Fc land types have on average a soil depth of less than 300mm
Strategic Water Source Areas (SWSA):	The site is not situated within a SWSA. The Southern Ghaap Plateau Ground Water Source Area is situated about 45km north of the sites.
Vegetation (Mucina and Rutherford, 2006) (Figure 7):	The site falls within the Nama Karoo Biome. Most of the sites fall within the Upper Gariep Alluvial Vegetation. This vegetation occurs on flat alluvial terraces and comprises complex alluvial thickets dominated by *Vachellia karroo* (sweet thorn) and *Diospyros lycioides* (blue bush), flooded grasslands, reed beds and ephemeral herblands on the sandy riverbanks. This vegetation is considered Vulnerable. More than 20% has been cultivated. The most southern sites fall within the Northern Upper Karoo which comprises shrubland dominated by dwarf karoo shrubs, grasses, and the tree *Senegalia melifera* subsp *ditensis* (black thorn).
Threatened ecosystem:	According to the 2011 Listed Ecosystems, the project area is not within a listed ecosystem (Government Gazette 34809, Government Notice 1002, and 9 December 2011). Although the National List of Threatened Terrestrial Ecosystems published in terms of the Biodiversity Act in 2011 remains in legal force, the data contained in the recent National Biodiversity Assessment (NBA) 2018 represents an update of the assessment of threat status for terrestrial ecosystems. The updated threatened ecosystems as per the recent NBA (2018) also lists the sites within a Least Concern ecosystem. These areas were the focus of the site verification. The proposed development will thus not impact on threatened ecosystems.
Northern Cape Critical Biodiversity Areas (CBA) Map: (Figure 8)	Most of the sites fall within a Critical Biodiversity Area 1 (CBA1), while the southern CBA2, which is the best option for meeting biodiversity targets, while avoiding conflict with other land uses. According to the Northern Cape Critical Biodiversity Area Map, these areas should remain natural, with only low impact development considered.

Ecological drivers and processes in savanna	Karoo vegetation comprise a mixture of grasses and dwarf shrubs, with grass abundance linked to the average annual rainfall. Higher rainfall usually results in higher grass abundance, while grazing also plays a role. Fire is not an important driver of the Karoo ecosystem as the rainfall is too low to support regular fire events. The establishment cultivated areas are unlikely to affect ecological processes, however, it is recommended that open spaces, or green stepping stopes should remain between cultivated areas.

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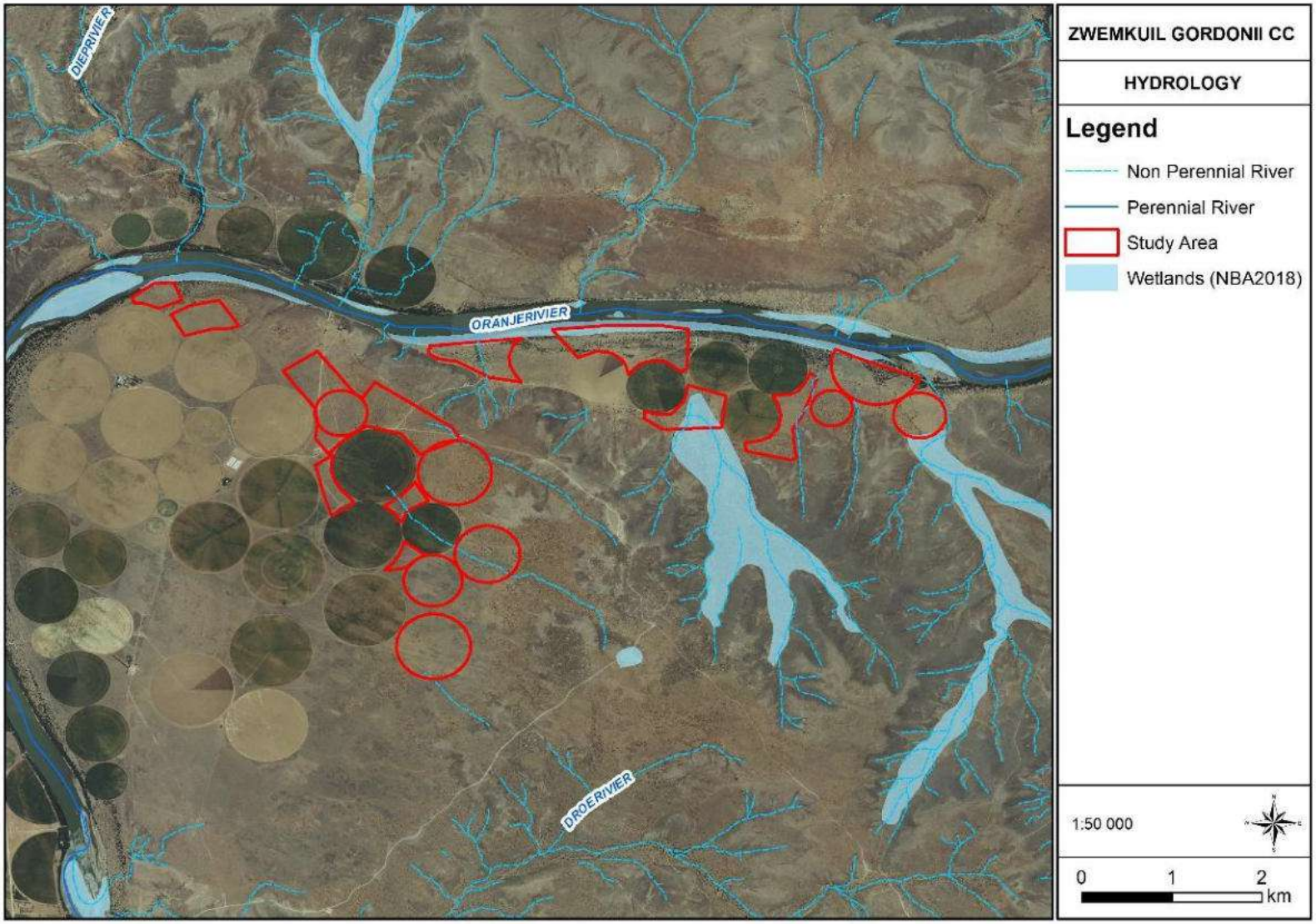

Figure 3: Hydrology of the site and surrounds as per the National Biodiversity Assessment (NBA) of 2018 (Skowno, *et al*, 2019)

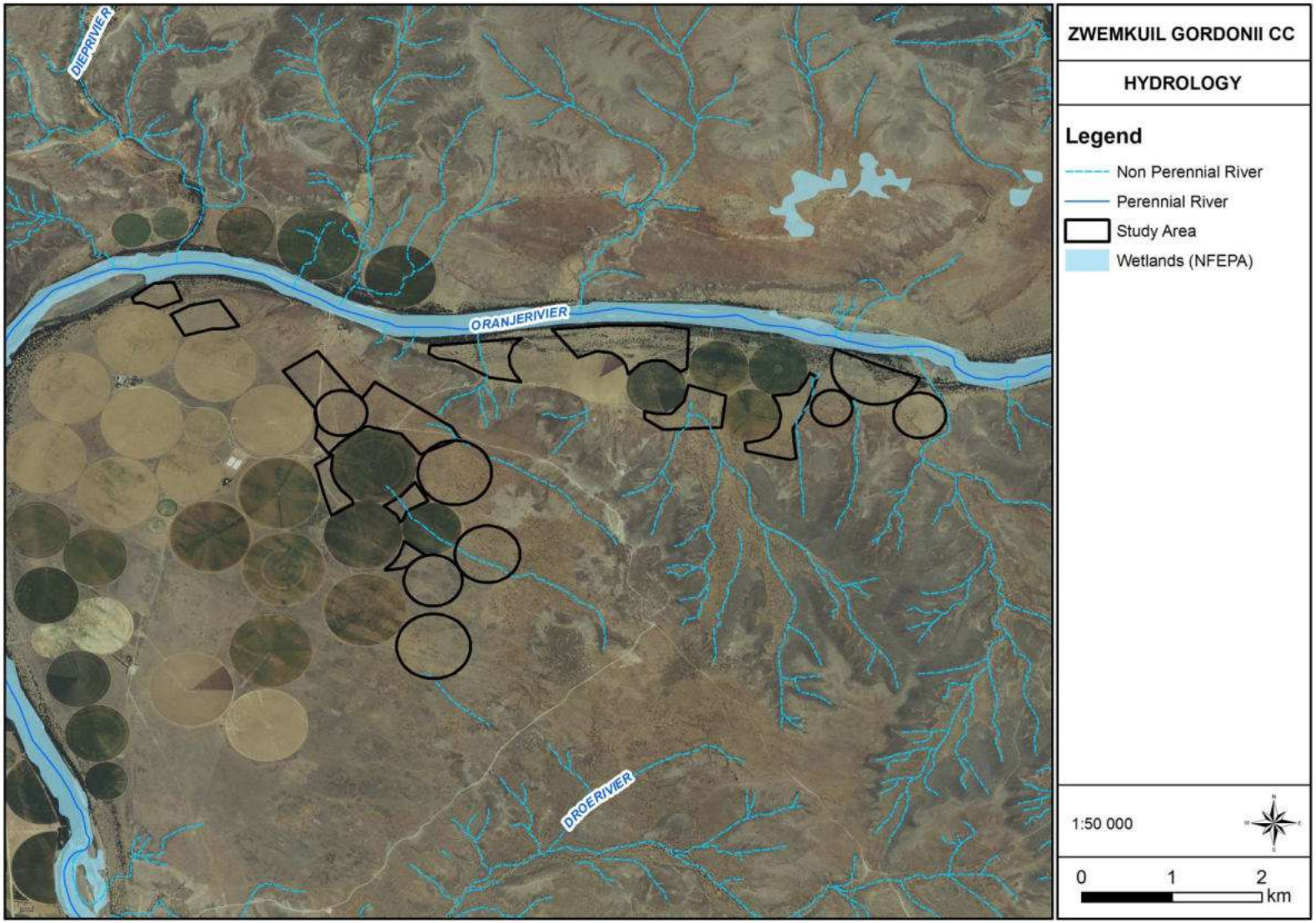

Figure 4: Hydrology of the site as per the National Freshwater Ecosystems Priority Areas (NFEPA), 2014

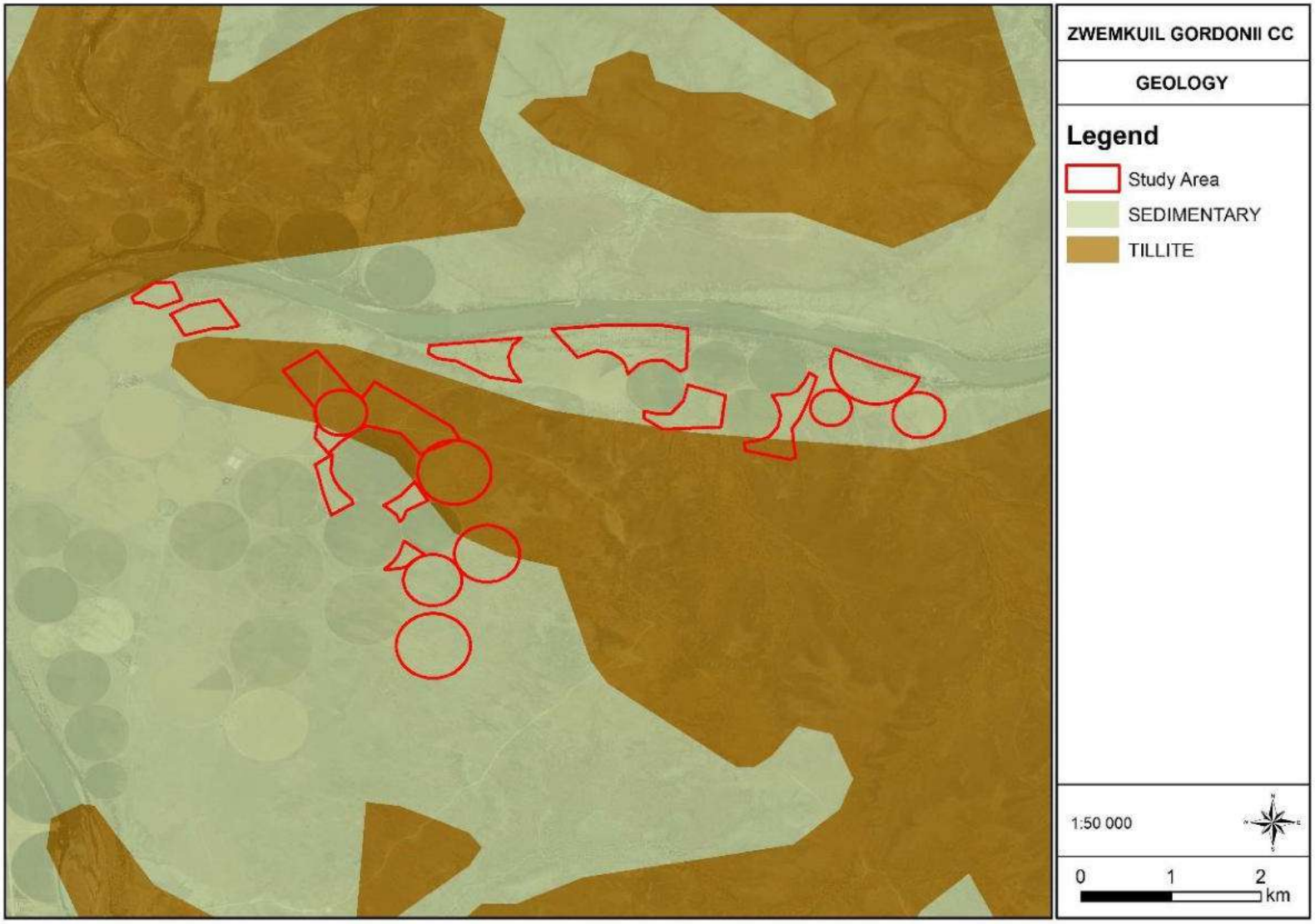

Figure 5: Geology of the sites and surrounds

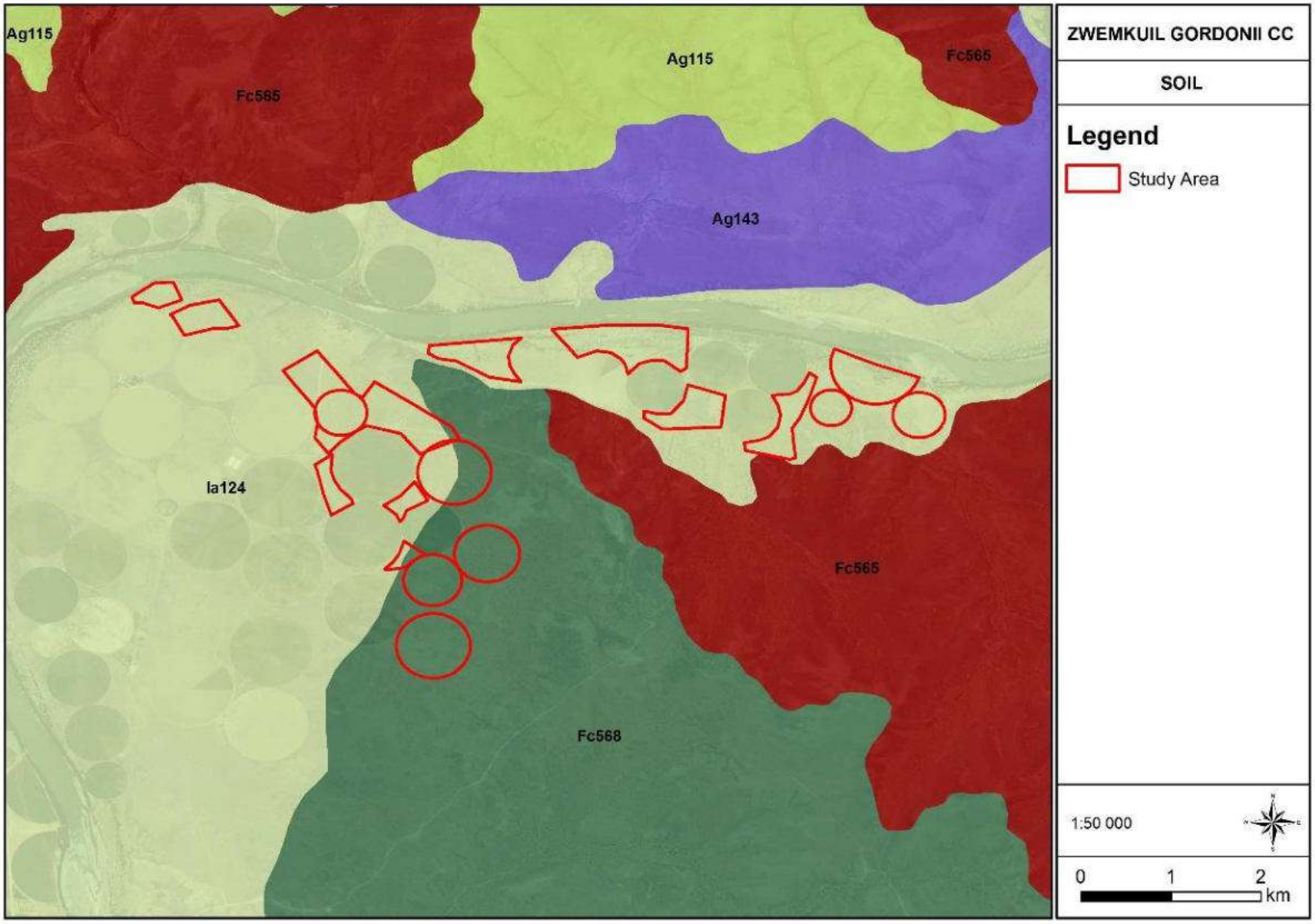

Figure 6: Land types

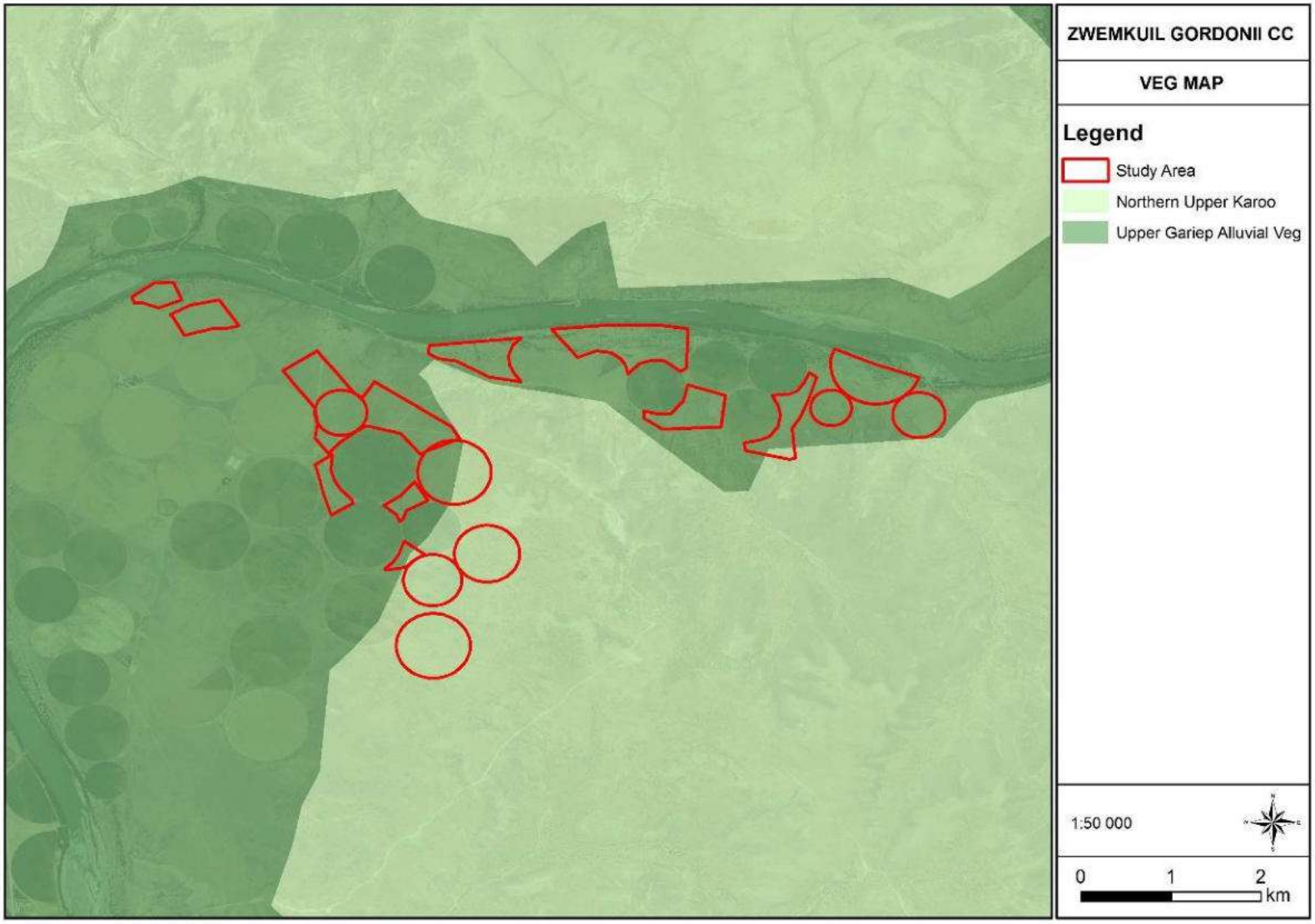

Figure 7: Vegetation as per the national vegetation assessment (Mucina and Rutherford, 2006; Skowno *et al*, 2019).

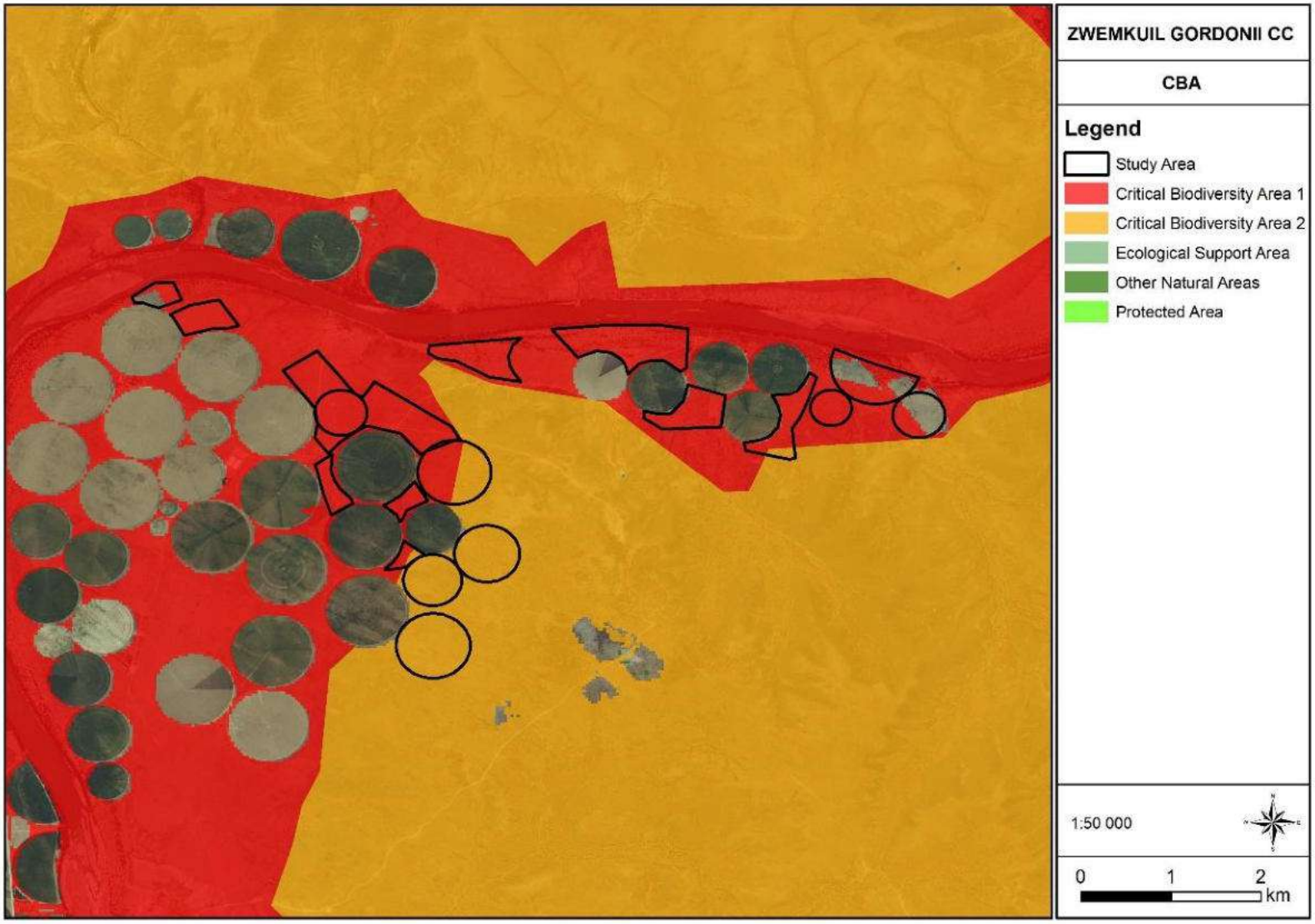

Figure 8: The site in relation to the Northern Cape Critical Biodiversity Map.

4 RESULTS

4.1 Land use and land cover on and around the site

An historic aerial image dated 1993 shows the project area, south of the Orange River, uncultivated (Figure 9). By the year 2005, several pivots were already established (Figure 10). Figure 11 shows the most recent Google Earth Satellite imagery of the sites and surrounds, including more recent pivots as well as mining to the east of the proposed sites.

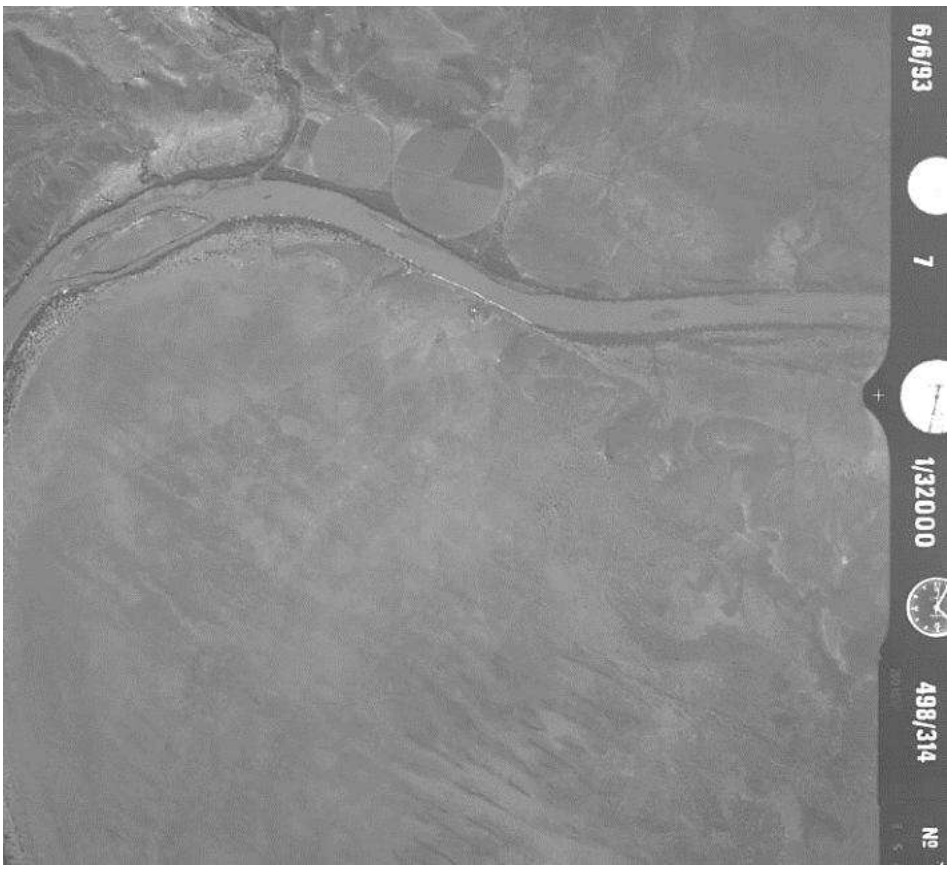

Figure 9: Aerial imagery of the project area dated 1993, prior to establishment of pivots (image sourced from Chief Directorate National Geospatial Information Geospatial Portal)

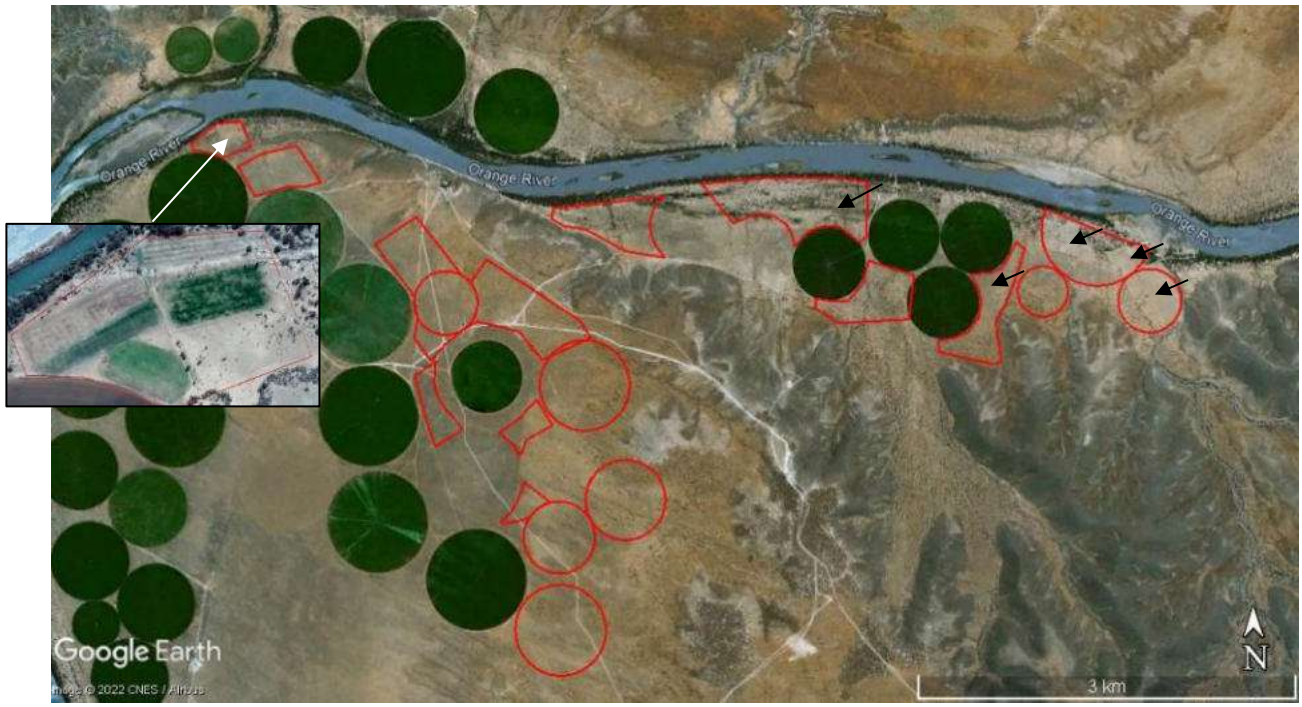

Figure 10: Google Earth Satellite imagery of the project area dated 2005. The insert shows cultivation on this site, while the most easterly sites were also historically cultivated (arrows)

Figure 11: A 2020 Google Earth satellite imagery of the proposed sites. The arrows point to mined areas

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4.2 Vegetation Communities on the sites

The site visit found that the vegetation on the sites ranged from modified to natural vegetation. The grass layer displayed a patchy dominance of grass species (*Eragrostis, Enneapogon* and *Stipagrostis* species), while the tree layer was mostly dominated by *Senegalia melifera* (swart haak), except along the Orange River, where *Vachellia karroo* (sweet thorn) dominated. Dominance of species varied depending on soils substrate (e.g. sandy, red sandy and pebbly soils). Several ephemeral and dry drainage lines were recorded, characterised by a higher number of tree species.

Vegetation was broadly delineated and discussed as per below. Note that a fine scale vegetation assessment was beyond the scope of this report and that variation exist within mapped units.

1. Modified land
    a. Impacted land
    b. *Tribulus terrestris* veld
    c. *Eragrostis lehmanniana – Enneapogon cenchroides* veld

2. *Rhigozum trichotomum Eragrostis lehmanniana* veld
3. *Senegalia mellifera veld*
    a. *Senegalia melifera- Enneapogon cenchroides* veld
    b. *Searsia burchellii-Eragrostis lehmanniana* veld

4. Ephemeral drainage- and dry drainage lines
5. *Vachellia karroo* riparian woodland

The vegetation is shortly discussed below and geographically represented in Figure 12. The plant species identified in walked transects are listed in Appendix B.

4.2.1 Modified land

Modified vegetation refers to an ecological condition class in which the ecosystem has been modified, with an almost complete loss of composition and structure. Much of the ecosystem function has been destroyed and the changes may be irreversible. Such land is usually in a poor ecological condition and can range from irreversibly modified to moderately modified.

a) Mine and agricultural impacted land.

Mining has destroyed some vegetation to the east of Site K (Figure 11; Photo plate 1). At the time of the site visit, the area was cleared of vegetation. East of the farm workshop area, the vegetation has also been historically impacted on and comprised compacted soils with limited natural vegetation (western portion of Site D).

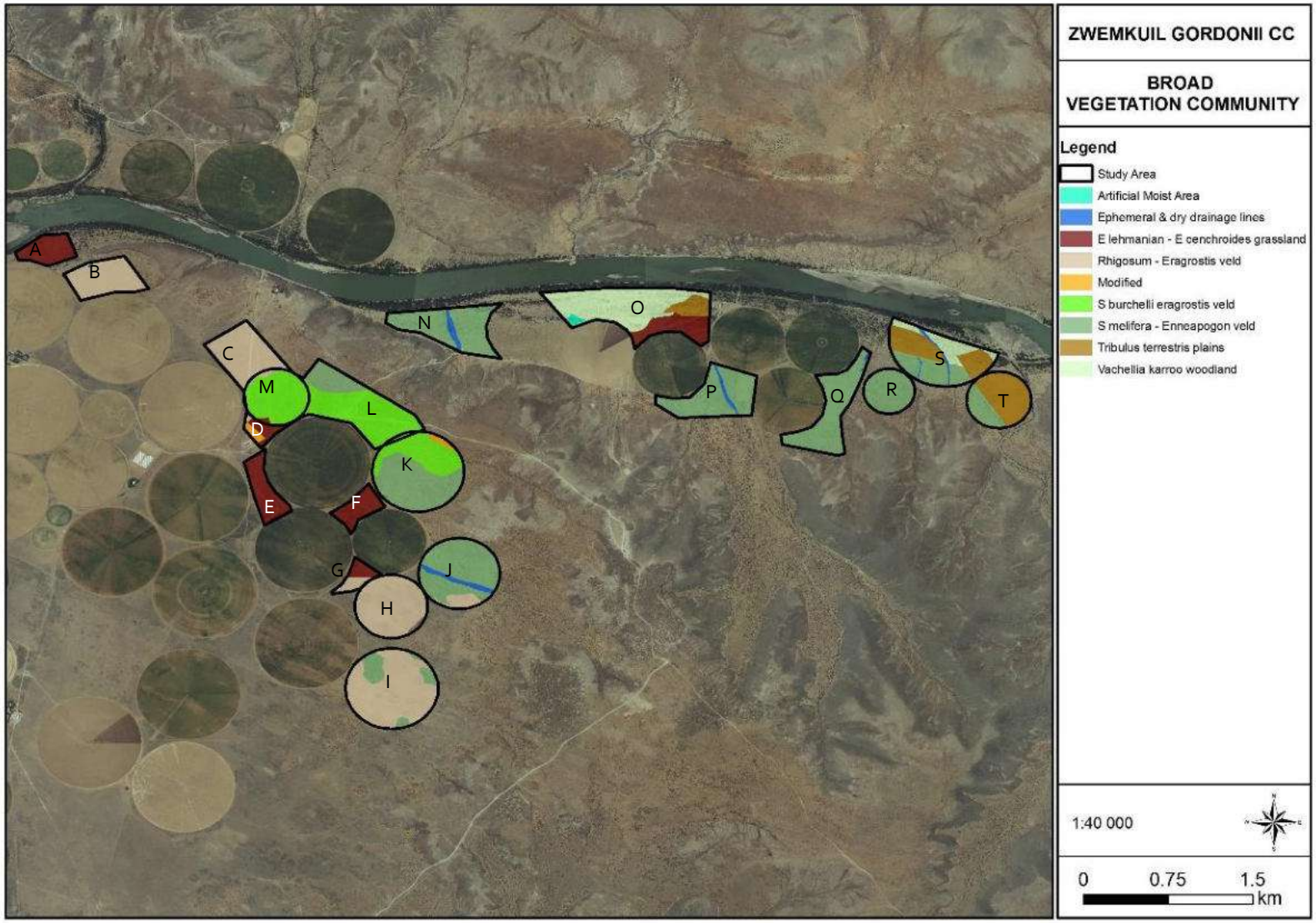


Figure 12: Broad vegetation groups on the sites

Photo plate 1: Cleared vegetation (mining related) on the eastern extent of Site K

b) Tribulus terrestris plains

Historically cultivated land along the northern sites were dominated by the weedy *Tribulus terrestris* as (common devil's thorn / dubbeltjie) (Photo plate 2)

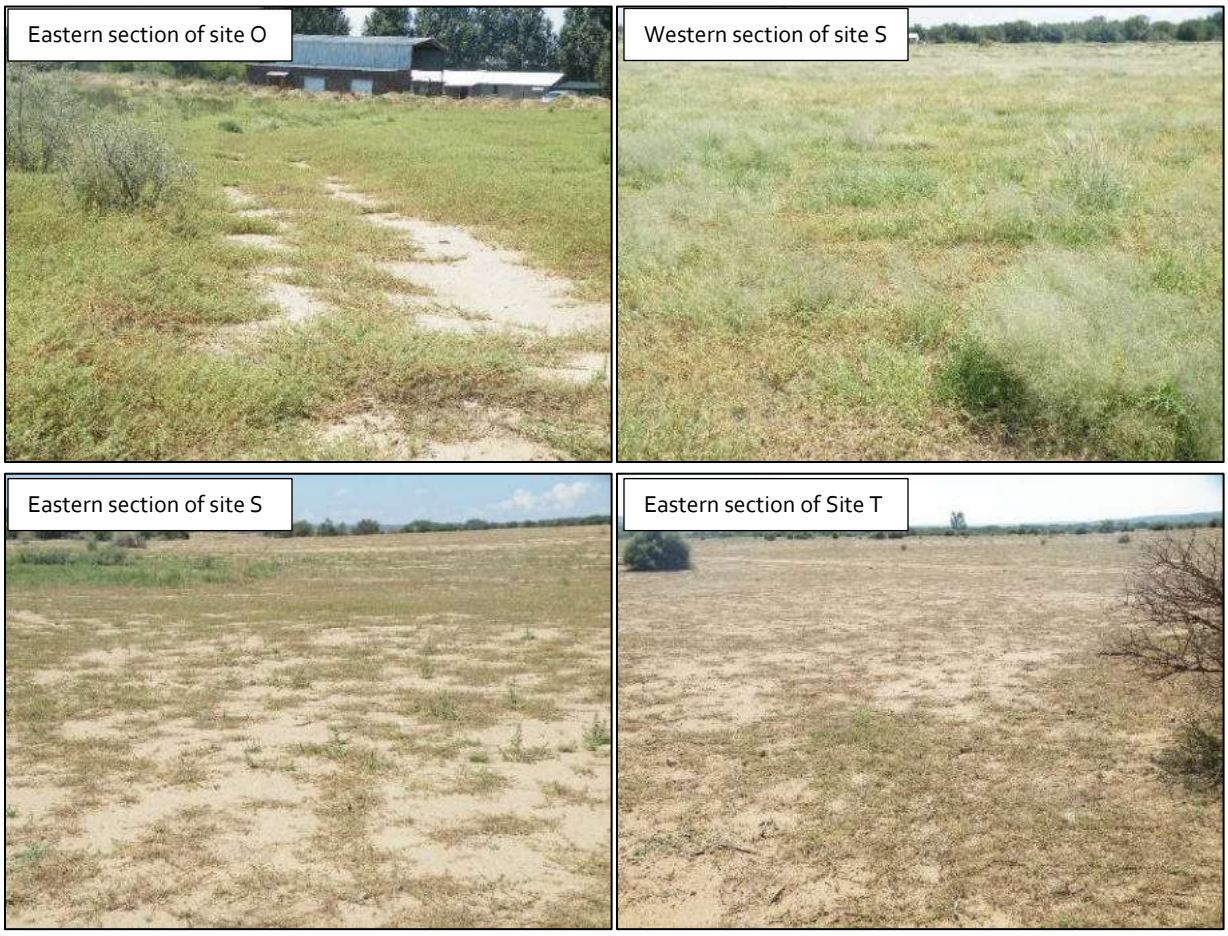


Photo plate 2: *Tribulus terrestris* plains on the site along the Orange River

The vegetation ranged from compacted and bare soils with only *T terresris* and some hardy pioneer species noted. Aerial imagery indicate that these areas were not recently cultivated and are remaining in a pioneer state. No natural succession is expected due to the degraded and compacted nature of the soils. The species diversity is low with weedy species such as *Dyspania (Chenopodium) carinata* (green goosefoot), *Xanthium spinosum* (spiny cocklebur) and the grass *Tragus berteronianus* (carrot seed grass). The opportunist tree *Senegalia melifera* (black thorn) and shrub *Lycium* species (Krie doring) were also noted. No plant species of conservation concern were recorded or are expected to be present in this group.

c) Eragrostis lehmaniana Enneapogon cenchroides grasslands

Historically cultivated land along the Orange River (e.g., Sites A and O), as well as areas continuously impacted on by surrounding cultivation (Sites D, E, F, G) were found to be dominated by the grasses *Eragrostis lehmanniana* (Lehmann's grass) and dense patches of *Enneapogon cenchroides* (nine-awned grass) (Photo plate 3).

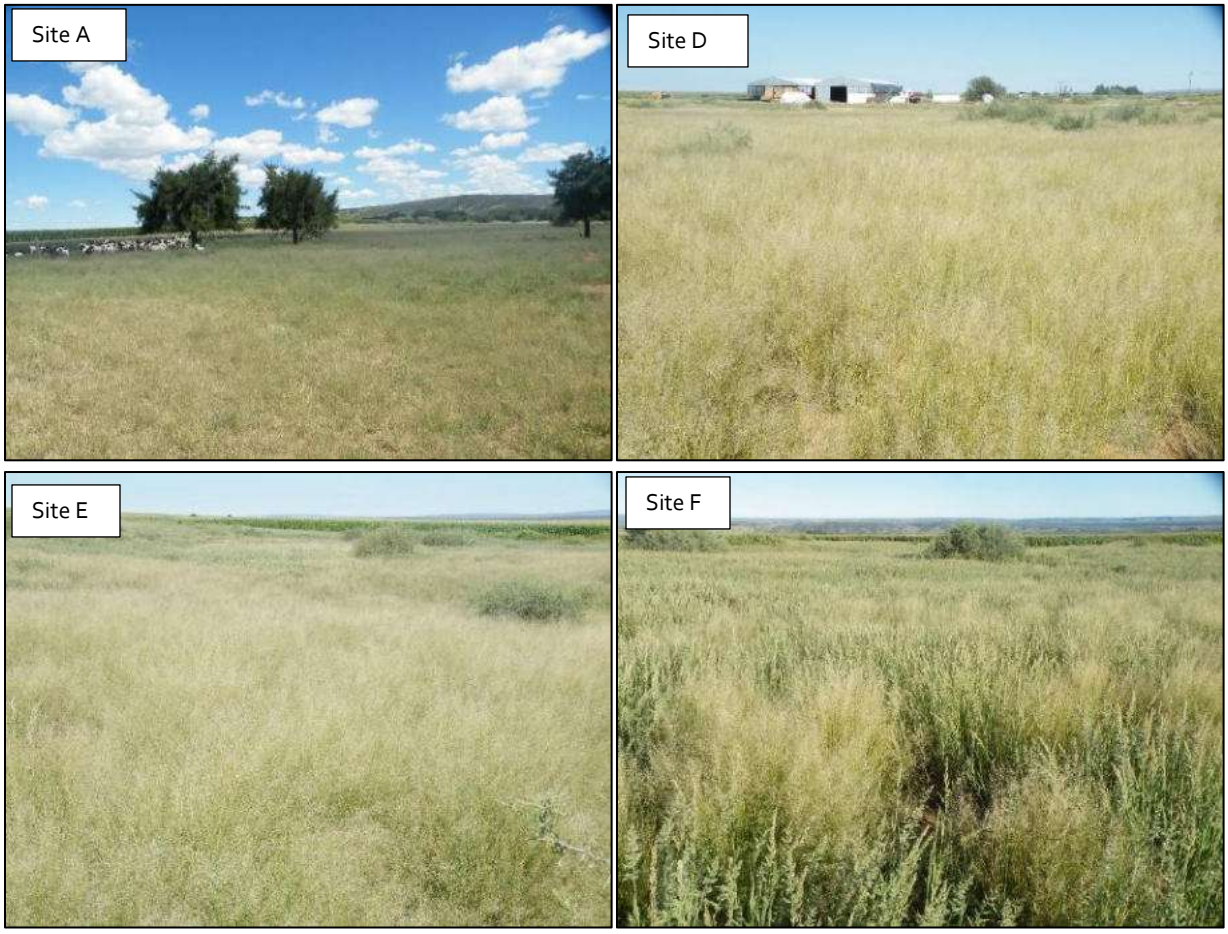


Photo plate 3: *Eragrostis – Enneapogon* dominated grasslands in historically / continuously disturbed land

These areas comprised indigenous species natural to the area, however, the diversity of species was low. Other grasses included *Setaria verticulata, Eragrostis obtusa, E echinochloidea* and *Tragus berteronianus*.

Hardy forbs such as *Tribulus terrestris* (dubbeltjie), *Indigofera alternans* (skaap-ertjie), *Seasamum capense, Hermbstaedtia fleckii, Cucumis zeyheri* and patches of *Gisekia africana var africana* were recorded. the shrub *Lycium cinereum* (krie doring) was also common. No plant species of conservation concern were recorded or are expected to be present in this group.

d) Artificial moist area

Site O includes an artificial moist area, likely seepage from the pivot system. However, this must be confirmed by a wetland / soil specialist. Here the vegetation was modified as it comprised vegetation associated with most conditions that does not correspond to the Upper Gariep Alluvial Vegetation expected here. The vegetation comprised a dominance of the grass *Chloris virgata, Eragrostis rotifer* and dense, almost impenetrable patches of *Setaria verticulata*. The tree *Ziziphus mucronata* was recorded.

4.2.2 *Rhigozum trichotomum Eragrostis lehmanniana* veld

Various sites, comprising largely of sandy soils, were dominated by the grass *Eragrostis lehmanniana* Lehmann's grass with dense patches shrub *Rhigozum trichotomum* (three thorn Rhigozum) (Photo plate 4). These areas comprised open grasslands with patches of *Rhigozum* that can also be distinguished on historical aerial imagery.

Photo plate 4: *Rhigozum trichotomum Eragrostis lehmanniana* veld on site B. The circular patches of *R trichotomum* on this site can also be seen in the excerpt of a 1993 aerial images (arrows)

The grass layer included *Enneapogon cenchroides*, *Stipagrostis obtusa* (bushman grass), *Aristida congesta* (tassel three-awn) and *Schmidtia pappophoroides* (sand quick). The shrubs *Lycium cinereum* (Krie doring), *Helichrysum luciliodes* (bergkerriebos) and *Gnidia polycephalus* (Jannuariebos) were recorded, as well as small individuals of the tree *Senegalia mellifera* and larger *Ziziphus mucronata* to the south of Site C (Photo plate 5). The forb diversity included *Pentzia* species, *Indigofera daleoides* and *Osteospermum leptolobum*. No plant species of conservation concern were recorded or are expected to be present in this group.

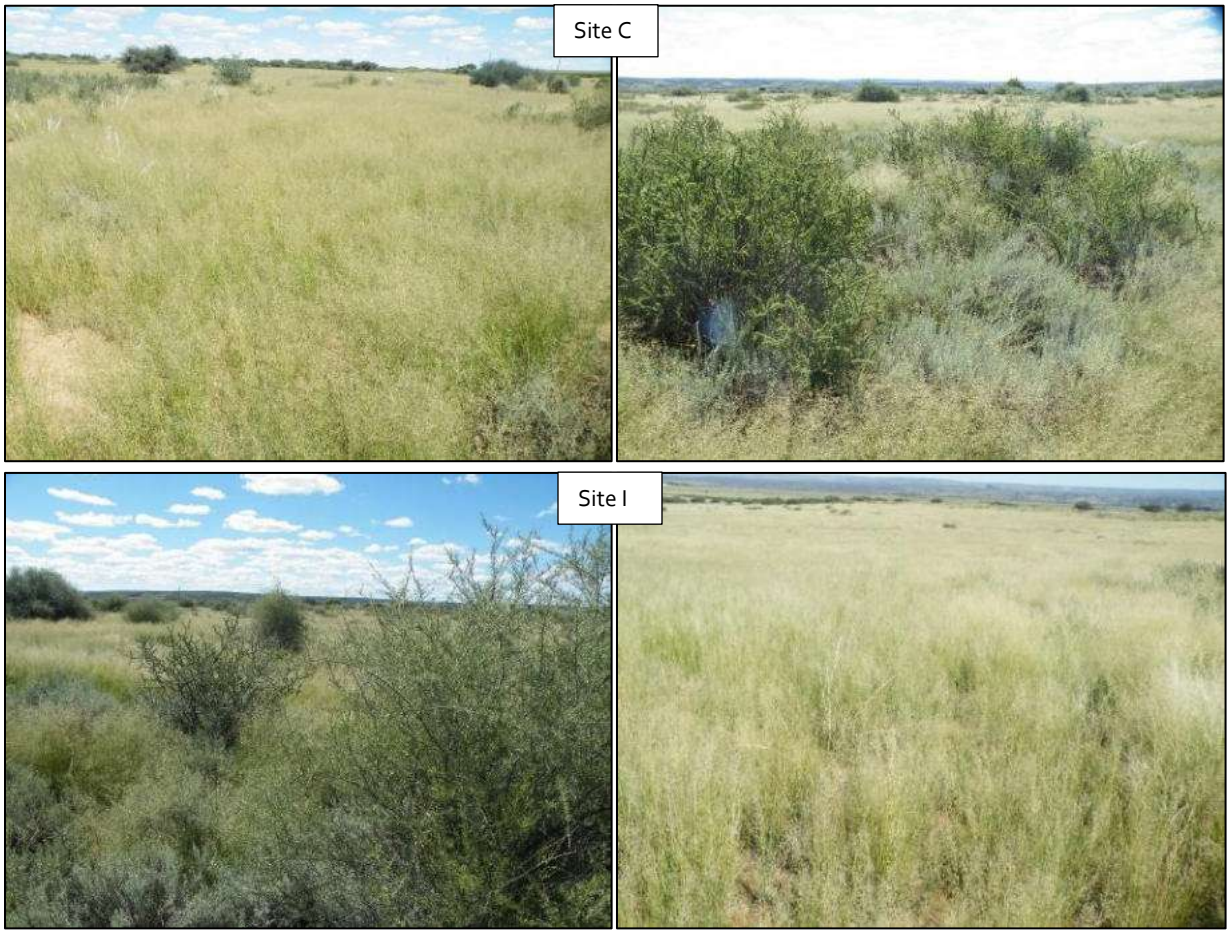


Photo plate 5: *Rhigozum trichotomum Eragrostis lehmanniana* veld

4.2.3 *Senegalia mellifera* veld

Many of the sites were dominated by the tree *Senegalia mellifera*, which is typical of the Northern Upper Karoo (Mucina and Rutherford, 2006). However, this tree forms dense, almost impenetrable stands in many areas on the sites. This is likely indicative of bush encroachment due to a combination of historic land uses, grazing, climatic changes, and elevated atmospheric carbon dioxide (Department of Environmental Affairs, 2019). The *Senegalia mellifera* veld were further divided into two variants based on the dominant grass species (*Senegalia mellifera – Enneapogon* species veld), as well as the presence of

the discriminant species *Searsia burchelii* (Karoo kuni bush) (*Searsia burchelii-Eragrostis lehmanniana* veld).

a) Senegalia mellifera – Enneapogon species veld

The grass layer was dominated by grasses of the *Enneapogon* genus and varied depending on grazing and sandiness. Sites grazed by goats were dominated by *E devauxii* (eight-day grass) and *Aristida congestus* (Photo plate 6). Other sites included dense patches of *E. cenchroides* (nine-awned grass) interspersed with *Eragrotis lehmanniana, Stipagrostis obtusa*, *Eragrostis cilianensis* (stink love grass), *E porosa* (besembiesie) and *Schmidtia pappophoroides* (Photo-plate 7). Other than *S melifera,* the nationally protected tree *Boscia albitrunca* (witgat) was recorded, as well as *Ziziphus mucronata* (buffalo-thorn).

The forb diversity varied depending on the grass densities and dominance. Areas covered by *E cenchroides* were low in forb species diversity. Forbs and shrubs recorded included *Pentzia* species, *Gnidia polycephalus*, *Helichrysum luciliodes*, *Indigofera alternans*, *Roepera (Zygophyllum) lichtensteinianum* (skildpadbos) and *Lycium cinerea.*

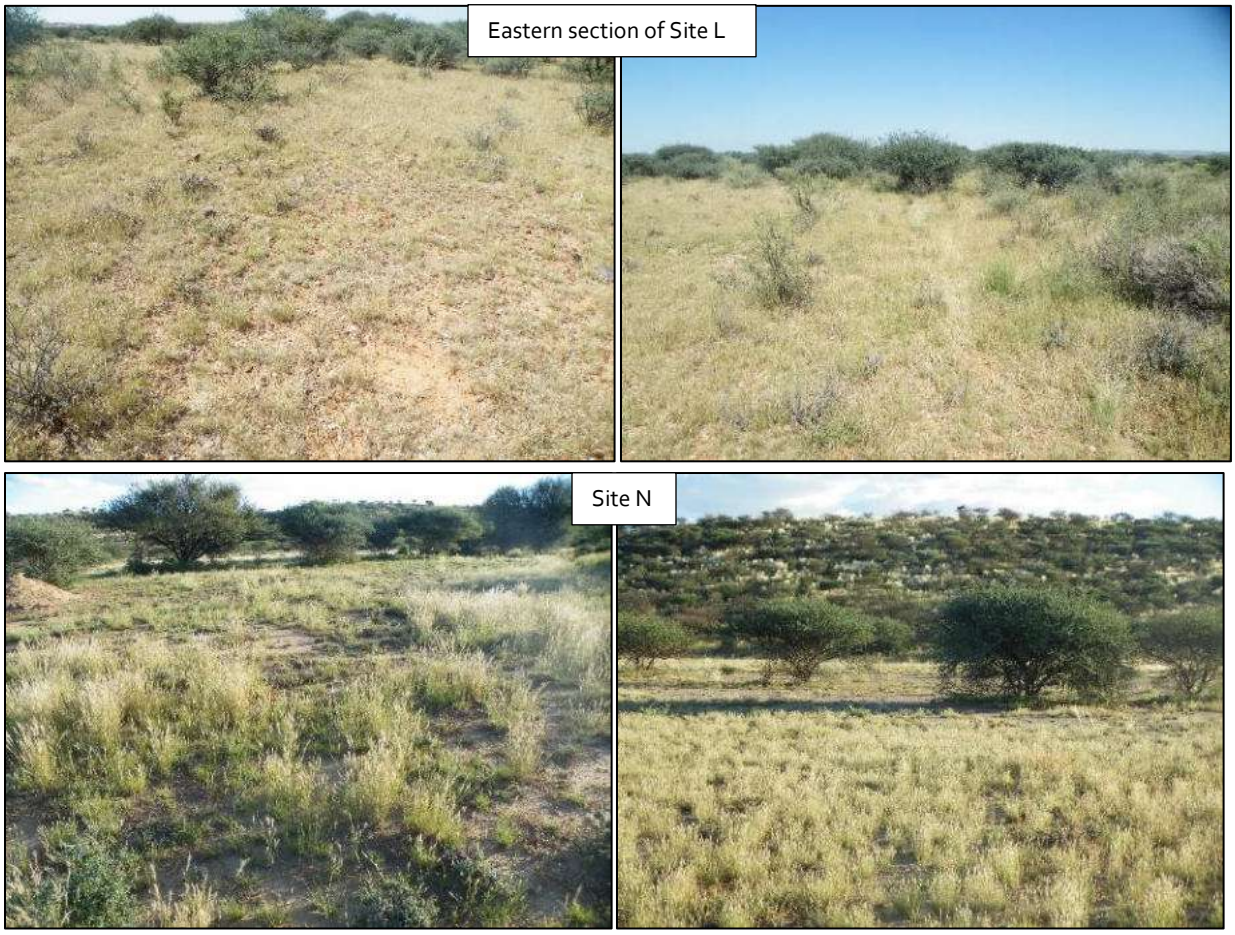


Photo plate 6: Grazed *Senegalia melifera- Enneapogon devauxii* veld on sites L and N

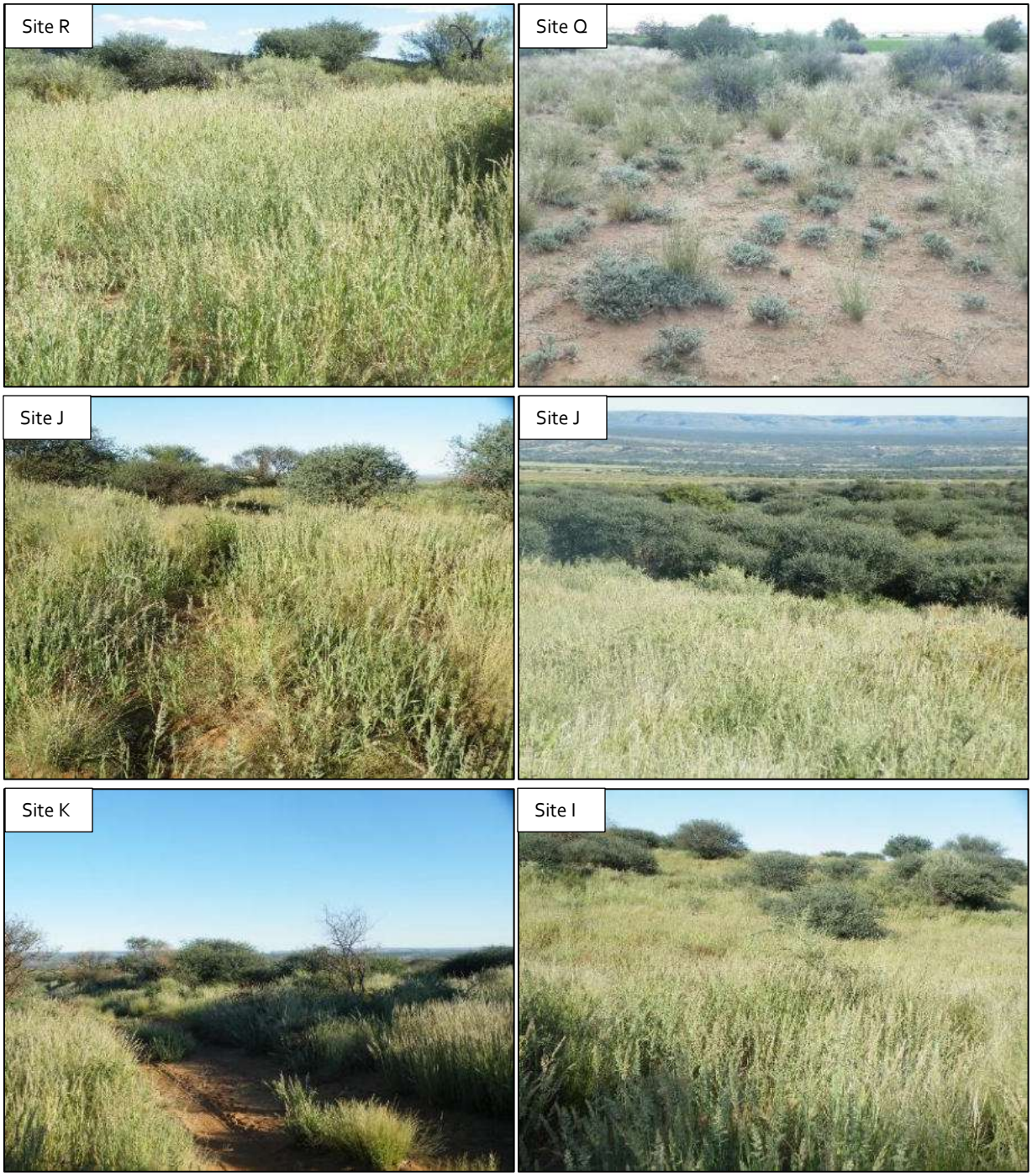


Photo plate 7: Various images of the *Senegalia mellifera-Enneapogon cenchroides* veld

Other than the protected tree, *Boscia albitrunca*, no other plant species of conservation concern were recorded. Bulbous species and succulents may be present; however, it may have been dormant or obscured by dense stands of *S meliifera* and *E cenchroides.*

b) Searsia burchelli- Eragrostis lehmanniana veld

This variant had a patchy dominance of the grass *Eragrostis lehamnniana* (particularly the eastern portion of Site L). However, to the south (Site K), the dominant patches of *Enneapogon cenchroides* were prevalent. *Senegalia mellifera* dominated, however, the small tree *Searsia burchelli* was only recorded in this variant (Photo plate 8). Also, this vegetation included a bulbous species that was becoming dormant (assumed to be an *Ammocharis* species), the shrub *Asparagus* cf *glaucus*,as well as the succulent *Aloe claviflora.* This variant also included a high frequency of the national protected tree, *Boscia albitrunca*.

No plant species of conservation concern were recorded. However, this area is the most likely to support such species.

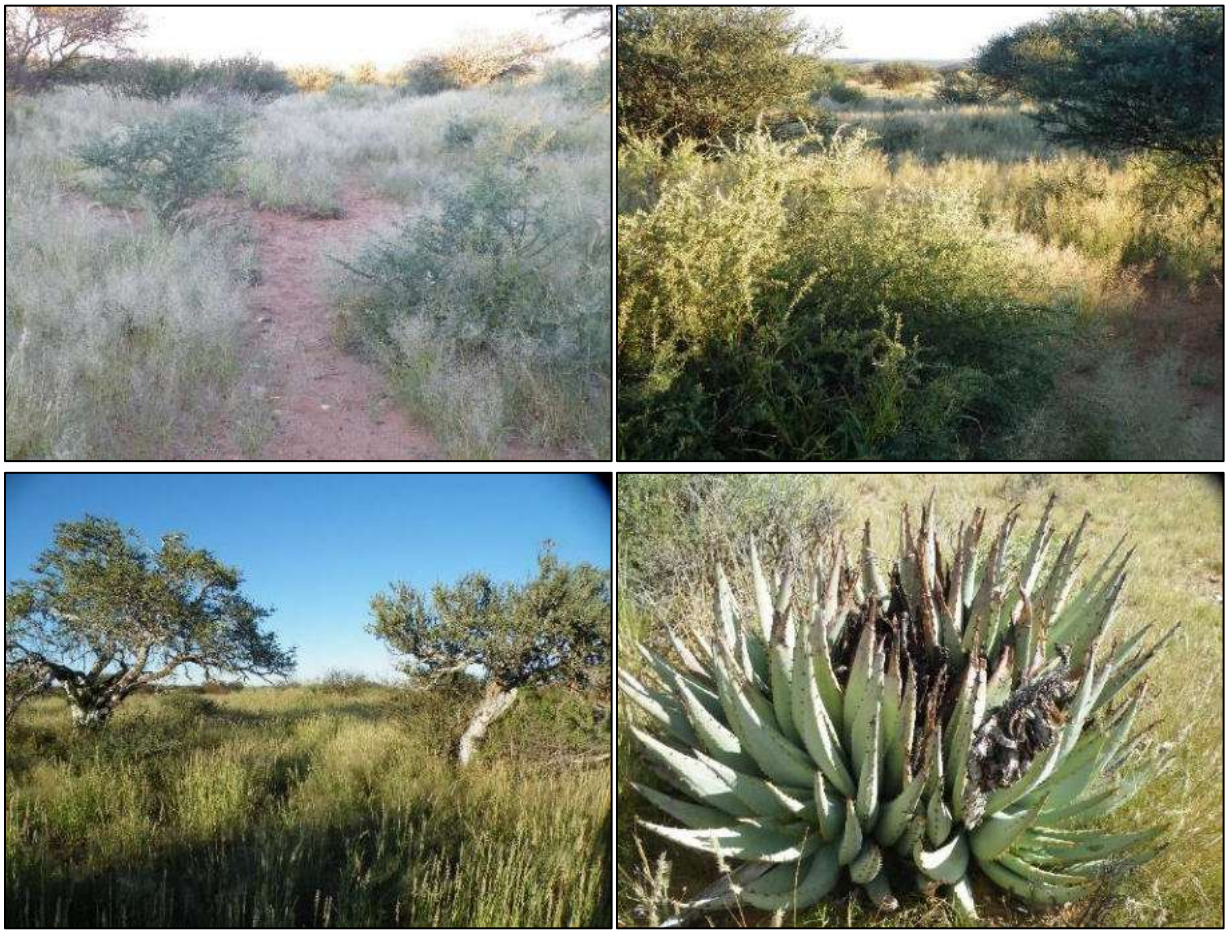


Photo plate 8: b)*Searsia burchelli- Eragrostis lehmanniana* veld on site K and L, with *Boscia albitrunca* (below left) and *Aloe claviflora* (right)

4.2.4 Ephemeral and dry drainage lines

A network of drainage lines flow through some of the sites, all of which was dry at the time of this assessment (Photo plate 9). The tree diversity was higher along these drainage lines with species such as *Ziziphus mucronata* (buffalo-thorn), *Searsia lancea* (karee), *Vachellia karroo* (sweet thorn) and *Lycium*

oxycarpum (Karoo honey-thorn). Sandy banks were dominated by the grasses *Cenchrus ciliaris* (foxtail buffalo grass), *Chloris virgata*, *Eragrostis rotifer* (pearly love grass) and *Setaria verticulata*. Forbs and small shrubs that were recorded included *Salsola aphylla* (rivierganna), *Plinthus karooicus* (Karooganna) and *Roepera lichtensteinianum*. No plant species of conservation concern were recorded or were expected to be present.

Photo plate 9: Dry drainage lines

4.2.5 *Vachellia karoo* riparian woodland

None of the sites proposes to clear riparian vegetation along the Orange River. However, Sites O and S does impact on the associated *Vachellia karoo* woodland along the riparian area.

The areas that will be impacted on, were historically disturbed (Photo plate 10). Other tree species recorded included *Diospyros lycioides* (blueish), *Searsia lancea, Ziziphus mucronata*, and *Gymnosporia buxifolia*. The most prominent grass species were *Setaria verticulata* (burr bristle grass), *Chloris virgata* (feather-top Chloris), *Eragrostis cilianensis* and *Cenchrus ciliaris* (foxtail buffalo grass).

No plant species of conservation concern were recorded or were expected to be present.

Photo plate 10: *Vachellia karroo* woodland south of the Orange River, including an historic retaining wall (below, right)

4.3 Plant Species of Conservation Concern

Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened, Extinct in the wild, Data deficient, Near-threatened, Critically rare and Rare (Figure 13). Chapter 4, Part 2 of NEMA Biodiversity Act, 2004 (Act No. 10, 2004) provides for listing of species that are threatened or in need of protection to ensure their survival in the wild, while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival.

A list of plants of conservation concern was compiled using information from the South African National Biodiversity Institute's (SANBI) checklist (SANBI, 2009b), Raimondo *et al*, (2009), information gathered from the Plants of Southern Africa website (POSA) for the area the site is situated in, and information within the screening tool report on sensitive plant species.

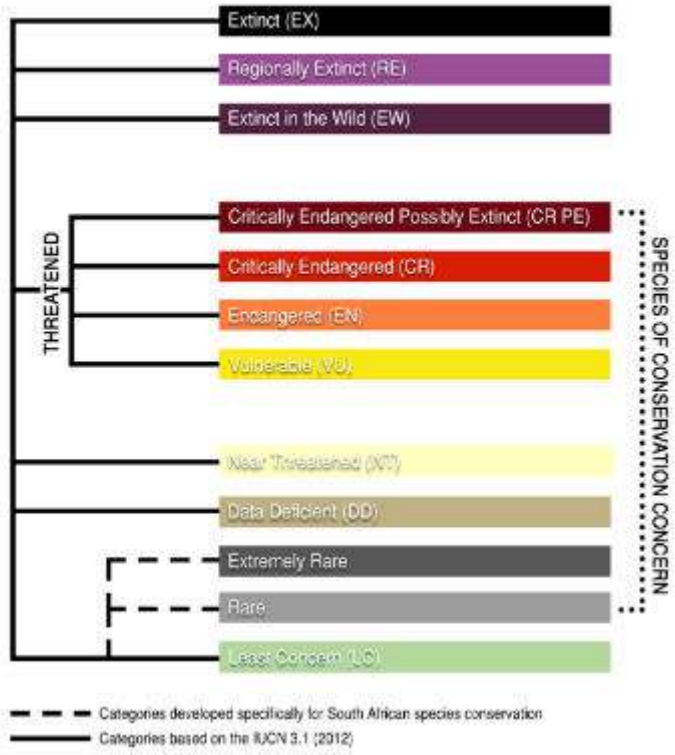


Figure 13: Categories of species of conservation concern (SCC) modified from the IUCN's extinction risk categories (reproduced in part from IUCN, 2012).

4.3.1 Plant species compliance statement

Appendix C list five (5) species that has been short-listed to have a possibility of occurring, and for which the habitat assessment was undertaken. None of these species were recorded in walked transects on the sites and the habitat assessment agrees with the screening tool report which indicates much of the site as being of low plant species sensitivity. Only one species, listed as Rare, has a likelihood of occurring: *Tridentia virescens* and the likelihood of occurring is considered medium to low (Appendix C). Appendix C provides an image of this species which should be relocated if found during clearing. No further plant species of conservation concern assessments are thought to be needed.

4.4 Protected plants

4.4.1 NEMBA Threatened or Protected Plant Species (TOPS)

Chapter 4, Part 2 of the National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA) provides for listing of plant and animal species as threatened or protected. If a species is listed as threatened, it must be further classified as Critically Endangered, Endangered or Vulnerable. These species are commonly referred to as TOPS listed. The Act defines these classes as follows:

- Critically endangered species: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.

- Endangered species: any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- Vulnerable species: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category will include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known as 'Restricted Activities', are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the act are keeping, moving, having in possession, importing and exporting, and selling. The first list of threatened and protected species published under NEMBA was published in the government gazette on the 23rd of February 2007 along with the Regulations on Threatened or Protected Species.

At the time of this assessment, only one (1) TOPS listed species was recorded within Sites D (Figure 13). This species, *Harpagophytum procumbens* subsp *procumbens* (devil's claw) is listed as a Protected medicinal plant species and may not be traded. It is recommended that these species be replanted outside of the proposed clearing footprint.

4.4.2 Provincially Protected Plants

Several plants are provincially protected by the Northern Cape Nature Conservation Act No.9 of 2009. The removal or pruning of these plants will require a permit from the Northern Cape Department of Environment and Nature Conservation.

At the time of this assessment, only *Ammocharis carinica* (bulb almost dormant and was assumed to be *Ammocharis*) and the tree *Boscia albitrunca* were recorded (Figure 13). It is likely that a denser grass layer obscured the smaller succulent species. Where such species are encountered, they should be relocated to outside of the proposed development footprint. However, the tree *Boscia albitrunca* will require a permit for removal – (see 4.4.3)

4.4.3 National protected trees

The National Forest Act, 1998 (Act No. 84 of 1998) enforces the protection of several indigenous trees. The removal, thinning or relocation of protected trees will require a permit from the Department of Agriculture, Land Reform and Rural Development (DALRD, formerly Agriculture, Forestry and Fisheries) ((Notice of the List of Protected Tree Species under the National Forests Act, 1998 (ACT NO 84 OF 1998), Notice 536 of 2018, Government Gazette, 7 September 2018).

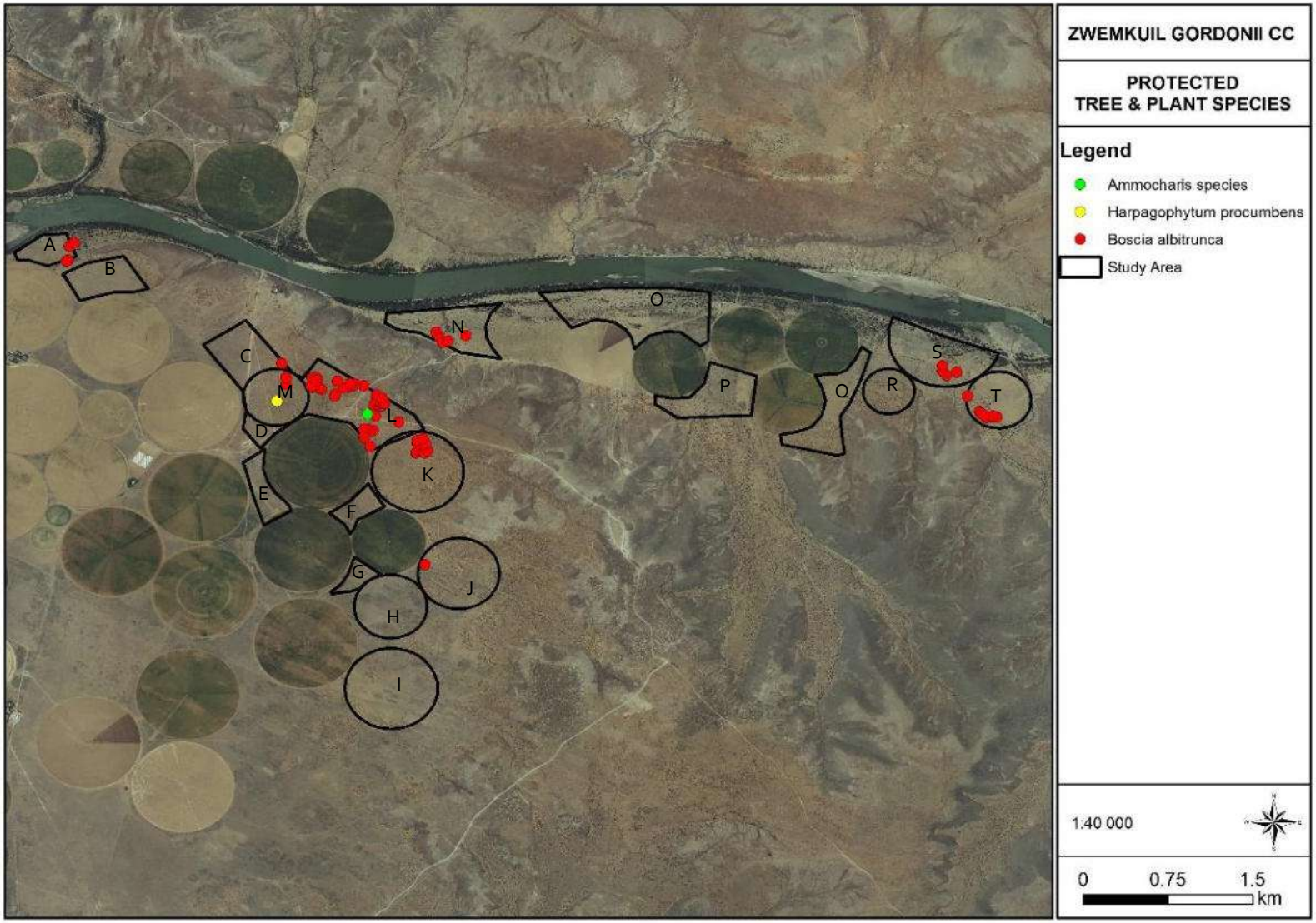


Figure 14: Locality of *Boscia albitrunca* and protected plants recorded in walked transects

Of these trees, *Boscia albitrunca* (witgat / shepherd's tree), occurred abundantly on the farm and specific Sites D, L, O, J and K, as well as around site A (Figure 14). These trees require a permit from the local Department of Environment, Forestry and Fisheries to be removed.

In areas of high occurrence, three 1ha plots were drawn around *Boscia* sampling transects and the number of trees in the ha counted (Figure 15). In total 31 trees were counted in 3 ha (9+9+13=31), bringing the average to 10 trees per ha in areas of high occurrence (Site K, L, M S and T).

Figure 15: *Boscia albitrunca* per ha in high occurrence areas

4.5 Alien Invasive Plant Species

The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. On 18 September 2020, the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 43726 of 2020). The Alien and Invasive Species Regulations were published in the Government Gazette No. 43735, 25 September 2020. The legislation calls for the removal and / or control of alien invasive plant species (Category 1 species). In addition, unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within close proximity to a watercourse. Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.

Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential

that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.

Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

The alien plant species identified on the study site are listed in Appendix B. Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

(a) notify the competent authority in writing

(b) take steps to manage the listed invasive species in compliance with

(i) section 75 of the Act;

(ii) the relevant invasive species management programme developed in terms of regulation 4; and

(iii) any directive issued in terms of section 73(3) of the Act.

The following category 1b plants were observed within the site

Table 6: Category 1b invasive plant species recorded in walked transects.

Species	Common name	Vegetation groups
Argemone mexicana	Yellow-flowered Mexican Poppy	Site A
Eucalyptus camaldulensis	Red River Gum	Along orange River, specifically Site S
Opuntia ficus-indica	Sweet Prickly Pear	Site N
Salsola kalii	Russian Tumbleweed	Site P, along dry drainage line
Xanthium spinosum	spiny cocklebur	Site S – *Tribulus terrestris* plains

5 SITE ECOLOGICAL IMPORTANCE

It has been clearly demonstrated that vegetation not only forms the basis of the trophic pyramid in an ecosystem, but also plays a crucial role in providing the physical habitat within which organisms complete their life cycles (Kent & Coker 1992). Therefore, the vegetation of an area will largely determine the ecological sensitivity thereof.

5.1 Rating and Analysis

The Site Ecological Importance (SEI) in terms of vegetation is discussed and mapped as per the requirements of the Species Environmental Assessment Guideline (SANBI, 2020) and detailed in the methodology section (Section 2.5) (Figure 16).

SEI is a function of the (BI) of the receptor (e.g. species of conservation concern, the vegetation/fauna community or habitat type present on the site and its resilience to impacts as follows:

SEI = Biodiversity Importance (**BI) +** Receptor Resilience **(RR)**

Wherein **BI** in turn is:

BI = Conservation Importance (**CI) +** Functional Integrity (**FI)**

Table 7: Scoring of vegetation that occurs within the sites

Broad vegetation community	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI) – mitigation
Modified land • **Impacted land** • ***Tribulus terrestris* plains;** • ***E lehmanniana-E cenchoides* veld**	Low No confirmed or highly likely SCC / range-restricted species, Less than 50 % contains natural habitat with limited potential to support SCC	Medium Mostly minor current negative ecological impacts with some major historical impacts	Low	High	**Very Low (Minimise)**
Modified land • **Artificial moist area**	**Medium-Low** More than 50 % of receptor contains natural habitat No confirmed or highly likely SCC	**Medium** Good habitat connectivity	**Medium**	**High**	**Low (Minimise & Restore**
***Rhigozum-Eragrostis* veld**	**Medium** More than 50 % of receptor contains natural habitat with	**High** Good habitat connectivity, Only minor current negative	**Medium**	**High**	**Low (Minimise & Restore)**

Broad vegetation community	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI) – mitigation
	potential to support SCC	ecological impacts			
***Senegalia melifera-Enneapogon* veld**	**Medium** More than 50 % of receptor contains natural habitat with potential to support SCC	**High** Good habitat connectivity, Only minor current negative ecological impacts	**Medium**	**High**	**Low (Minimise & Restore)**
***Searsia burchelii-Eragrostis* veld**	**Medium** More than 50 % of receptor contains natural habitat with potential to support SCC	**High** Good habitat connectivity, Only minor current negative ecological impacts	**Medium**	**Medium**	**Medium (Minimise & Restore)**
Ephemeral and dry drainage lines	**Medium** More than 50 % of receptor contains natural habitat with potential to support SCC	**High** Good habitat connectivity, Only minor current negative ecological impacts	**Medium**	**Medium**	**Medium (Minimise & Restore)**
***Vachellia karoo* woodland**	**Medium** More than 50 % of receptor contains natural habitat with potential to support SCC	**High** Good habitat connectivity, Only minor current negative ecological impacts	**Medium**	**Medium**	**Medium (Minimise & Restore)**

The interpretation of the SEI ranks is described in Section 2: Methodologies; Table 4. The SEI rating was utilised to generate the vegetation sensitivity map (Figure 16). This map must be considered along with the other applicable specialist reports and maps (e.g. soils and wetlands) to obtain an overall sensitivity map.

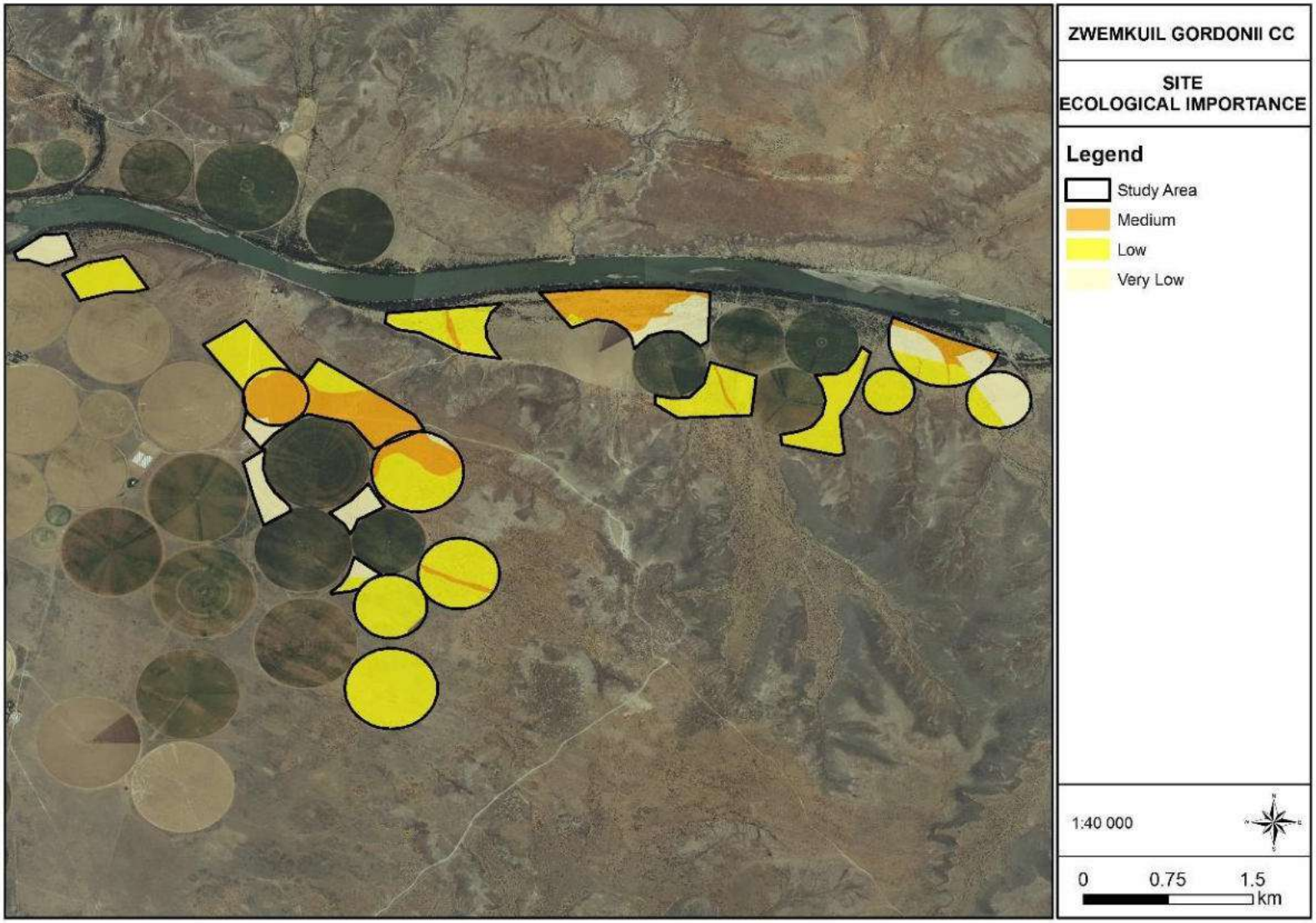


Figure 16: Site Ecological Sensitivity

6 IMPACT ASSESSMENT AND MITIGATION

Mankind depends on the natural environment for many ecological services provided for by ecosystems, ecological processes, and plant species in general. However, any development activities in natural systems will impact on the surrounding natural environment and usually in a negative way. To limit or negate these impacts, the source, extent, duration and intensity of the possible impacts needs to be identified. Once the significance of the impacts is understood, the development could both adequately plan for and mitigate these impacts to a best practise and acceptable level. However, if the impacts are significant, especially in already threatened ecosystems and vegetation units, and no adequate mitigation measures could reduce or avert these impacts, then the development should not be allowed to proceed.

6.1 Impact Statement

The main impacts related to the clearing of vegetation will take place during the clearing activities. Once the crop areas are operational, the impacts are likely to be contained to the cleared areas with minimum edge effects. The following impacts are expected, but can be mitigated:

1. Destruction of natural vegetation
2. Destruction of protected tree and plant species
3. Potential increase in invasive vegetation
4. Degradation of remaining natural vegetation
5. Bush densification
6. Potential pollution of the soil and water

The main mitigation measure to consider is to ensure that open, naturally vegetated areas remain through the cleared areas as ecological corridors, while clustering the cleared as is proposed. This could assist the movement of pollinators and the continuation of ecological processes.

6.2 Cumulative Impacts

Cumulative impacts are limited. The area that the site is situated in is located south of the Orange River. Several pivot systems, as well as mining is taking place along and around the river. Thus, clearing of additional vegetation on the sites will reduce the remaining Northern Upper Karoo vegetation in this area. however, currently, this vegetation is not threatened.

6.3 Impact Ranking Criteria

The possible impacts, as described in the next section, were assessed based on the Significance Rating. The Significance of the impact is calculated as follows and rating significance is explained below:

Significance = Consequence *(Extent + Duration+ Magnitude)* **X Probability**

I. The **nature,** which shall include a description of what causes the effect, what will be affected and how it will be affected.

II. The **extent,** wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):

III. The **duration,** wherein it will be indicated whether
- the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
- the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
- medium-term (5–15 years) – assigned a score of 3;
- long term (> 15 years) - assigned a score of 4; or
- permanent - assigned a score of 5;

IV. The **consequences (magnitude),** quantified on a scale from 0-10, where
- 0 is small and will have no effect on the environment,
- 2 is minor and will not result in an impact on processes,
- 4 is low and will cause a slight impact on processes,
- 6 is moderate and will result in processes continuing but in a modified way,
- 8 is high (processes are altered to the extent that they temporarily cease), and
- 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

V. The **probability** of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where
- 1 is very improbable (probably will not happen),
- 2 is improbable (some possibility, but low likelihood),
- 3 is probable (distinct possibility),
- 4 is highly probable (most likely) and
- 5 is definite (impact will occur regardless of any prevention measures).

VI. The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and

VII. The **status,** which will be described as either positive, negative or neutral.

VIII. The degree to which the impact can be reversed.

IX. The degree to which the impact may cause irreplaceable loss of resources.

X. The degree to which the impact can be mitigated.

The **significance** weightings for each potential impact are as follows:

- **< 30 points: Low** (i.e. where this impact would not have a direct influence on the decision to develop in the area),

- **30-60 points: Medium** (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- **60 points: High** (i.e. where the impact must have an influence on the decision process to develop in the area).

6.4 Impact Assessments

The tables below list the activities that could impact on the vegetation because of the proposed vegetation clearing on the site. The tables also list recommended mitigation measures to limit the impacts.

6.4.1 Destruction of natural vegetation

Nature: The development will require the removal of vegetation for the purpose of cultivation, access roads, and related infrastructure.
The sources of this impact include:

- Clearing of and damage to vegetation;
- Edge effects e.g. heavy vehicles turning in adjacent natural areas;
- Storage of equipment within natural vegetation.

	Without mitigation	**With mitigation**
CLEARING PHASE		
Probability	Definite (5)	Definite (5)
Duration	Permanent (5)	Permanent (5)
Extent	Limited to site (1)	Limited to site (1)
Magnitude	High (8)	Low (4)
Significance	**70 (high)**	**50 (medium)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Probable (3)	Improbable (2)
Duration	Short term (2)	Very short term (1)
Extent	Limited to site (1)	Limited to the Site (1)
Magnitude	Moderate (6)	Low (4)
Significance	**30 (medium)**	**12 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Moderate	Low
Can impacts be mitigated?	Yes	

Mitigation:
Planning and clearing:

- Keep the vegetation clearing in Medium SEI categories as small as possible and align with already modified areas. Endeavour to utilise as much Low and Very low SEI as possible and the areas of Medium SEI bordering it.

- Maintain riparian areas and allow for naturally vegetated corridors through the cultivated areas. Narrow slithers of vegetation in-between cultivated areas play a role in ecological processes; however, these areas are prone to edge effects and low in species diversity. Therefore, open spaces should be as large as possible and preferably connected by the narrower vegetation in between crop areas.
- Prevent vehicular access into natural areas beyond the demarcated area to be cleared.
- Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.

Operational:

- After clearing, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land must be left in a condition as close as possible to that prior to clearing.
- Prevent operational activities from impacting on adjacent vegetation e.g. harvester and other machinery may not turn or park in naturally vegetated areas, prevent drift from chemical herbicides and pesticides.

Cumulative impacts: Reduction and fragmentation of remaining natural Northern Upper Karoo.

Residual Risks: Localised alteration of soil surface characteristics and loss of flora, increased fragmentation of remaining vegetation. If mitigation measures are adequately undertaken, the residual risk is low.

6.4.2 Removal / Destruction of protected trees and plants

Nature: Vegetation clearing will result in the removal of the national protected tree species *Boscia albitrunca*. The protected *Harpagophytum procumbens* (devil's claw) was also recorded in Site M and might be present elsewhere. One Rare species may be present.

	Without mitigation	**With mitigation**
CLEARING PHASE		
Probability	Definite (5)	Probable (3)
Duration	Long term (5)	Long -term (4)
Extent	Limited to site (1)	Limited to site (1)
Magnitude	Moderate (6)	Moderate (6)
Significance	**60 (high)**	**33 (medium)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Improbable (2)	Very improbable (1)
Duration	Short term (3)	Short term (2)
Extent	Limited to site (1)	Limited to the Site (1)
Magnitude	Moderate (6)	Low (4)
Significance	**20 (low)**	**7 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation:

Clearing and planning:

- Apply for permits for the removal of protected tree species prior to clearing of the land. The final proposed footprint of clearing must be walked to determine whether *B albitrunca* or *H. procumbens* will be affected. If so, apply for permits for their removal (or relocation of *H procumbens)* prior to vegetation clearing.
- Contractors / clearing team should familiarize themselves with the protected species and the Rare *Tridentia virescens* (Appendix C). If found during clearing, the species should be relocated to outside of the proposed clearing footprint and monitored for survival for at least two years.

Maintenance:

- Operational activities may not trample natural vegetation and work should be restricted to previously disturbed footprint.
- Prevent operational activities from impacting on adjacent vegetation e.g. harvester and other machinery may not turn or park in naturally vegetated areas, prevent drift from chemical herbicides and pesticides

Cumulative impacts: Reduction of the number of national protected trees in the area.

Residual Risks: Relocated *H procumbens* could die due to transplantation shock or damage during replanting.

6.4.3 Potential increase in invasive vegetation

Nature: The seed of alien invasive plant species that occur on and in the vicinity of the areas to be cleared, could spread into the disturbed and stockpiled soil. Also, the vehicles and equipment that will be sued were likely used on various other sites and could introduce alien invasive plant seeds or indigenous plants not belonging to this vegetation unit to the site. Areas disturbed by edge effects, could be infested by alien invasive plant species

	Without mitigation	**With mitigation**
CLEARING PHASE		
Probability	Probable (3)	Improbable (2)
Duration	Medium-term (3)	Short-term (2)
Extent	Local Area (2)	Site bound (1)
Magnitude	Moderate (6)	Low (4)
Significance	**33 (medium)**	**14 (low)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Probable (3)	Improbable (2)
Duration	Short term (2)	Short term (2)
Extent	Limited to site (1)	Limited to the Site (1)
Magnitude	Low (4)	Minor (2)
Significance	**21 (low)**	**10 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation: *Construction:* • Alien invasive species, in particular category 1b species that were identified within the study area, should be removed from the development footprint and immediate surrounds, prior to clearing or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation. • All alien seedlings and saplings must be removed as they become evident for the duration of clearing • All vehicles and equipment that enters the site must be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the areas to be cleared. *Maintenance:* • Continuously monitor the emergence of alien invasive plant species on the site and remove such species as soon as they become apparent.
Cumulative impacts: Potential increase of alien invasive plant species in the area.
Residual Risks: None

6.4.4 Degradation of remaining Northern Upper Karoo

Nature: Edge effects from the cultivation could impact on the remining natural vegetation. It could change the fire regime (if any) on the site, as well as the presence and activity of herbivores, small mammals, and pollinators within the Northern Upper Karoo.

	Without mitigation	**With mitigation**
CLEARING PHASE		
Probability	Highly probable (4)	Probable (3)
Duration	Short term (2)	Short-term (2)
Extent	Limited to site (1)	Limited to site (1)
Magnitude	Moderate (6)	Low (4)
Significance	**36 (medium)**	**21 (low)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Highly probable (4)	Probable (3)
Duration	Long term (3)	Short term (2)
Extent	Limited to site (1)	Limited to the Site (1)
Magnitude	Moderate (6)	Low (4)
Significance	**40 (medium)**	**21 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate to high
Irreplaceable loss of resources?	Moderate	Low
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

- Irrigated areas should be kept to a minimum and should not extent to beyond the cultivated areas.
- Conserve large areas of open space, instead of narrow portions where edge effects can degrade the entire natural area.
- Limit fragmentation by roads and other linear developments etc. in conserved open space.

Clearing:

- Only clear the footprint needed for cultivation and associated activities.
- Do not infringe into natural areas beyond the proposed cultivated areas.
- Prevent the unnecessary removal and trampling of vegetation

Operational:

- No operational activities may directly impact on the watercourses or veer from dedicated roads.
- Limit the use of chemicals (pesticides and herbicides) and do not spray in windy conditions. Pesticides may impact on pollinators and lead to a decline in species diversity and densities.
- Do not prevent the movement of mammals and insects, except to safeguard crops (e.g. grazing kudu's)

Cumulative impacts: Degradation of the vegetation due to edge effects.

Residual Risks: Operational activities may cause indirect impacts to the natural vegetation. This could result in a change in species composition and functionality. If mitigation measures are adequately undertaken, the residual risk is low as the impacts are unlikely to be exceed the clearing impacts.

6.4.5 Bush densification

Nature: The vegetation is prone to bush densification whereby open veld, in the absence of good veld management, become denser and dominated by stands of encroacher species e.g. "stands of plants of the kinds specified in Table 4 of Regulation 16 (CARA), where individual plants are closer to each other than three times the mean crown diameter" (Agricultural Research Council, 2013). Plants in this group are not alien plants, but indigenous plants that tend to become abnormally abundant when the area is degraded (Agricultural Research Council, 2013). The plants themselves are thus not the problem, but their increased abundance or encroachment into vegetation serves as an indicator of poor land management practices. Several species occurring on the site could become encroachers e.g. *Lycium species, Rhigozum trichotomum, Senegalia mellifera* and *V karroo*. Clearing edge effects and operational disturbances can result in densification of such species, a change in vegetation composition, and a loss of species diversity, particularly grass and forb species.

	Without mitigation	**With mitigation**
CLEARING PHASE		
Probability	Highly probable (4)	Probable (3)
Duration	Long term (4)	Short term (1)
Extent	Limited to site (1)	Limited to site (1)
Magnitude	Moderate (6)	Low (4)
Significance	**44 (medium)**	**24 (low)**
Status (positive or negative)	Negative	Neutral
OPERATIONAL PHASE		
Probability	Highly probable (4)	Probable (3)
Duration	Long term (3)	Short term (2)

Extent	Limited to site (1)	Limited to the Site (1)
Magnitude	Moderate (6)	Low (4)
Significance	**40 (medium)**	**21 (low)**
Status (positive or negative)	Negative	Neutral
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Moderate	Low
Can impacts be mitigated?	Yes	

Mitigation:

Clearing:

- Leave as much natural vegetation intact as possible.
- Do not disturbed soil or vegetation alongside cultivated areas unnecessary.
- Ensure that areas outside of the operational footprint that were disturbed, are adequately rehabilitated and prevent dense stands of encroacher species.

Operation:

- Monitor the establishment of dense stands of encroacher species and remove or thin as soon as detected.
- If game or grazers will be excluded from the natural vegetation, a management plan to prevent densification or a shift in species composition should be implemented to maintain the vegetation in a natural to near-natural state.

Cumulative impacts: Possible bush densification on the site and loss of indigenous species diversity.

Residual Risks: Bush densification

6.4.6 Pollution of the soil and water

Nature: Clearing of vegetation as well as the operational activities, may cause soil and water pollution, which could impact on nearby watercourses and natural vegetation. Operational activities such as the use of chemicals may further impact on natural vegetation surrounding the cultivated land.

	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	Probable (3)	Improbable (2)
Duration	Short-term (3)	Very short-term (1)
Extent	Limited to site (1)	Site bound (1)
Magnitude	Moderate (6)	Low (4)
Significance	**30 (moderate)**	**12 (low)**
Status (positive or negative)	**Negative**	**Negative**
OPERATIONAL PHASE		
Probability	Probable (3)	Improbable (2)
Duration	Medium-term (3)	Short-term (2)
Extent	Limited to site (1)	Limited to site (1)
Magnitude	Moderate (6)	Low (4)
Significance	**30 (medium)**	**14 (low)**
Status (positive or negative)	**Negative**	**Negative**
Reversibility	Moderate	Low

Irreplaceable loss of resources?	Not Applicable	Not Applicable
Can impacts be mitigated?	Yes	
Mitigation: *Clearing:* • Prevent spillage of oils and other pollutants, contain, and treat any spillages immediately, strictly prohibit any pollution/littering during clearing. • No vehicles may be washed within naturally vegetated areas, except in suitably designed and protected areas • No vehicles may be serviced or repaired within naturally vegetated areas unless it is an emergency in which case adequate spillage containment must be implemented *Operational:* • Prevent spillage of oils and other pollutants, contain, and treat any spillages immediately. • During spraying of chemicals, prevent drift into natural vegetation.		
Cumulative impacts: If mitigation measures are not strictly implemented, a considerable loss of biodiversity could occur because of contamination of ground water and soils. This will lead to the increase in modified areas and fragmentation of natural habitats		
Residual Risks: None		

7 CONCLUSION

Much of the vegetation on the sites were in a good ecological condition, and due to its size and limited disturbances, rates high in its functional integrity and scores a medium SEI. Most of this vegetation also falls within CBAs, which should ideally remain in natural state. However, areas that was historically cleared and highly disturbed rated as very low and low SEI. Also, most of the vegetation on the site is not unique and the Upper Nama Karoo vegetation is not considered threatened. Furthermore, no plant species of conservation concern were recorded or are expected to be present in these groups.

At the time of this assessment, only one (1) TOPS listed species was recorded within Site M. This species, *Harpagophytum procumbens* subsp *procumbens* (devil's claw) is listed as a Protected medicinal plant species and may not be traded. It is recommended that these species be replanted outside of the proposed clearing footprint. the national protected tree, *Boscia albitrunca*, occurred abundantly on the farm and specific Sites D, L, O, J and K, as well as around site A. These trees require a permit from the local Department of Environment, Forestry and Fisheries to be removed.

This report therefore has no objection to the clearing of the propsoed sites, provided that mitigation measures as listed in this report be adhered to as a minimum.

8 REFERENCES

Bromilow, C, (2010): Problem Plants of Southern Africa. Third edition, first impression Briza Publications, Pretoria.

Department of Environmental Affairs (2019): Towards a policy on indigenous bush encroachment in South Africa. DEA, Pretoria, South Africa

Department of Water Affairs and Forestry (2005b): Environmental Best Practice Specifications: Construction for Construction Sites, Infrastructure Upgrades and Maintenance Works. Version 3

Eco Agent, (2018): A biodiversity and wetland assessment of the proposed development on Portion 18 of the Farm Roodepan 70, Kimberley, Northern Cape. Report drafted for Envirobalance Solutions. March 2018

Gauteng Department of Agriculture, Conservation and the Environment (GDACE) (2006): Red List Plant Species Guidelines.

Gauteng Department of Agriculture and Rural Development (GDARD) (2012): Requirements for Biodiversity Assessment Version 2. GDACE, South Africa. June 2012

Gauteng Department of Agriculture and Rural Development, (2011): Gauteng Conservation Plan Version 3 ArcGIS Spatial data

Germishuizen, G. and Meyer, N.L. (eds). (2003): Plants of southern Africa: an annotated checklist. Strelitzia 14. South African National Biodiversity Institute, Pretoria.

Golding, J.S. (ed), (2002): South African plant red data list. Southern African Botanical Diversity Network (SABONET) Rep. No.14

Government Gazette No 32689, (2009): Draft National List of Threatened Ecosystems in terms of the National Environmental Management Act, 2004 (Act 10 of 2004). Department of Environmental Affairs Notice 1477 of 2009 in Government Gazette No 32689, 6 November 2009.

Henderson, L., (2001): Alien Weeds and Invasive Plants. A complete guide to declared weeds and invaders in South Africa. Plant Protection Research Institute Handbook No. 12. Agricultural Research Council, South Africa.

Kasl, B. (2022): Fauna compliance statement for the Proposed Oliphant Estate Township Development on the Remainder of Portion 18 of Roode Pan 70, Kimberley, Northern Cape Province. Report drafted for Envirolution Consulting, January 2022.

Kremen, C., (2005): Managing ecosystem services: what do we need to know about their ecology? Ecology Letters 8: 468-479.

Limosella Consulting, (2022): Verified wetlands for the Proposed Oliphant Estate Township Development on the Remainder of Portion 18 of Roode Pan 70, Kimberley, Northern Cape Province. Report drafted for Envirolution Consulting. January 2022.

Manning, J., (2009): Field Guide to Wild Flowers of South Africa. Random House Struik (Pty) Ltd.

Mucina, L. &): Rutherford, M.C. (2006): The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia 19. South African National Biodiversity Institute*, Pretoria.

Mueller-Dombois, D. & Ellenberg, H., (1974): Aims and methods of vegetation ecology. Wiley, New York.

Perlman, D.L., and Milder, J.C., (2005): Practical ecology for planners, developers and citizens. Island Press, Washington.

Raimondo, D., von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A. & Manyama P.A., (eds) (2009): Red List of South African plants 2009. *Strelitzea* 25, South African National Biodiversity Institute.

SANBI, (2009b): Updating National Land Cover. SANBI (South African National Biodiversity Institute), Pretoria 13/10/2009. http://bgis.sanbi.org/landcover/Landcover2009.pdf

Skowno, A.L., Raimondo, D.C., Poole, C.J., Fizzotti, B. & Slingsby, J.A. (eds.): (2019): South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6370

South African National Biodiversity Institute (SANBI)(2020): Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.0.

Tainton N. (1999): Veld Management in South Africa. University of Natal Press, Pietermaritzburg

Van Oudtshoorn, F., (2002): *A Guide to Grasses of Southern Africa.* Briza Publications,

Van Rooyen, N., (1983): Die plantegroei van die Roodeplaatdam-natuurreservaat II. Die plantgemeenskappe. South African Journal of Botany. Volume 2, Issue 2, May 1983, Pages 115-125. https://doi.org/10.1016/S0022-4618(16)30125-5

Van Wyk, B. and Van Wyk, P., (1997): *Field Guide to Trees of Southern Africa*. Struik Publishers, Cape Town.

Van Wyk, B., Van Oudshoorn B., & Gericke N., (2005): Medicinal Plant of South Africa. Briza Publications, Pretoria.

Websites:

BGIS: http://bgis.sanbi.org/website.asp

SANBI databases: http://posa.sanbi.org/searchspp.php

http://SIBIS.sanbi.org

9 GLOSSARY

Alien species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Azonal	Water-logged and salt-laden habitats require specially adapted plants to survive in these habitats. Consequently the vegetation deviates from the typical surrounding zonal vegetation and are considered to be of azonal character (Mucina & Rutherford, 2006)
Biodiversity	Biodiversity is the variability among living organisms from all sources including inter alia terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems
Biome	A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.
Buffer zone	A collar of land that filters edge effects.
Conservation	The management of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystems function and integrity.
Conservation concern (Plants of…)	Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened (see **Threatened**), Extinct in the wild, Data deficient, **Near threatened**, Critically rare, Rare and **Declining**. These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are provincially protected are also discussed under this heading.
Conservation status	An indicator of the likelihood of that species remaining extant either in the present day or the near future. Many factors are taken into account when assessing the conservation status of a species: not simply the number remaining, but the overall increase or decrease in the population over time, breeding success rates, known threats, and so on
Conservation Importance	The importance of a site for supporting biodiversity features of conservation concern present e.g. populations of IUCN Threatened and Near-Threatened species (CR, EN, VU & NT), Rare, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.
Community	Assemblage of populations living in a prescribed area or physical habitat, inhabiting some common environment.
Critically Endangered	A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
Data Deficient	There is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. However, "data deficient" is therefore not a category of threat. Listing of taxa in this category

	indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.
Declining	A taxon is declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Threatened or Near Threatened, but there are threatening processes causing a continuous decline in the population (Raimondo *et al*, 2009).
Ecological Corridors	Corridors are roadways of natural habitat providing connectivity of various patches of native habitats along or through which faunal species may travel without any obstructions where other solutions are not feasible
Ecosystem	Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space
Edge effect	Inappropriate influences from surrounding activities, which physically degrade habitat, endanger resident biota and reduce the functional size of remnant fragments including, for example, the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution
Endangered	A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future
Endemic	Naturally only found in a particular and usually restricted geographic area or region
Exotic species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Forb	An herbaceous plant other than grasses.
Habitat	Type of environment in which plants and animals live
Indigenous	Any species of plant, shrub or tree that occurs naturally in South Africa
In Situ	"In the place" In Situ conservation refers to on-site conservation of a plant species where it occurs. It is the process of protecting an endangered plant or animal species in its natural habitat. The plant(s) are not removed, but conserved as they are. Removal and relocation could kill the plant and therefore in situ conservation is preferred/ enforced.
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas
Mitigation	The implementation of practical measures to reduce adverse Impacts
Near Threatened	A Taxon is Near Threatened when available evidence indicates that that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future (Raimondo *et al*, 2009).
Plant Community	A collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighbouring patches of different vegetation types. The components of each plant community are influenced by soil type, topography, climate and human disturbance. In many cases there are several soil types within a given plant community (Gobbat *et al*, 2004)
Protected Plant	According to Provincial Nature Conservation Ordinances or Acts, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation.
Threatened	Species that have naturally small populations, and species which have been reduced to small (often unsustainable) population by man's activities

Red Data	A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. *Now termed Plants of Conservation Concern*
Species diversity	A measure of the number and relative abundance of species
Species richness	The number of species in an area or habitat
Suffrutex	Low-growing woody shrub or perennial with woody base, sometimes referred to as underground trees
Threatened	Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo *et al,* 2009)
Transformation	The removal or radical disturbance of natural vegetation, for example by crop agriculture, plantation forestry, mining or urban development. Transformation mostly results in a serious and permanent loss of biodiversity and fragmentation of ecosystems, which in turn lead to the failure of ecological processes. Remnants of biodiversity may survive in transformed landscapes
Vegetation Association	A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: "Our vegetation units are the obvious vegetation complexes that share some general ecological properties such as position on major ecological gradients and nutrient levels and appear similar in vegetation structure and especially floristic composition".
Vulnerable	A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and are therefore facing a high risk of extinction in the wild in the future (Raimondo *et al*, 2009)

APPENDIX A: SAMPLE POINT AND TRACK MAP

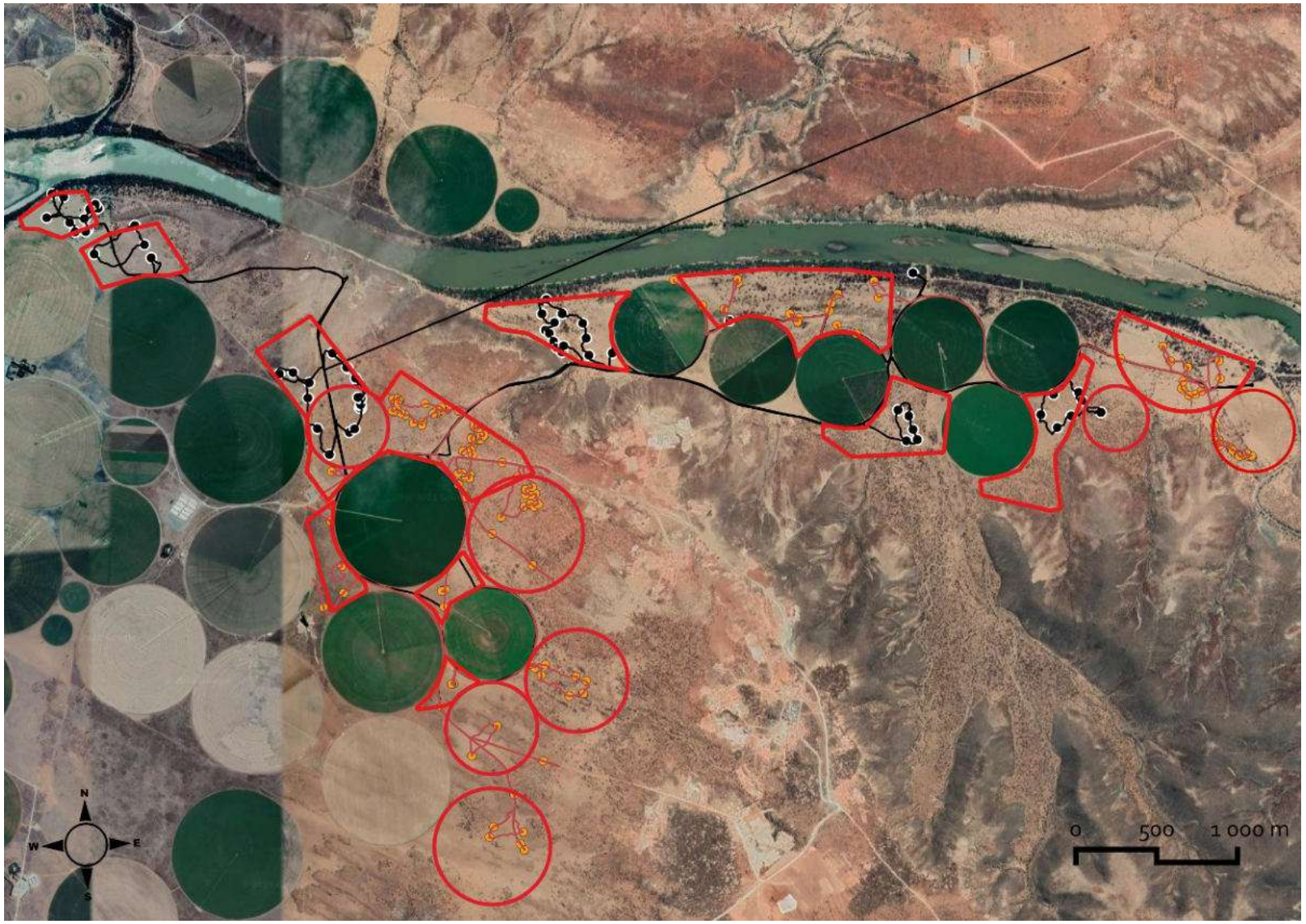


Figure 17: Tracks and sample points recorded during the 16th and the 17th of March 2022

APPENDIX B: SPECIES RECORDED DURING THE FIELD SURVEY

1 = species recorded in broad vegetation group

M = Medicinal

P= Protected by provincial legislation

D=Declining

Species	Common name	Habitat notes	*T terrestris* plains	*E lehmannianaE. cnechroides*	Artificial moist area	Rtrichotomum – E lehmanniana	S mellifera-Enneapogon veld	S. burchelii – E lehmanniana	Dry drainage lines	*V karoo* riparian woodland
Trees										
Acacia (Vachellia) karroo (M)	Sweet Thorn	Widespread, often proliferate in overgrazed areas							1	1
Senegalia mellifera subsp detinens	Black Thorn	Very thorny shrub to small tree occurring in bushveld and semi-desert areas, often on Kalahari sand and forming impenetrable thickets				1	1	1		1
Boscia albirtrunca (M)(P)	Shepherds' Tree	Occur in semi-desert areas and bushveld, often on termitaria		**1**			1	1	1	
Diospyros lycioides	Bluebush	Wide variety of habitats							1	1
Ehretia alba									1	1
Gymnosporia buxifolia	Common Spike Thorn	Widespread, often as pioneer in disturbed places							1	1
Lycium oxycarpum	Karoo Honey-thorn	Streambanks, ravines and depressions on deep sandy alluvial plains							1	
Rhigozum trichotomum	Three thorn Rhigozum	Lower hillslopes, rocky areas, dune srteet, can invade degraded veld				1	1	1		

Species	Common name	Habitat notes	*T terrestris* plains	*E lehmannianaE. cnechroides*	Artificial moist area	Rtrichotomum – E lehmanniana	S mellifera-Enneapogon veld	S. burcehlii – E lehmanniana	Dry drainage lines	*V karoo* riparian woodland
Salix mucronata (M)	Wild willow	Along streams, widespread								1
Searsia lancea	Sour Karee	Grassland and bushveld					1	1	1	
Searsia burchelii	Karoo Kuni Bush	Arid grassland and karroid vegetation						1		
Searsia pyroides	Common Wild Currant	Mountain grassland, bushveld, grassland - wide range of habitats								1
Ziziphus mucronata	Buffalo-thorn	Widespread, in various habitats					1	1	1	1
Number of indigenous tree species recorded = 13			**0**	**1**	**0**	**2**	**5**	**6**	**8**	**8**
Grasses										
Aristida congesta	Tassel Three-awn	Disturbed, overgrazed or farmed land. Increaser II grass		1		1	1			
Cenchrus ciliaris	Foxtail Buffalo Grass	Grows in dry areas and is an excellent grazing grass. However difficult to establish.					1		1	1
Chloris virgata	Feather-top Chloris	Disturbed, moist areas, mostly clay soils and on edge of pans. Increaser II								
Enneapogon cenchroides	Nine-awned Grass	Disturbed veld in sandy and rocky soils. Increaser II grass	1	1	1	1	1	1	1	1
Enneapogon devauxii	Eight Day Grass	Mainly in shallow calcerous soils, abundant in overgrazed veld		1		1	1	1		
Enneapogon scaber	Klipgras	Rocky areas					1	1		
Eragrostis cilianensis	Stink Love Grass	Disturbed areas, usually where water accumulates			1				1	

Species	Common name	Habitat notes	*T terrestris* plains	*E lehmannianaE. cnechroides*	Artificial moist area	Rtrichotomum – E lehmanniana	S mellifera-Enneapogon veld	S. burchelii – E lehmanniana	Dry drainage lines	*V karoo* riparian woodland
Eragrostis echinochloidea	Tick Grass	Occurs mainly in disturbed areas, in shallow calcerous soils, also around pans	1	1			1			
Eragrostis lehmanniana	Lehmann's Grass	Sandy soil, mostly in disturbed land. Increaser II grass	1	1	1	1	1	1	1	
Eragrostis obtusa	Dew Grass	Disturbed areas such as road reserves and trampled veld.	1	1						1
Eragrostis porosa	Besembiese	Hot dry country, in short grassland and wooded grassland on sandy soil; also, in disturbed ground at roadsides					1	1		
Eragrostis rotifer	Pearly Love Grass	Riverbeds, next to pans or vleis, next to roads			1					
Eragrostis truncata		Dry areas		1			1	1		
Setaria verticillata	Burr Bristle Grass	Grows in disturbed /overgrazed moist areas	1	1		1	1	1	1	1
Schmidtia pappophoroides	sand quick	Sand, loam and rocky soils. Can form dense stands in sandveld				1	1	1		
Stipagrostis obtusa	Small Bushman Grass	Coarse sandy soil, indicator of good condition veld		1			1	1		
Stipagrostis uniplumis	Silky Bushman Grass	Open grassland, often in red sandy soil. Dry areas. Increaser II, palatable grass						1		
Themeda triandra	red grass	Undisturbed or disturbed open grassland. Decreaser Grass				1	1	1		

Species	Common name	Habitat notes	*T terrestris* plains	*E lehmannianaE. cnechroides*	Artificial moist area	Rtrichotomum – E lehmanniana	S mellifera-Enneapogon veld	S. burcehlii – E lehmanniana	Dry drainage lines	*V karoo* riparian woodland
Tragus berteronianus	Carrot Seed Grass	Disturbed, bare patches and compacted soils.	1	1					1	1
Minimum number of indigenous grass species = 19			**6**	**10**	**4**	**7**	**13**	**11**	**6**	**5**
Small shrubs / Forbs / succulents										
Aloe claviflora	Kanonaalwyn / Kraalaalwyn	Arid interior of SA						1		
Ammocharis coranica (P)	Groundlily	Widespread in hot, dry and flat areas.						1		
Aptosimum marlothi		Karoo veld					1			
Aptosimum lineare	Carpet Flower	Dry bushveld				1	1			
Aptosimum procumbens	Carpet Flower	Floodplains, plains and disturbed areas	1				1			
Acrotome inflata	Tumble Weed	Sandy areas		1						
Asparagus cf glaucus		Karoo veld						1		
Chrysocoma ciliata	Bitterbos	Widespread, proliferate in overgrazed areas	1	1		1	1			
Citrillus lanatus	t'samma Melon	Grassland and bushveld, usually in disturbed places, particularly cultivated lands		1		1				
Clematis brahiata	Traveller's Joy	Bushy hillsides, particularly rocky places								1
Cleome gynandra	African cabbage	Plains, roadsides	1							

Species	Common name	Habitat notes	*T terrestris* plains	*E lehmannianaE. cnechroides*	Artificial moist area	Rtrichotomum – E lehmanniana	S mellifera-Enneapogon veld	S. burcehlii – E lehmanniana	Dry drainage lines	*V karoo* riparian woodland
Cleome maculata		Grassland, often a weed of disturbed sandy places			1					
Cucumis zeyheri (M)		Grassland and bushveld				1	1			
Dicoma capensis	Karmedik	Widespread				1	1	1		
Gisekia africana var africana		Sandy plains, can occur in large patches	1	1			1			
Gnidia polycephalus	Jannuariebos	Plain, increase in trampled veld		1		1	1			
Harpagophytum procumbens subsp *procumbens (M) (P)*	Devil's Claw	Sandy and sometimes overgrazed areas						1		
Helichrysum luciliodes	Bergkerriebos	Dry, semi-desert areas				1	1	1		
Hermbstaedtia fleckii	Katstert	Open areas, often in patches		1						
Indigofera alternans	Skaap-ertjie	Widely distributed		1			1	1		
Indigofera daleoides	Sand-ertjie	Grassland, often in disturbed places	1	1						
Justicia divaricata	Wild lucerne	Woodland, often in disturbed areas and along roadsides							1	
Kleinia longiflora	Sjambokbos	Hot, dry areas, under trees					1			
Lessertia cf pauciflora									1	
Leucas capensis		Grassland / karoo veld / dry bushveld					1	1		
Lycium hirsutum	River Honey-thorn	Sandy plains under trees				1			1	1

Species	Common name	Habitat notes	*T terrestris* plains	*E lehmannianaE. cnechroides*	Artificial moist area	Rtrichotomum – E lehmanniana	S mellifera-Enneapogon veld	S. burcehlii – E lehmanniana	Dry drainage lines	*V karoo* riparian woodland
Lycium cinereum	Krie doring	Wide distribution in arid areas	1	1		1	1	1		
Monechma spartioides	Maklikbreekbos	Seasonal streams, wide range of habitats					1		1	
Osteospermum leptolobum		karoo veld				1				
Pentzia incana	Ankerkaroo	Wide distribution throughout the Karoo and encroach into dry grassland if overgrazed	1	1		1	1	1	1	
Pentzia cf calcarea										
Plinthus karooicus	Karooganna	Calcareous sand on riverbanks.							1	
Radyera urens	Wildekalbas	Flats and disturbed areas	1							
Salsola aphylla	Rivierganna	In depressions, riparian veld and sometimes in plains. Indicates saline soil. Drainage lines and river courses							1	1
Sarcostemma verminale	Cuastic Vine / Melktou	Vine in dry areas					1			
Senna italica subsp. arachoides (M)	Eland's Pea	Increases in disturbed, overgrazed areas and along roads					1	1		
Sericocoma avolans	Gras-bo-bas-onder / katstert	Drier, arid areas, resembles a grass		1						
Sesasum capense	Aprilbaadjie	Usually in disturbed areas	1	1		1	1	1	1	
Solanum cf tomentosum	Slangappel	Growing among scrub or grass on rocky lower hillsides, riverbeds or		1			1			

Species	Common name	Habitat notes	*T terrestris* plains	*E lehmannianaE. cnechroides*	Artificial moist area	Rtrichotomum – E lehmanniana	S mellifera-Enneapogon veld	S. burchelii – E lehmanniana	Dry drainage lines	*V karoo* riparian woodland
		roadsides where it thrives on disturbed sites								
Tapinanthus cf rubromarginatus	Red mistletoe / voelent	Parasitic on trees such as Acacia and Dichrostachys					1			
Tribulus terrestris	Common Devil's Thorn / Dubbeltjie	Spreading weed in disturbed places	1	1			1			
Ursinia nana		Weedy plant, often in disturbed places	1	1						
Roepera (Zygophyllum) lichtensteinianum	Skilpadbos	Flats, ridges and seasonally moist areas				1	1	1		
Minimum number of indigenous forb species recorded = 41			**11**	**15**	**1**	**13**	**22**	**13**	**8**	**3**
Alien / Invasive Species										
Achyranthes aspera (M)	Burweed	Grassland, savanna, forest margins - usually in shaded moist sites. Category 1 invader in CARA					1	1		
Argemone mexicana	Yellow-flowered Mexican Poppy	Category 1b		1						
Boerhavia diffusa	spiderling	Common on roadsides and waste places	1	1						
Dyspania (Chenopodium) carinata	Green goosefoot	Weed, particularly in vegetable crops	1							

Species	Common name	Habitat notes	*T terrestris* plains	*E lehmannianaE. cnechroides*	Artificial moist area	Rtrichotomum – E lehmanniana	S mellifera-Enneapogon veld	S. burcehlii – E lehmanniana	Dry drainage lines	*V karoo* riparian woodland
Eucalyptus camaldulensis	Red River Gum	Category 1b in riparian areas. On site these species occur within the watercourse								1
Opuntia ficus-indica	Sweet Prickly Pear	Category 1b					1 (N)			
Pinus spp.	Pines	Invaders. Category 2, transform landscape and reduce carrying capacity	1							
Salsola kalii	Russian Tumbleweed	Category 1b					1		1	
Verbesina encelioides var encelioides	Wilde Sonneblom	Naturalised,weed from S. America	1							1
Xanthium spinosum	spiny cocklebur	Category 1b	1							
Number of alien and invasive species recorded= 10			**5**	**2**	**0**	**0**	**2**	**1**	**1**	**2**
Minimum indigenous species per vegetation group			**17**	**26**	**5**	**22**	**40**	**30**	**22**	**16**

APPENDIX C: PLANTS OF CONSERVATION CONCERN (CONFIDENTIAL -NOT FOR PUBLICATION)

The species listed below have previously been recorded in the area that the proposed sites are situated in and are the most likely to occur on or around the farm. Data for sensitive species is available from SANBI and may not be published.

Specie	Conservation status (SA)	Habitat notes	Suitable habitat on site	Flowering period
Cullen biflora	Data Deficient Taxonomic problems hamper threat assessment	Possibly in Douglas area	Limit information available on habitat and the **possibility of occurrence can not be determined. However, no Cullen species were recorded.**	Spring
Hoodia officinalis	Near Threatened	Always found growing inside bushes in flattish or gently sloping areas across the Northern Cape to Griqualand West near Douglas and Kimberley.	Nama Karoo, found on low, stony ridges. This species was not recorded in walked transects and no suitable habitat was present in the areas assessed. **This species is unlikely to be present on the sites.**	Early summer and in late autumn
Lithops aucampiae subsp. *eunicea*	Vulnerable D2	Fine-grained, brown sandstone with some amygdaloidal lava. Hopetown."	This species was not recorded in walked transects and no suitable habitat was present in the areas assessed. **This species is unlikely to be present on the sites.**	Autumn
Senecio gariepiensis	Data deficient (Insufficient information)	Near the Orange River in the Northern Cape and/or Namibia.	**Not enough is known about the distribution, specific habitat or population status of this species to determine its status or potential occurrence on the site.**	Unknown
Tridentea virescens	Rare	Stony ground, or hard loam in floodplains. Prieska in the Northern Cape stretching east to Prince Albert and Aberdeen.	Suitable habitat is present for this species on the sites, particularly floodplain areas. this species would have been in flower and easily recognised, however, it was not recorded in walked transects at the time of this assessment. This plant is likely present on the farm and surrounds, however, the suitable habitat on site was historically disturbed. As the extent of the sites were not walked, it is not possible to rule out is occurrence,	Feb-March

Specie	Conservation status (SA)	Habitat notes	Suitable habitat on site	Flowering period
			however, historically disturbances in the suitable habitat renders **the possibility of occurring medium to low.** Images taken by Ilonka Cronje, https://www.ispotnature.org/communities/southern-africa/view/observation/692631/tridentea-virescens  	

APPENDIX D: SPECIALIST CV

Curriculum Vitae

Antoinette Eyssell-Knox

Personal Information Summary

Name: Antoinette Eyssell-Knox
Highest qualification: MSc Environmental Science (2010), University of Pretoria
Professional membership: SACNASP Pr Sci Nat (400019/11) Ecological Science
Company: Dimela Eco Consulting
Contact details: Antoinette@dimela-eco.co.za
Tel 083 642 6295

Professional Experience

1. Environmental Management:

I have been working in the field of environmental management as a vegetation specialist since the year 2007 (11 years). I have been self-employed since November 2011.

Nov 2011 – current: Dimela Eco Consulting
Sep 2007 – Nov 2011: Strategic Environmental Focus (SEF)

Main field of work and experience include:

- Vegetation assessments, overviews or scans;
- Strategic ecological assessments;
- Ecological management, rehabilitation- and biodiversity action plans (including alien vegetation management);
- Specialist input: Gauteng and North-West Outlook Reports, ecological conditional requirements for Green Star rating;
- Ground-truthing of vegetation related data;
- Review of ecological reports; and
- Mentoring.

2. Environmental Education:

2011 – current: Writer of the ecology feature for the bimonthly Supernova Kids Magazine
Aug 2003 – Sep 2007: Snr Environmental Education Officer, South African National Biodiversity Institute (SANBI), Pretoria National Botanical Garden

3. Horticulture

Jun – Jul 2003: Horticultural Trainer, 7 Shaft Training Centre, Johannesburg
May 1997 – Mar 2002 Horticulturist, Pretoria National Botanical Garden (then NBI, now SANBI)

Qualifications

- M.Sc Environmental Science, University of Pretoria (2010)

Dissertation: *Land cover change and its effect on future land uses*

- B. Sc (Hons) Horticulture, University of Pretoria (1999-2000)

Dissertation: *Horticultural uses of the indigenous Barleria species*

- B. Sc (Agriculture) Horticulture, University of Pretoria (1993-1996)

Memberships and Affiliations

SACNASP: Registered as a Professional Natural Scientist in the field of ecology since 2011 (Reg no 400019/11)

Botsoc: Member of the Botanical Society of Southern Africa since 2013

Course History

2018: Asteraceae Identification Course

2015: SAGIC Invasive Species Consultant Training

2012: Tools for Wetland Assessment (Rhodes University – September 2012)

2012: Landscape Functional Assessment, introductory workshop with David Tongway and Prof Klaus Kellner (North West University)

2012: Soil Classification and Wetland Delineation (Terra Soil)

2007: ISO 14000 Advanced EMS Auditors Course (SGS & University of Pretoria)

2007: Introduction into Forestry Stewardship Council (FSC) (University of Pretoria)

2006: Permaculture training course (S.E.E.D)

2005: Project Management Course (Wildlife and Environment Society of South Africa (WESSA) Umgeni Valley)

2004: Grass and plant identification courses

Presentations

July 2007: Environmental Education in a changing world, World Environmental Education Conference (WEEC), Durban

Sept2006: Environmental Education, BGCI Conference, Oxford England

Selected Project Experience (2011 onwards)

1. <u>Provincial Environmental Outlook Reports</u>

2017-2018: Vegetation input: Gauteng Outlook Report

in process: Vegetation input: North-West Outlook Report

2. <u>Open Space Planning</u>

Nov 2015: The proposed Kaalspruit Open Space Project, Thembisa, Gauteng. Kaalspruit River Rehabilitation Biodiversity Scan: (NuLeaf Planning and Environmental)

2015-2016: City of Johannesburg Open Space Planning – vegetation input for Linbro Park, Bassonia, Kyalami and Ruimsig areas (Iggdrasil)

3. Management- and Rehabilitation Plans

April-May 2012: Vegetation base line study and input into Biodiversity Action Plan for Kumba Iron Ore (Lidwala Consulting Engineers)

Jan 2015: Environmental Management Plan for the Krugersdorp Nature Reserve – vegetation section

Jan 2016: Tharisa Mine Railway Line – Vegetation rehabilitation plan (Limosella Consulting)

Sept 2016: General vegetation rehabilitation plan for the proposed Mezo Kitchens Panel Processing Facility (Shangoni)

Nov 2016: General Ecological Rehabilitation and Monitoring Plan for the N4 additional lane between: R52 Koster offramp & D1325 Marikana Interchange; and The R512 (Brits West Interchange) & K67 (Ga-Rankuwa Interchange) North West and Gauteng Provinces

Nov 2016: Biodiversity Management Plan: Afrisam (Sa) (Pty) Ltd, Dudfield Cement – vegetation input

June 2017: Rehabilitation planning for the Klip- Lower and Upper Rietspruit Water Management Units (Pregio, via Limosella Consulting)

Dec 2017: Eskom underground cable river crossings – vegetation input into rehabilitation plants (Envirolution)

4. Linear Infrastructure

March 2012: Kranspoort road upgrade Protected tree identification (Lidwala Consulting Engineers)

Oct 2012: Eskom: Perseus to Gamma Vegetation assessment (Mokgope Consulting)

March 2013: Diepsloot Eskom line and substation, Johannesburg (Envirolution)

Nov 2013: Masa Ngwedi 750kV and 400kV lines (Limpopo & North-West Provinces) Section D & E Vegetation Input for EMP (Mandara Consulting)

2013-2014 Eskom: Northern Alignments (Perseus in the Northern Cape to Juno in the Western Cape) (Mokgope Consulting)

Feb 2014: Meteor substation, as well as the 88kV line between the Pulsar, Meteor and Sonland substations, Sebokeng, (Nsovo Environmental Consulting)

Dec2014: Upgrading of Internal Roads in Stinkwater, Hammanskraal (Gauteng) (GladAfrica)

Sept 2015: Railway Siding for GCMC Open Cast Mine, Lephalale (Limpopo)

Feb 2016: N4 - Additional lane between Brits and Rustenburg (Environamic)

Nov 2016: Aggeneis-Paulputs 400kV Powerline and Substations Upgrades

Feb 2017: Proposed Lulamisa to Diepsloot East to Blue Hills to Crowthorne 88kv Power Line / Cable and 2 Substations Gauteng (Envirolution)

May 2017: Proposed 132 kV Powerline Between Fochville Municipal Substation and an Existing Line, Gauteng Province (Envirolution)

5. Solar Developments

January 2012: Schmidsdrift, Northern Cape Vegetation Assessment for Solar Panels (Nuleaf)

Aug 2015: Proposed Construction of A 75mw Solar Energy Facility Project, Limpopo Tshikovha Environmental and Communication Consulting

6. Mining

April 2012:	Rietfontein Open Cast Vegetation assessment (Cabanga Concepts)
Jan 2013:	Vierfontein Colliery Vegetation assessment and EMP input (Cabanga Concepts)
Jan 2017:	G&W Base and Industrial Minerals Koppies Betonite Mine Vegetation Assessment & Management Input Report (Cabanga Concepts)

7. Other Development

Dec 2013:	Marekele Bush camp – vegetation & fauna assessments (NuLeaf)
May 2013:	Komati Power Station – Coal stockyard (Envirolution)
April 2014:	Blesboklaagte & Leeupoort Township development (Shangoni)
May 2014:	Goldi Farm Composting Site, Section 24G Fauna and Flora assessment and Summary document (Shangoni)
Feb 2015:	TOPIGS: Proposed Piggery,Mpumalanga(Shangoni)
May 2015:	Kwaggasrant Recycling Facility Upgrade (Shangoni)
Oct 2016:	Proposed piggery on portion 139 of the farm Honingnestkrans 269JR Vegetation and Fauna investigation (Methale Environmental Consulting)
Oct 2017:	Ongoing Clinic Development & Proposed Emergency Medical Services Facility on Prt 79 of the farm De Wagendrift 417 JR Gauteng Province. (Methale Environmental Consultants)

8. Plant relocation and monitoring

April 2014:	Relocation of *C bulbipermum,* overlooked Colliery in Mpumalanga (Cabanga Concepts)
Feb 2017:	Monitoring report for the relocated *Crinum bulbispermum* at Overlooked Colliery
May 2017:	Relocation of protected plant species: Evander Mine

9. International:

Oct 2009:	Tatu, Nairobi: Vegetation Assessment (Kenya) (Lokisa Environmental Consulting)
Sept 2014:	Vegetation input to the Regional Environmental and Social Assessment of Coal-based Energy Projects along the South Africa- Botswana Border (World bank Project, Mott MacDonald)

10. Mentorship:

May 2017:	Technical Peer Review of the vegetation section for the Emfuleni Bulk Water Supply Pipelines: Ecological Assessment. GIBB Engineering & Architecture (Pty) Ltd
Nov 2017:	Mentorship and Technical Peer Review of the vegetation section for the Merensky-Kennedy Powerline: vegetation assessment GIBB Engineering & Architecture (Pty) Ltd

Phase 1 Heritage Impact Assessment for establishment of new agricultural pivots on the farm Zwemkuil 37, Prieska, NC Province.

Report prepared by
Paleo Field Services
PO Box 38806
Langenhovenpark
9330

May 2022

Summary

A Phase 1 Heritage Impact Assessment was carried out for a proposed new agricultural development of sixteen individual areas, covering 448 ha in total, on the farm Zwemkuil 37 near Prieska in the Northern Cape Province. The proposed developments will largely impact geologically recent and well-developed superficial overburden. Surface limestones and geologically recent aeolian sand overburden in the region are generally not considered to be fossiliferous in the absence of intact (Neogene) terrace gravels, pans, springs, and pre-Holocene alluvial exposures. Areas 1, 4, 10, 11, 12 and part of 5 have been degraded by previous agricultural activities. The farm is located within a wider region that has previously yielded ample archaeological evidence of prehistoric human occupation, but visible evidence of Stone Age/Prehistoric presence at two out of 16 areas is considered minor in terms of overall impact. A low-density, *ex situ* stone tool component observed in Areas 5 and 8 has been mapped and recorded. All the areas are assigned an archaeological site rating of Generally Protected C (Low significance), but it is noted that the potential occurrence of isolated and unmarked graves, subsurface burial cairns or intact subsurface archaeological finds not observed during this survey can never be excluded. Therefore, it is advised that the relevant heritage authority (SAHRA) and a qualified archaeologist be informed immediately in the event of potential archaeological exposure during the construction phase of the proposed project (protocol for finds included).

Contents

Introduction

A Phase 1 Heritage Impact Assessment was carried out for a proposed new agricultural development on the farm Zwemkuil 37 near Prieska in the Northern Cape Province (**Fig 1**). The region's unique and non-renewable archaeological and palaeontological heritage sites are 'Generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. As many such heritage sites are threatened daily by development, both the environmental and heritage legislation require impact assessment reports that identify all heritage resources including archaeological and palaeontological sites in the area to be developed, and that make recommendations for protection or mitigation of the impact of the sites. Archaeological Impact Assessments (AIAs) and Palaeontological Impact Assessments (PIAs), or overarching Heritage Impact Assessments (HIAs) are most often specialist reports that form part of the wider heritage component of Environmental Impact Assessments (EIAs) required in terms of the National Environmental Management Act or of the Environment Conservation Act by the provincial Department of Environment Affairs; or Environmental Management Plans (EMPs) required by the Department of Minerals and Energy.

Legislative framework

The primary legal trigger for identifying when heritage specialist involvement is required in the Environmental Impact Assessment process is the National Heritage Resources (NHR) Act (Act No 25 of 1999). The NHR Act requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures over 60 years of age, living heritage and the collection of oral histories, historical settlements, landscapes, geological sites, palaeontological sites and objects.

The Act identifies what is defined as a heritage resource, the criteria for establishing its significance and lists specific activities for which a heritage specialist study may be required. In this regard, categories of development listed in Section 38 (1) of the NHR Act are:

- The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

- The construction of a bridge or similar structure exceeding 50m in length;
- Any development or other activity which will change the character of the site;
- Exceeding 5000 m² in extent;
- Involving three or more existing erven or subdivisions thereof;
- Involving three or more subdivisions thereof which have been consolidated within the past five years;
- Costs of which will exceed a sum set in terms of regulations by the South African Heritage Resources Agency (SAHRA).
- The rezoning of a site exceeding 10 000 m².
- Any other category of development provided for in regulations by the South African Heritage Resources Agency (SAHRA).

If a heritage resource is likely to be impacted by a development listed in Section 38 (1) of the NHR Act, a heritage assessment will be required either as a separate HIA or as the heritage specialist component (AIA or PIA) of an EIA.

The significance or sensitivity of heritage resources within a particular area or region can inform the EIA process on potential impacts and whether or not the expertise of a heritage specialist is required. A range of contexts can be identified which typically have high or potential cultural significance and which would require some form of heritage specialist involvement. This may include formally protected heritage sites or unprotected, but potentially significant sites or landscapes. The involvement of the heritage specialist in such a process is usually necessary when a proposed development may affect a heritage resource, whether it is formally protected or unprotected, known or unknown. In many cases, the nature and degree of heritage significance is largely unknown pending further investigation (e.g. capped sites, assemblages or subsurface fossil remains). On the other hand, it is also possible that a site may contain heritage resources (e.g. structures older than 60 years), with little or no conservation value. In most cases it will be necessary to engage the professional opinion of a heritage specialist in determining whether or not further heritage specialist input in an EIA process is required.

Methodology

The significance of the affected area was evaluated on the basis of existing field data, database information and published literature. This was followed by a field assessment

(site visit) of the affected area. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes. Relevant archaeological and palaeontological information, maps, Google Earth images and site records were consulted and integrated with data acquired during the on-site inspection.

The task also involved identification and assessment of possible palaeontological and archaeological heritage with the following terms of reference:

- Identify and map possible heritage sites and occurrences using available resources.
- Determine and assess the potential impacts of the proposed development on potential heritage resources;
- Recommend mitigation measures to minimize potential impacts associated with the proposed development.

Potential impacts on heritage resources are summarized in **Table 1** and site significance classification standards, as prescribed by SAHRA, were used for the purpose of this evaluation (**Table 2**).

Locality Data

1 : 50 000 scale topographic map 2922DB Prieska Oos

1 : 250 000 scale geological map 2922 Prieska

Sixteen individual areas, covering 448 ha in total, have been identified for development on the farm Zwemkuil 37, which is located between the Orange River and the R357 provincial road and about 80 km northeast of Prieska in the Northern Cape Province (**Fig. 2 - 14**).

Individual GPS coordinates of the survey areas (**Fig. 2**):

Area 1a) 29°25'6.36"S 23° 1'17.56"E
Area 1b) 29°25'14.48"S 23° 1'32.24"E
Area 2) 29°25'26.88"S 23° 3'15.46"E
Area 3) 29°25'23.40"S 23° 4'10.13"E
Area 4) 29°25'37.34"S 23° 5'31.40"E
Area 5) 29°25'49.39"S 23° 5'51.67"E
Area 6a) 29°25'47.90"S 23° 5'4.50"E
Area 6b) 29°25'47.83"S 23° 5'19.73"E
Area 7) 29°25'48.48"S 23° 4'31.27"E
Area 8) 29°25'50.14"S 23° 2'45.50"E

Area 9a) 29°25'36.41"S 23° 2'13.75"E
Area 9b) 29°25'48.61"S 23° 2'22.98"E
Area 9c) 29°25'58.66"S 23° 2'18.27"E
Area 10) 29°26'15.00"S 23° 2'18.84"E
Area 11) 29°26'20.35"S 23° 2'46.49"E
Area 12) 29°26'40.20"S 23° 2'46.21"E
Area 13) 29°26'49.01"S 23° 2'56.25"E
Area 14) 29°26'39.66"S 23° 3'15.76"E
Area 15) 29°26'10.53"S 23° 3'4.04"E
Area 16) 29°27'13.09"S 23° 2'56.24"E

Background

Geology

According to the 1: 250 000 scale geological map 2922 Prieska, the study area is underlain by glacially-related sediments of the Mbizane Formation (Dwyka Group, *C-Pd*), a largely heterolithic unit recognized in the upper part of the Dwyka Group of the Karoo Supergroup (Von Brunn & Visser 1999; Johnson et al. 2006) (**Fig 15**). The mudstone and sandstone successions, tillites and conglomerates of the Mbizane Formation represents valley and inlet fill deposits that were laid down when Dwyka glaciers scoured out valleys and depressions in pre-Karoo rocks during the Permo-Carboniferous, *c*. 300 Ma years ago. Small, isolated exposures of early Vaalian oolitic and stromatolitic platform carbonates are located to the northeast and well outside the boundary of the proposed development footprint (Beukes 1979). Superficial deposits are primarily represented by late Tertiary surface limestones (T-Qc), windblown Kalahari Group sand (Qs), surface gravels and alluvium.

Palaeontology

Potential occurrences: Ichnofossil assemblages and plant fossils associated with Dwyka Group sediments; Late Neogene vertebrate fossils associated with intact river terrace gravels; Quaternary vertebrate fossils associated with Pleistocene alluvial deposits.

The Mbizane Formation is not considered to be highly fosilliferous, 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 mudrock facies (Almond and Pether 2008) (**Fig 16**). The

Middle and Lower Gariep basin cuts through a series of post-Karoo fluvial remnants. To the west of Prieska the landscape is dissected by the ancient Koa Valley, a Miocene relic with remnants of Cenozoic fluvial deposits that has produced fossil vertebrate bone as well as fossil wood. Southwards, the Koa Valley joins an extensive system of pans fossil where several Palaeogene and Neogene vertebrate fossil remains have been identified. No fossils have been explicitly reported from the late Neogene river terraces between Douglas and Prieska yet, but a variety of fossil fauna have been retrieved from gravel terraces along the Lower Vaal River basin (Cooke 1949). Here, gravel terraces between 21m and 30m above present river level, contain frequent sandy lenses and have yielded vertebrate fauna such as the extinct proboscidian, *Mammuthus subplanifrons* that are estimated to be ranging in age from 4.5 to 3.5 million years old. Other fossil remains include extinct suids and more proboscidian taxa, notably *Elephas iolensis (*Maglio, and Cooke 1978). Except for a few bovid horn core remains found in limestone quarries, there are no records of Quaternary fossils from the immediate vicinity of Prieska. A fossilized horn core of an extinct alcelaphine was found along the Ongers River near Britstown, while Florisian type faunal remains have been excavated from an archaeological site at Bundu Farm Pan near Copperton (Brink *et al*. 1995; Kiberd 2006).

Archaeology

Potential occurrences: Intact Stone Age open sites; burial cairns, unmarked graves, pastoralist kraals, rock art.

The archaeological footprint in the region are primarily represented by Stone Age archaeology, rock art localities, structural remnants dating back to the Anglo Boer War and its aftermath, as well as graveyards and other historical structures dating more than 60 years ago. The Stone Age archaeological footprint in the region is represented by Early, Middle and Later Stone Age sites associated with pans and alluvial contexts (see **Fig. 17**), while the landscape in general is characterized by low-density surface scatters (Beaumont et al. 1995; Kiberd 2006). Rock engravings have been recorded in the younger valley fills along the steeper slopes located near the eastern and south-eastern margins of the Asbesberge north of Prieska (van Riet Low 1949). In addition, rock art sites have been recorded on a number of farms around Prieska, including Kleindoring, Wonderdraai and Omdraaisvlei. Historical ruins and graveyards associated with the asbestos mining industry during the first half of the 20th century are located at various

localities north and south of Prieska. Further away, prehistoric graves and clay pottery have been recorded along the Orange River south of Douglas. Before the town of Prieska was founded 1882, early travellers frequently encountered Koranna and Bushmen groups in the region (Burchell 1824; Raper 1987; Skead 2009). The principal Khoikhoi inhabitants of the Middle Orange River were the Einiqua who belonged to the same language group as the Namaqua and Korana, namely the Orange River Khoikhoi (Penn 2005). The Einiqua occupied the area around and east of the Augrabies Falls while the Korana occupied the Middle-Upper Orange River further to the east towards Prieska (**Fig. 18**). A large number of burial cairns were excavated near the Orange River in the Kakamas area and appear to be related to Korana herders (Morris 1991, 1995). It is noted that while Bushmanland sites in the surrounding area appear to be ephemeral occupations by small hunter-gatherer groups, substantial herder encampments found along the Orange River itself indicate that the banks and floodplains of the river were more intensely exploited (Morris & Beaumont 1991). Hinterland sites are mainly restricted rock shelters near mountainous terrain sand dune deposits, or around seasonal pans and springs (Beaumont et al. 1995). No Iron Age sites are expected to be found in this area as it falls outside the southwestern periphery of distribution of Iron Age settlement in the region (Humphreys 1976, **Fig. 18**).

Field Assessment

The affected areas are generally located on superficial deposits resting on 40-60 m river terrace gravels (Neogene Period) and Mbizane Formation conglomerates (Palaeozoic Era).

Areas 1 – 4, 6 & 7

The study areas are capped by a geologically recent ~15 m alluvial overburden, as well as occasional pockets of well - developed Quaternary sand (*Qs*) (**Fig. 19**). No fossils or potential fossil exposures were observed within superficial sediments. There is 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 footprints. 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 sites.

Areas 5, 8, 9, 14 & 15

The study areas are capped by bedrock – derived surface gravels, surface limestones / reworked calcretes (*T-Qc*), and well - developed Quaternary sand deposits (*Qs*), abutting 60 m Neogene terrace. No fossils or potential fossil exposures were observed within superficial sediments. Low density scatters of locally derived and mostly weathered stone tools are found scattered in Area 5 (GPS coordinates 29°25'55.01"S 23° 5'47.56"E) and Area 8 (GPS coordinates 29°25'50.92"S 23° 2'47.21"E) (**Fig. 20 & 21**). However, there is no evidence of *in situ* Stone Age archaeological material, either as capped assemblages or distributed as surface scatters on the landscape. 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 sites.

Areas 10 – 12 & 16

The study areas are capped by well - developed Quaternary sand deposits (*Qs*). No fossils or potential fossil exposures were observed within superficial sediments. There is 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 footprints. 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 sites

Impact Statement and Recommendation

The proposed pivot developments will largely impact geologically recent and well-developed superficial overburden. Surface limestones (*T-Qc*) and geologically recent aeolian sand overburden (Qs) in the region are generally not considered to be fossiliferous in the absence of intact (Neogene) terrace gravels, pans, springs, and pre-Holocene alluvial exposures. Areas 1, 4, 10, 11, 12 and part of 5 have been degraded by previous agricultural activities. The farm is located within a wider region that has previously yielded ample archaeological evidence of prehistoric human occupation (Humphreys 1982; Beaumont & Vogel 1995). However, visible evidence of Stone Age/Prehistoric presence at two out of 16 areas is considered minor in terms of overall impact. The low-density, *ex situ* stone tool component observed in Areas 5 and 8 has been mapped and recorded. All the areas are assigned an archaeological site rating of Generally Protected C (Low significance, **Table 2**), but it is noted that the potential

occurrence of isolated and unmarked graves, subsurface burial cairns or intact subsurface archaeological finds not recorded during this survey can never be excluded. Therefore, it is advised that the relevant heritage authority (SAHRA) and a qualified archaeologist be informed immediately in the event of potential archaeological exposure during the construction phase of the proposed project.

Archaeological Chance Finds Protocol for Developer

Any subsurface evidence of archaeological sites or remains (e.g. stone tool artifacts, bone or ostrich eggshell fragments, charcoal and ash heaps, or remnants of stone-made structures or unmarked graves) found during construction phase of development, must be reported to the SAHRA APM Unit (Tel. 021 462 5402).

- In the meantime, *potential archaeological structures such as stone-build enclosures, buildings or graves* must be avoided by a no-go buffer zone until further confirmation by the archaeologist. Smaller *in situ* material must be kept in place and protected from further damage by covering it with light but rigid object like a box, bucket or metal sheet.
- If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit must be alerted immediately. A professional archaeologist must be contracted as soon as possible to inspect the findings.
- If newly discovered heritage resources prove to be of archaeological significance, a Phase 2 rescue operation may be required, subject to permits issued by SAHRA

References

Almond, J.E. & Pether, J. 2008. *Palaeontological heritage of the Northern Cap*e. Interim SAHRA technical report, 124 pp. Natura Viva cc, Cape Town.

Brink, J.S., de Bruiyn, H., Rademeyer, L.B. and van der Westhuizen, W.A. 1995. A new *Megalotragus priscus* (Alcelaphini, Bovidae) from the central Karoo, South Africa. *Palaeontologia africana* 32: 17-22

Beaumont, P.B., Smith, A.B. & Vogel, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. In: Smith, A.B. (ed.) Einiqualand: studies of the Orange River frontier: 236-264. Cape Town: University of Cape Town Press.

Beukes, N.J. 1979. Litostratigrafiese onderverdeling van die Schmidtsdrif-Subgroep van die Ghaap Groep in Noord Kaapland. *Transactions of the Royal Society of South Africa* 82: 313 – 327.

Burchell W.J. 1824. *Travels in the interior of southern Africa*. Vol II. Longman and Green. London.

Cole, D.I. and McLachlan, I.R. 1994. Oil shale potential and depositional environment of the Whitehill Formation in the main Karoo Basin. *Report Geol. Surv. S. Afr*. 1994-0213.

Cooke, H.B.S. 1949. Fossil mammals of the Vaal River deposits. Geological Survey of South Africa Memoir 35: 1 – 109.

Humphreys, A.J.B. 1976 Note on the Southern Limits of Iron Age Settlement in the Northern Cape. *South African Archaeological Bulletin*, Vol. 31 (121/122): 54-57.

Humphreys, A.J.B. 1982. Cultural Material from Burials on the Farm St. Clair, Douglas Area, Northern Cape. *South African Archaeological Bulletin*, 37 (136) 68-70.

Johnson M.R. et al 2006. Sedimentary rocks of the Karoo Supergroup. **In**: Johnson, M.R, Anhaeusser, C.R. and Thomas, R.J. (Eds.) *The geology of South Africa*, pp. 461 - 500. Geological Society of South Africa, Johannesburg & the Council for Geoscience, Pretoria.

Kiberd, P. 2006. Bundu Farm: a report on archaeological and palaeoenvironmental assemblages from a pan site in Bushmanland, Northern Cape, South Africa. *South African Archaeological Bulletin* 61: 189-201.

Maglio, V.J. and Cooke, H.B.S. 1978. Evolution of African Mammals. Cambridge, Mass. Harvard University Press.

Morris, D. & Beaumont, P.B. 1991. !Nawabdanas: archaeological sites at Renosterkop, Kakamas District, Northern Cape. *South African Archaeological Bulletin* 46:115-124.

Morris, A.G. 1995. The Einiqua: an analysis of the Kakamas skeletons. In: Smith, A.B. (ed.) *Einiqualand: studies of the Orange River frontier*. pp. 110 - 164. Cape Town: University of Cape Town Press.

Partridge, T.C. & Maud, R.R. 2000. *The Cenozoic of Southern Africa*. Oxford Monographs on Geology and Geophysics No. 40.

Penn, N. 2005. *The Forgotten Frontier: Colonist and Khoisan on the Cape's Northern Frontier in the 18th Century.* Athens, Ohio and Cape Town: Ohio University Press and Double Storey Books.

Smith, R. M. H. 1988. Palaeoenvironmental reconstruction of a Cretaceous crater-lake deposit in Bushmanland, South Africa. *Palaeoecology of Africa and Surrounding Islands* 19:27–41.

Visser, J.N.J., Loock, J.C. *et al*. 1977-78. The Dwyka Formation and Ecca Group, Karoo sequence in the northern Karoo Basin, Kimberley-Britstown area. *Annals of the Geographical Survey of South Africa* 12: 143 – 176.

Von Brunn, V. & Visser, J.N.J. 1999. Lithostratigraphy of the Mbizane Formation (Dwyka group). *South African Committee for Stratigraphy, Lithostratigraphic Series No. 32*, 10 pp. Council for Geoscience, Pretoria.

DECLARATION OF INDEPENDENCE

Paleo Field Services act as an independent specialist consultant and do not or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference. Paleo Field Services has no interest in secondary or downstream developments as a result of the authorization of this project.

Tables and Figures

Table 1. Summary of impacts within the proposed study area.

Impact	Extent of Development	Duration	Probability of impact	Confidence	Mitigation	Rating
Impact of proposed development on palaeontological heritage	Local	Permanent	Low; Sterile superficial deposits (T-Qc, Qs, allivium)	High	Phase 1 Evaluation	C (GP.C)
Impact of proposed development on archaeological heritage	Local	Permanent	Low: No *aboveground* evidence of *in situ* archaeological features, graves or structures older than 60 years	High	Phase 1 Evaluation	C (GP.C)

Table 2. Field rating categories as prescribed by SAHRA.

Field Rating	**Grade**	**Significance**	**Mitigation**
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP.A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

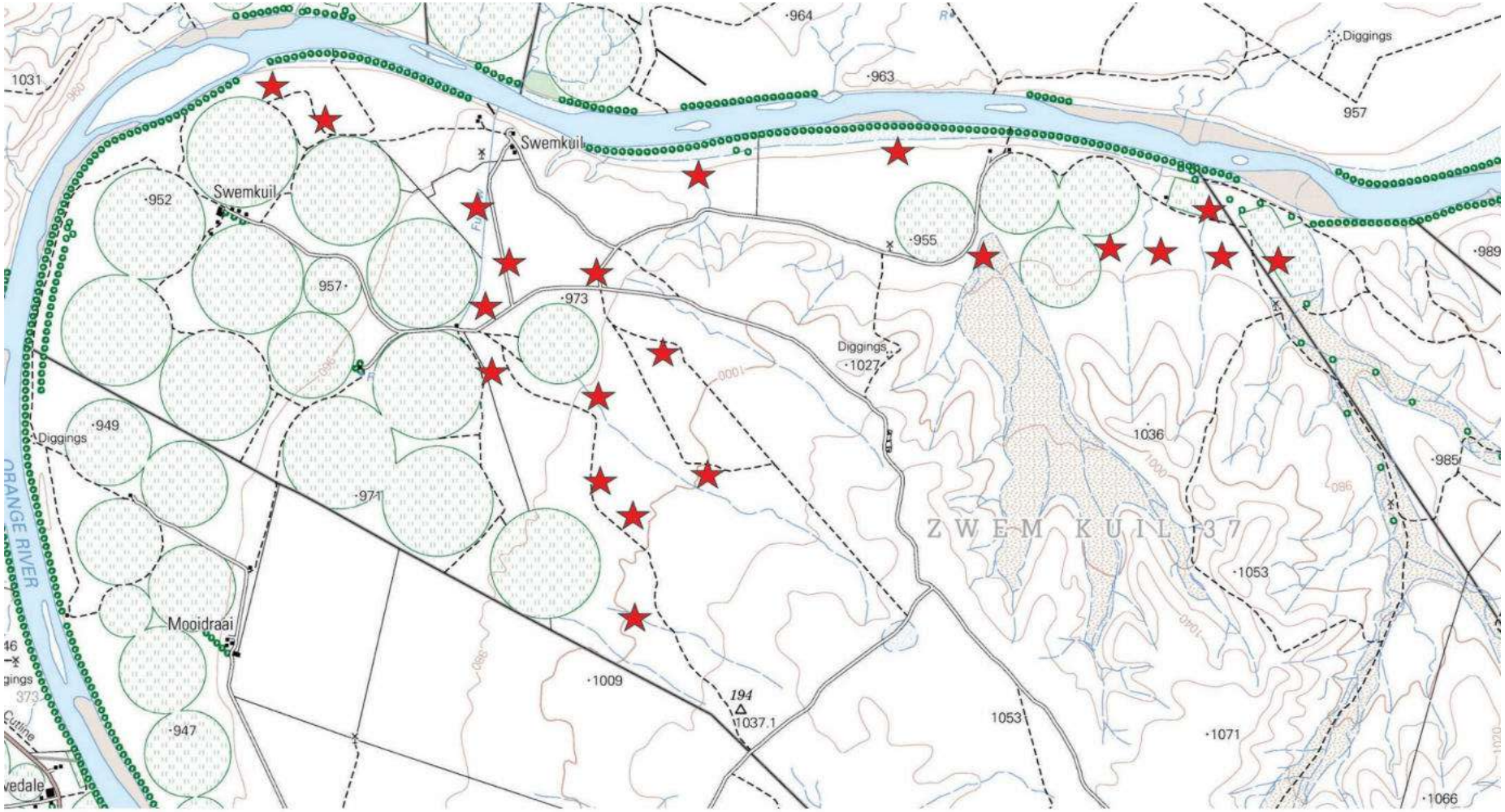


Figure 1. Map of the proposed agricultural developments (stars) on farm Zwemkiul (portion of 1:50 000 topographic map 2923AC Nuwejaarskraal)

Figure 2. Aerial view of proposed development footprints.

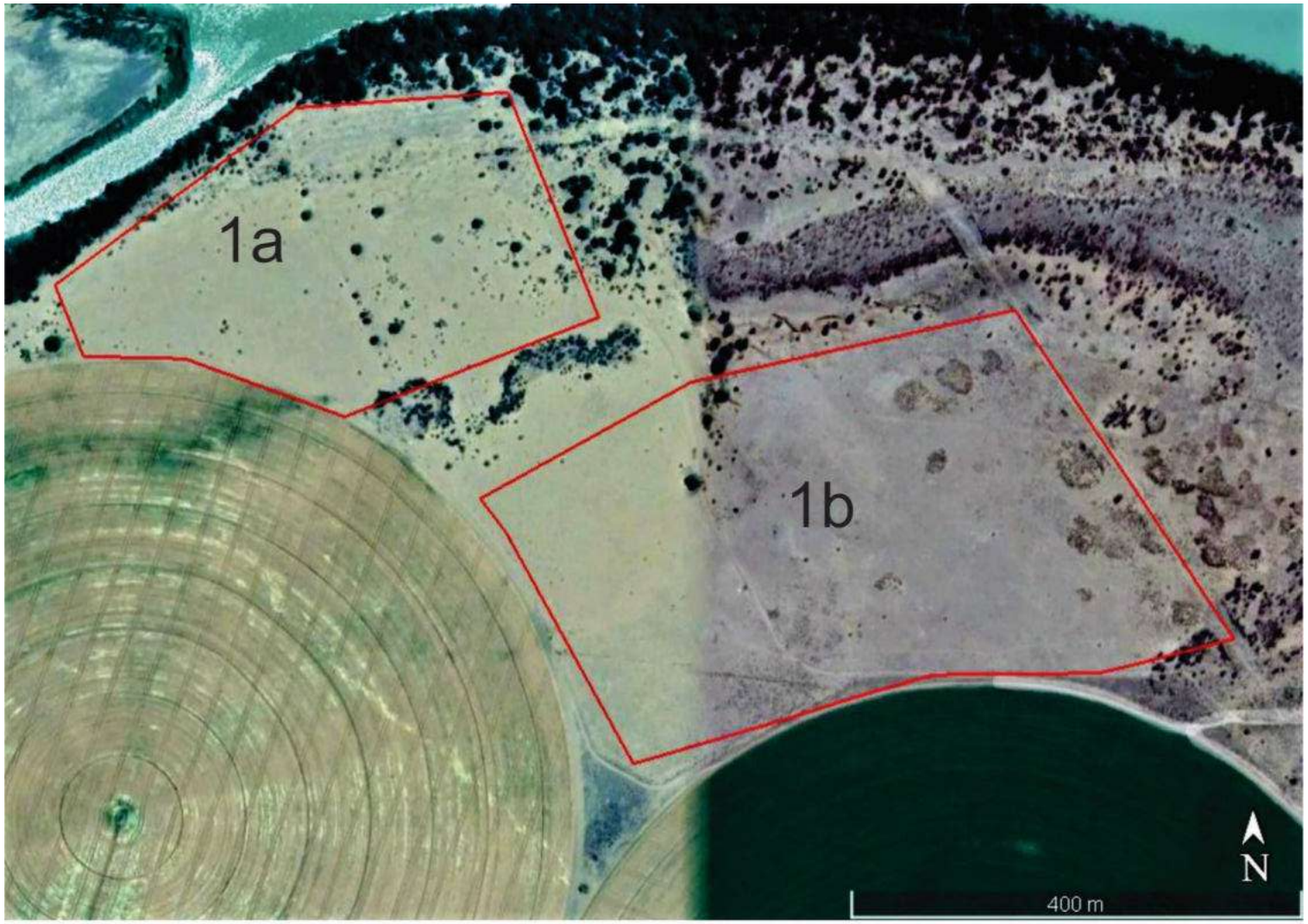


Figure 3. Layout of Area 1.

Figure 4. General view of Area 1a, looking west, north & east (top & center) and 1b, looking west (bottom).

Figure 5. Layout of Areas 2, 3 & 7

Figure 6. General view of Area 2, looking north (above left) Area 3, looking northeast (above right) and Area 7, looking south (below left) and north (below right).

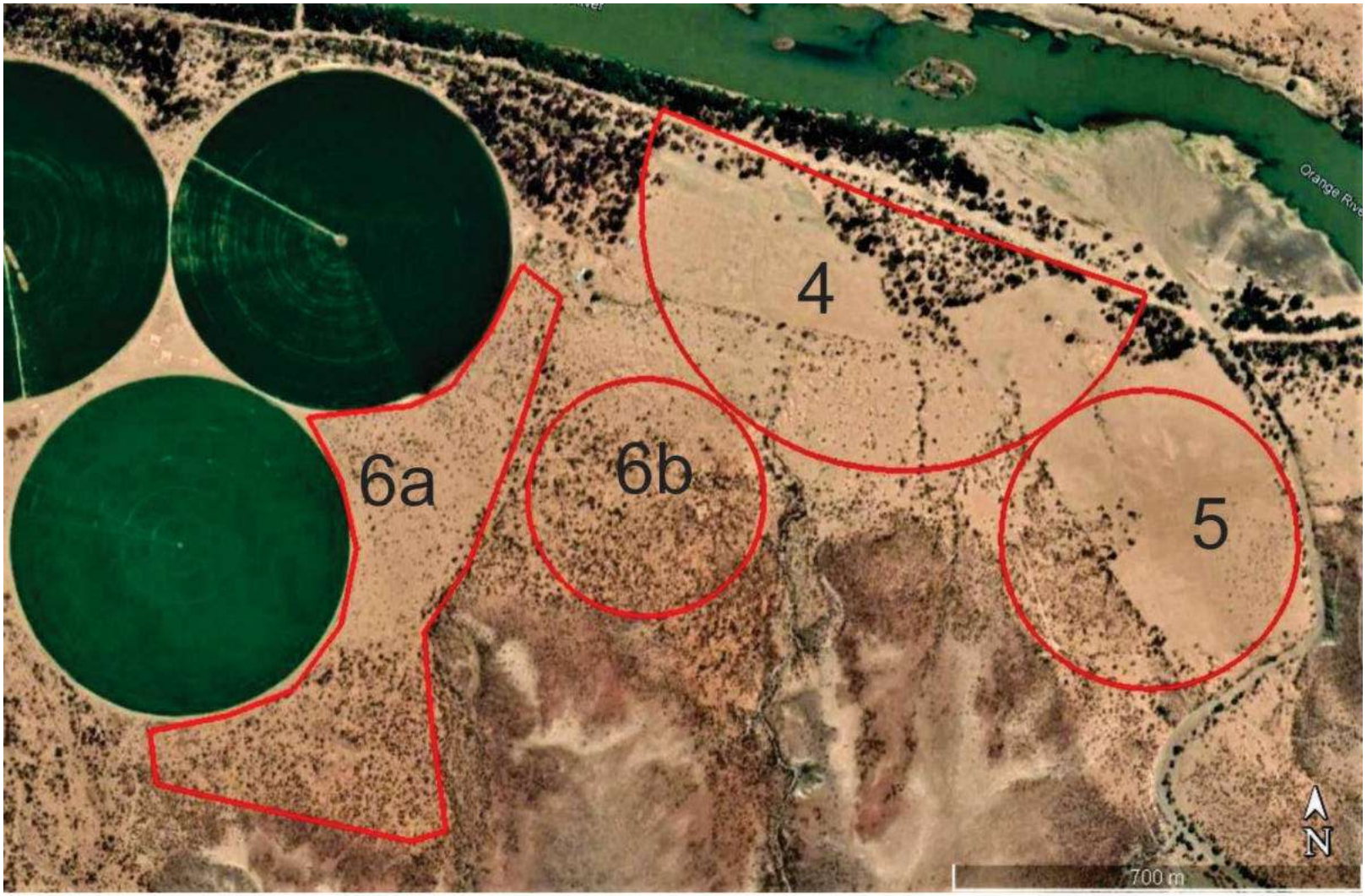


Figure 7. Layout of Areas 6, 5 & 6.

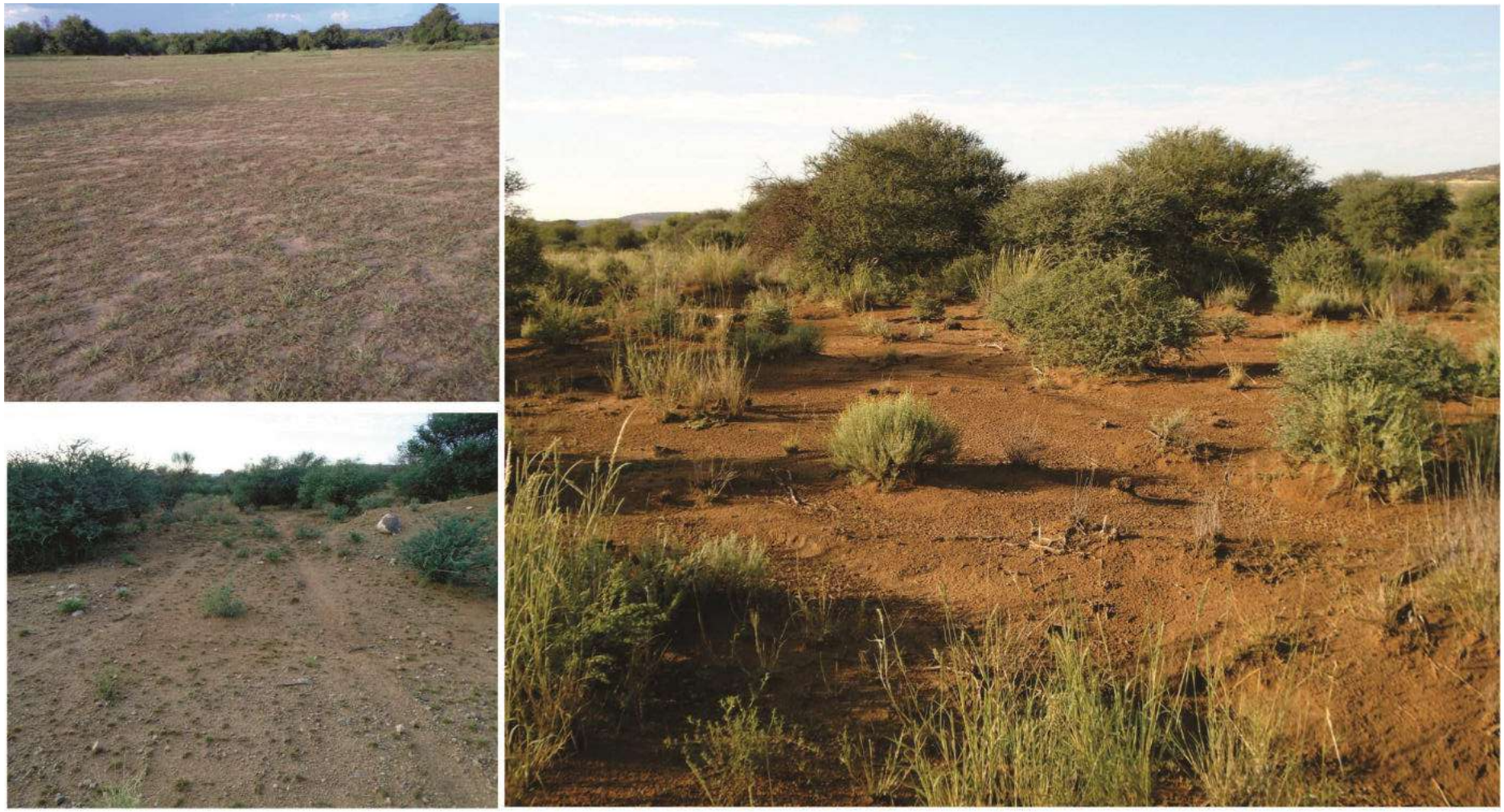


Figure 8. General view of Area 4, looking northeast (above left), Area 5, looking south (below left) and Area 6b, looking east (right).

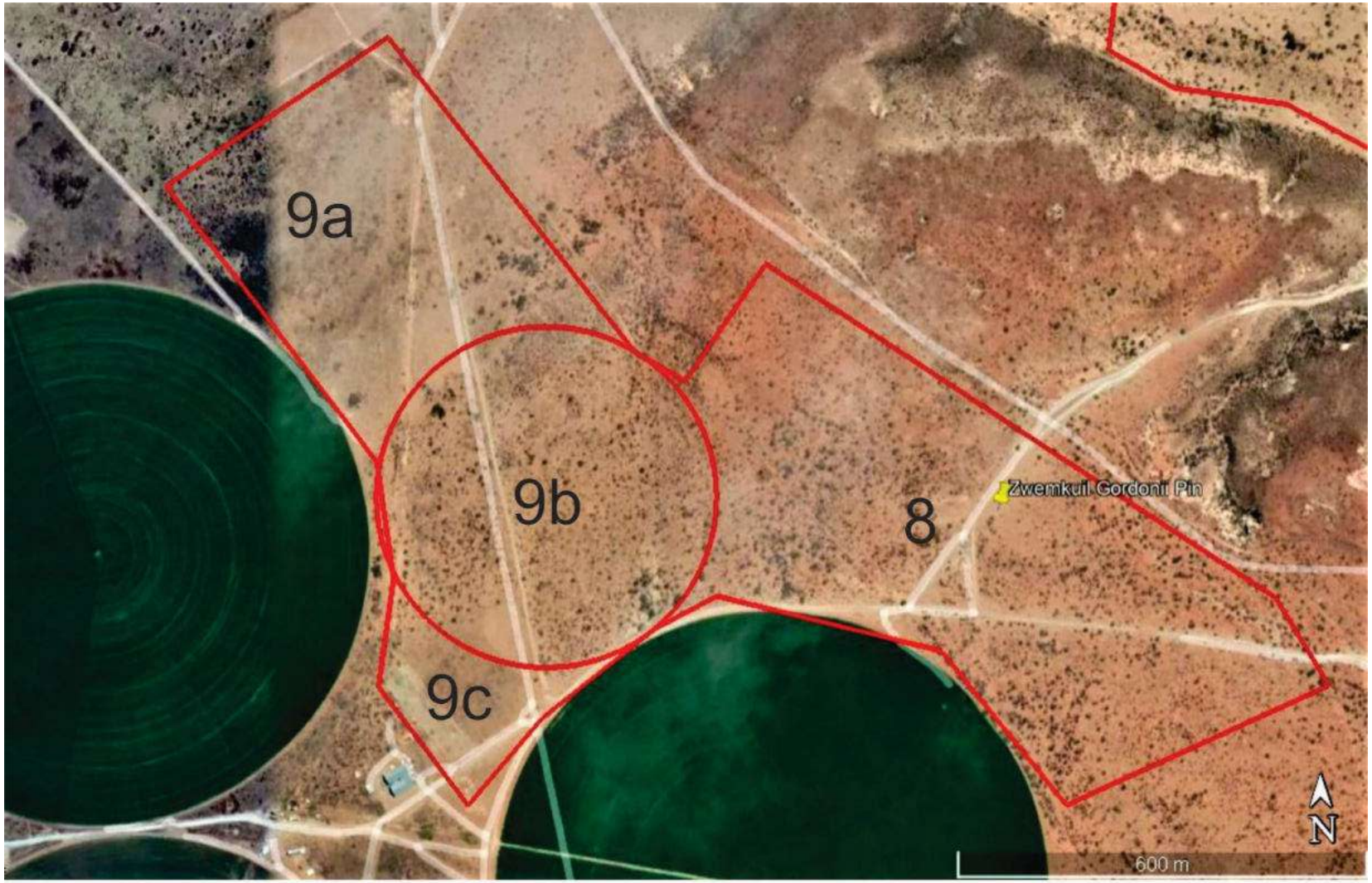


Figure 9. Layout of Areas 8 & 9.

Figure 10. General view of Area 8, looking east & west (above) and Area 9, looking west & south (below).
Scale 1 = 10 cm.

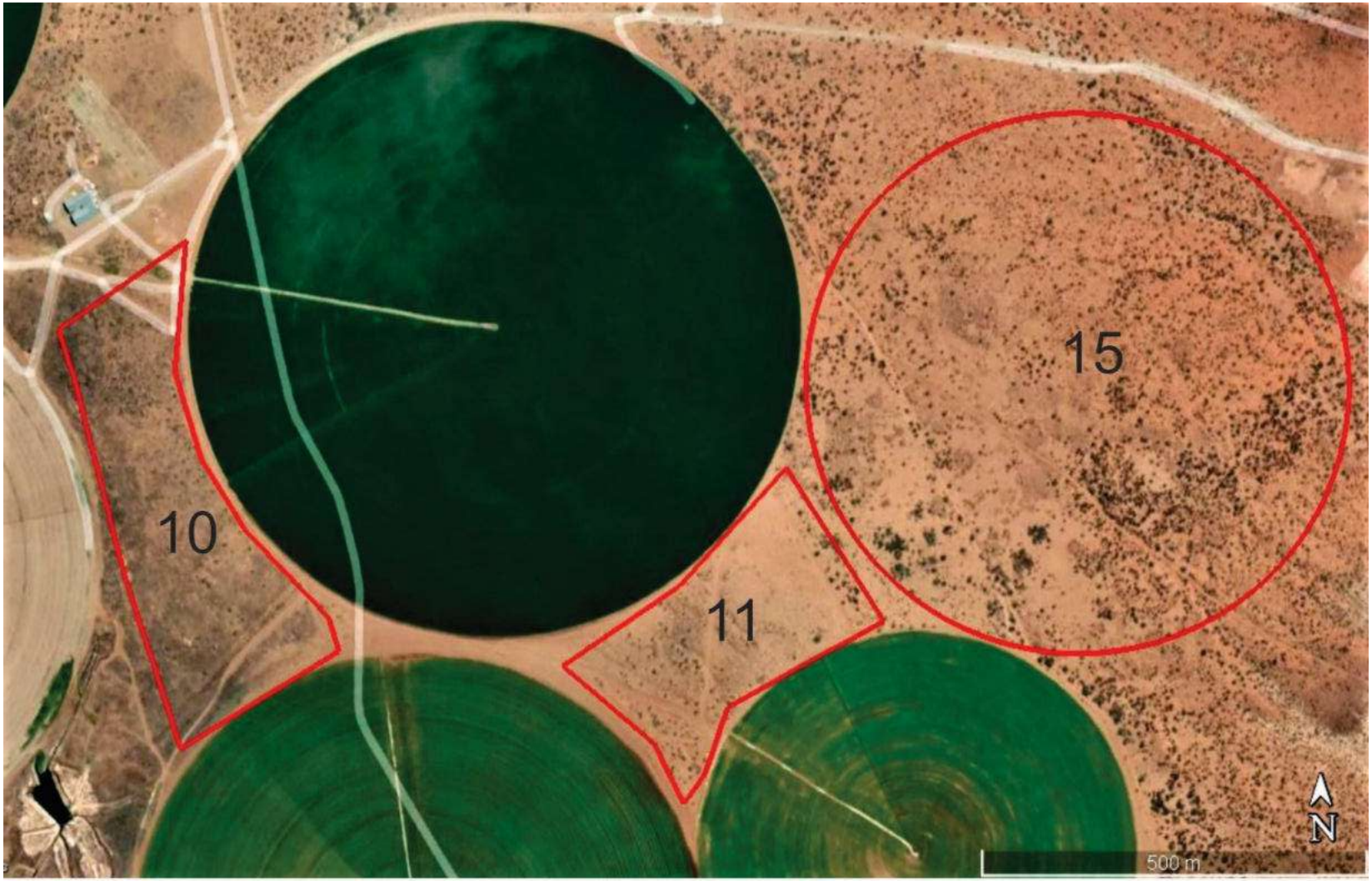


Figure 11. Layout of Areas 10, 11 & 15.

Figure 12. General view of Areas 10, looking west (above left), Area 11, looking southwest (below left) and Area 15, looking northeast (right).
Scale 1 = 10 cm.

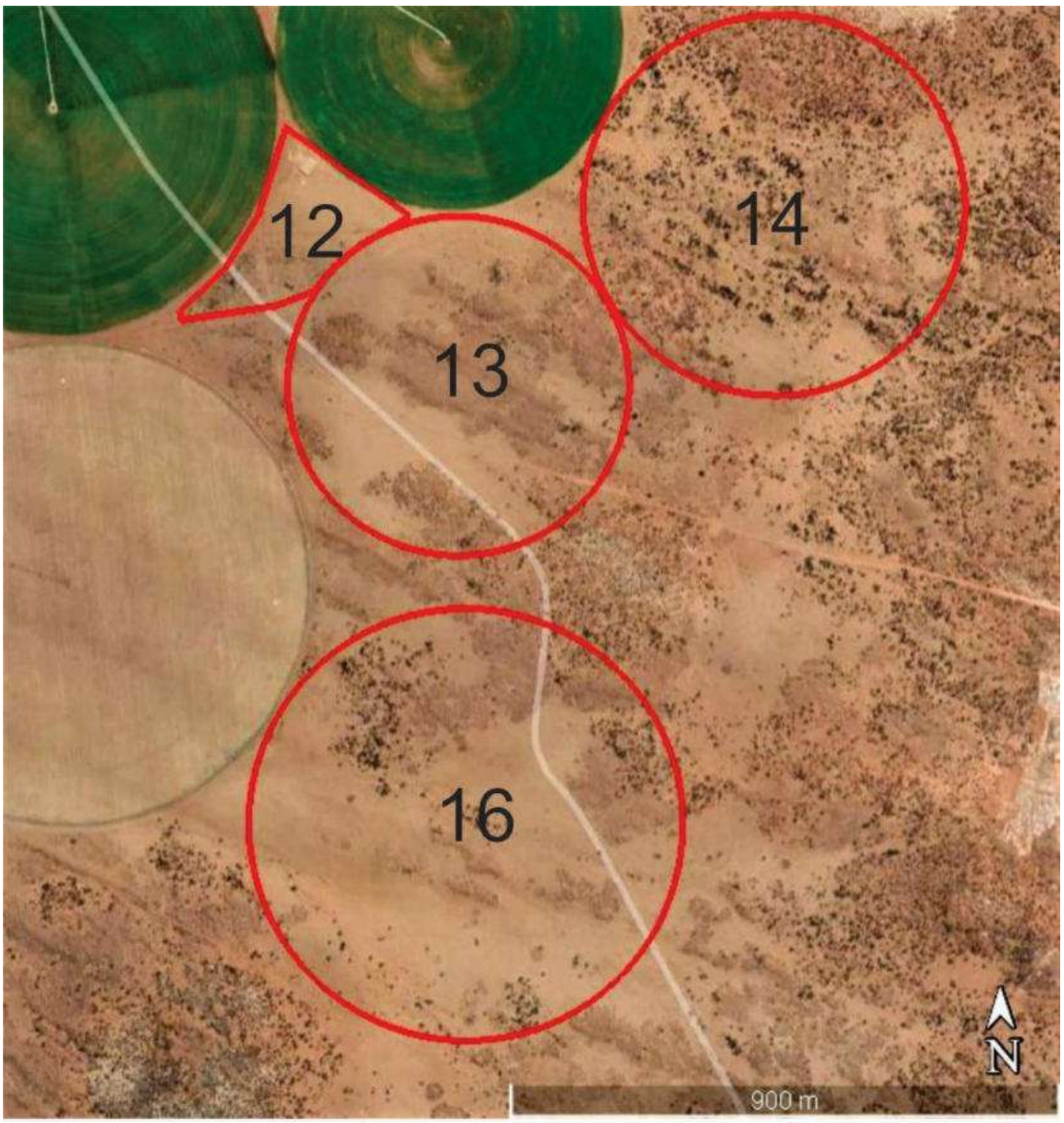


Figure 13. Layout of Areas 12 - 14 & 16.

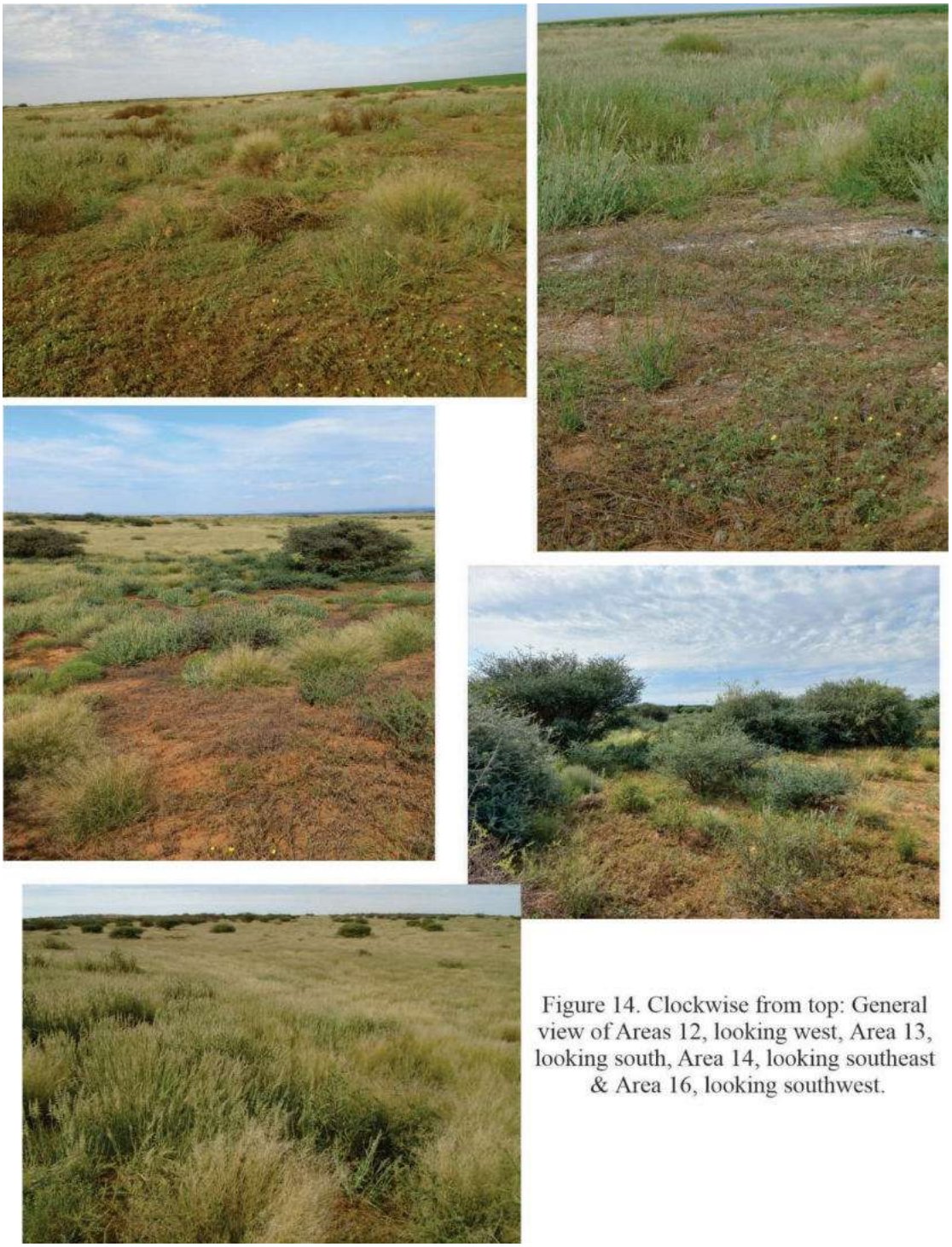


Figure 14. Clockwise from top: General view of Areas 12, looking west, Area 13, looking south, Area 14, looking southeast & Area 16, looking southwest.

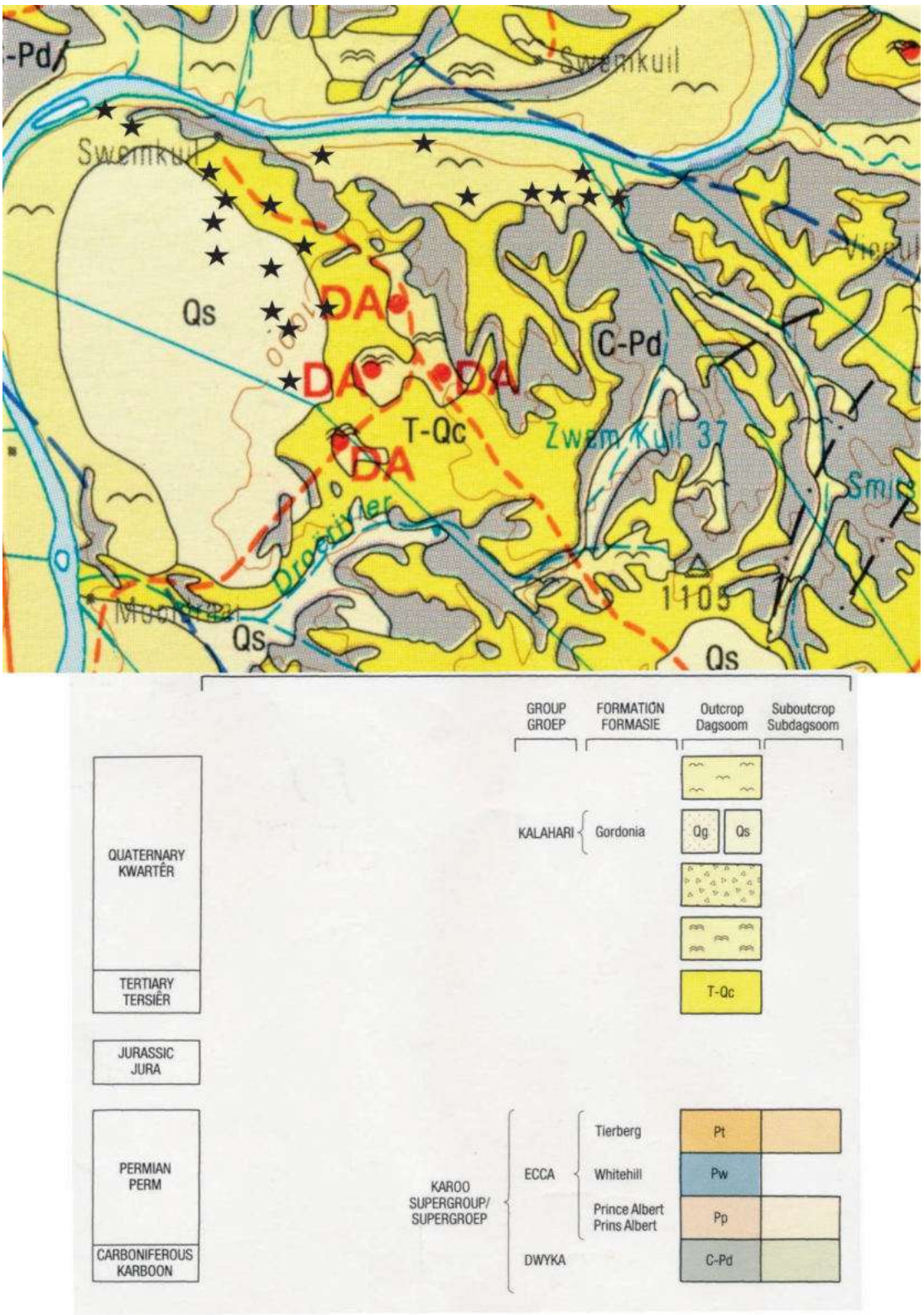


Figure 15. According to the 1: 250 000 scale geological map 2922 Prieska, the study area is underlain by glacially-related sediments of the Mbizane Formation (*C-Pd*; Dwyka Group, Karoo Supergroup). Superficial deposits are primarily represented by late Tertiary surface limestones (T-Qc), windblown Kalahari Group sand (Qs), surface gravels and alluvium.

Figure 16. Proposed development footprints (stars) marked on SAHRIS palaeosensitivity map (Sahris 2022)

Fig 17. Uncapped Stone Age surface scatters previously recorded along the Orange River between Douglas and Prieska (farms Marksdrift, Brakfontein, Nuwejaarsspruit and Kliphuis). ESA handaxe (above left), MSA parallel flake blade (above right), MSA Levallois core (below left & center) and LSA radial core (below right).

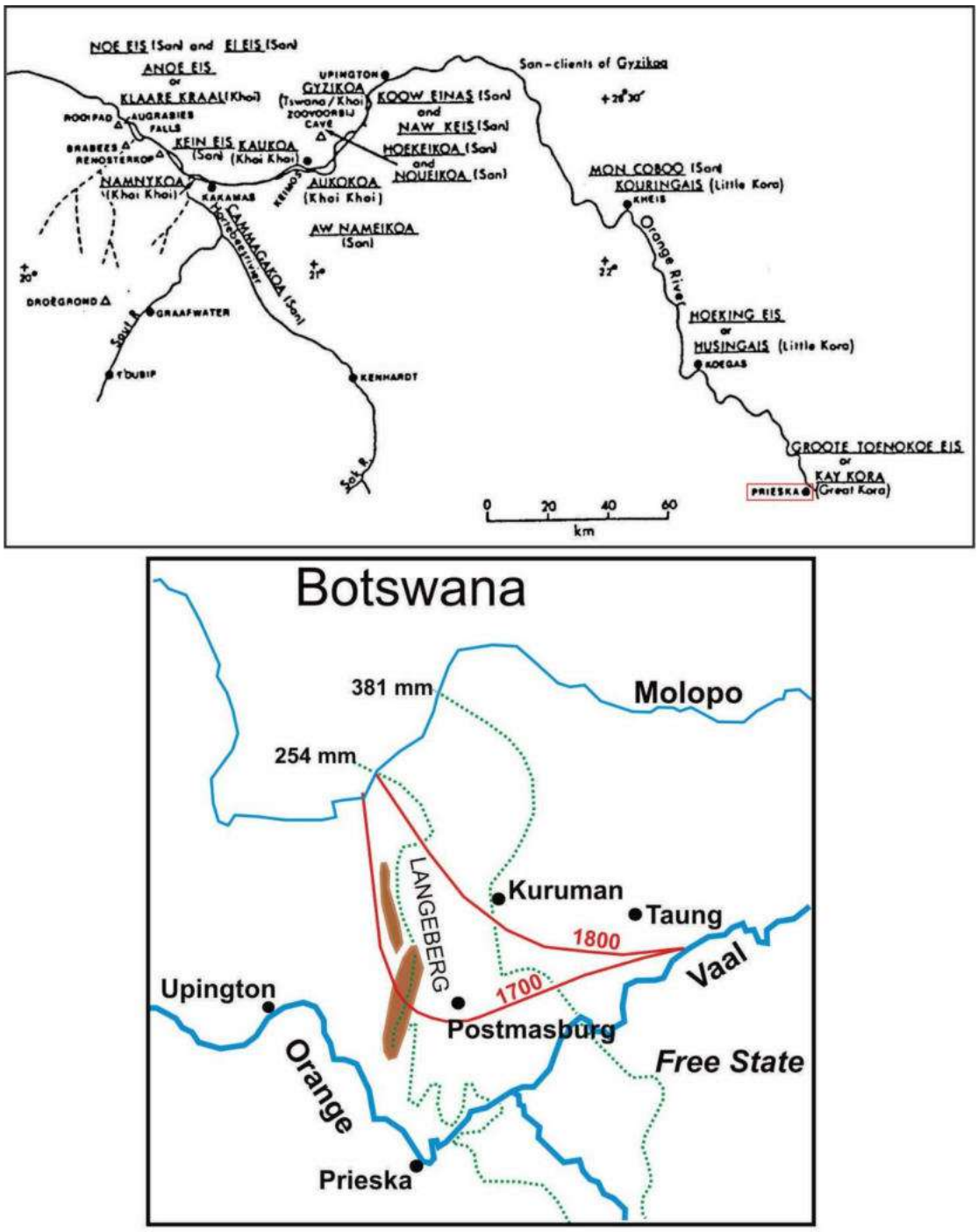


Figure 18. Distribution of Khoisan communities during the 18th century between Prieska and Kakamas (after Penn 1995) and southern limits of Tswana settlement during the 18th and 19th centuries (after Humphreys 1976).

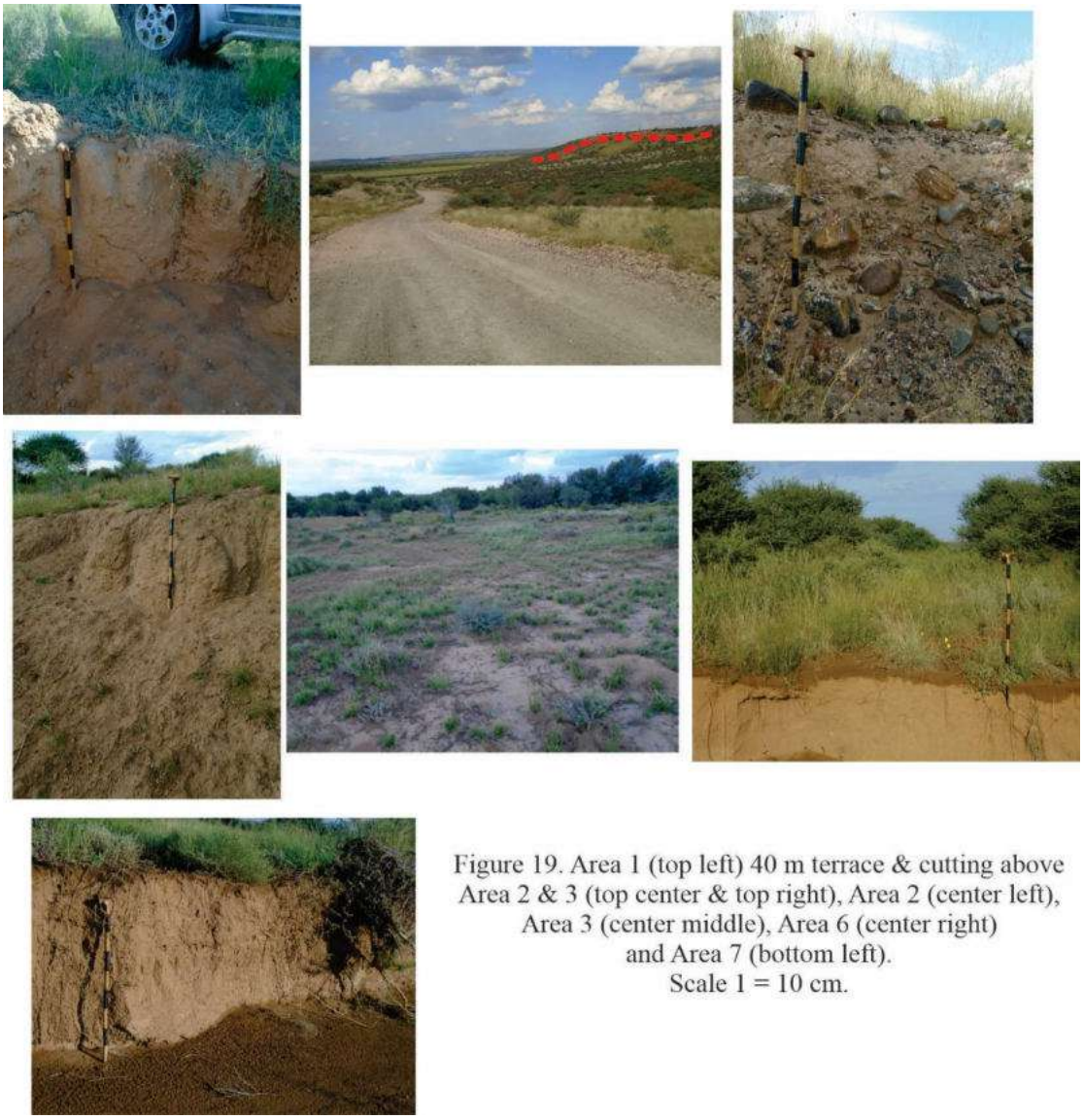


Figure 19. Area 1 (top left) 40 m terrace & cutting above Area 2 & 3 (top center & top right), Area 2 (center left), Area 3 (center middle), Area 6 (center right) and Area 7 (bottom left). Scale 1 = 10 cm.

Figure 20. Localized calcretes (left) and stone tool surface occurences, Area 5.
Scale 1 = 10 cm.

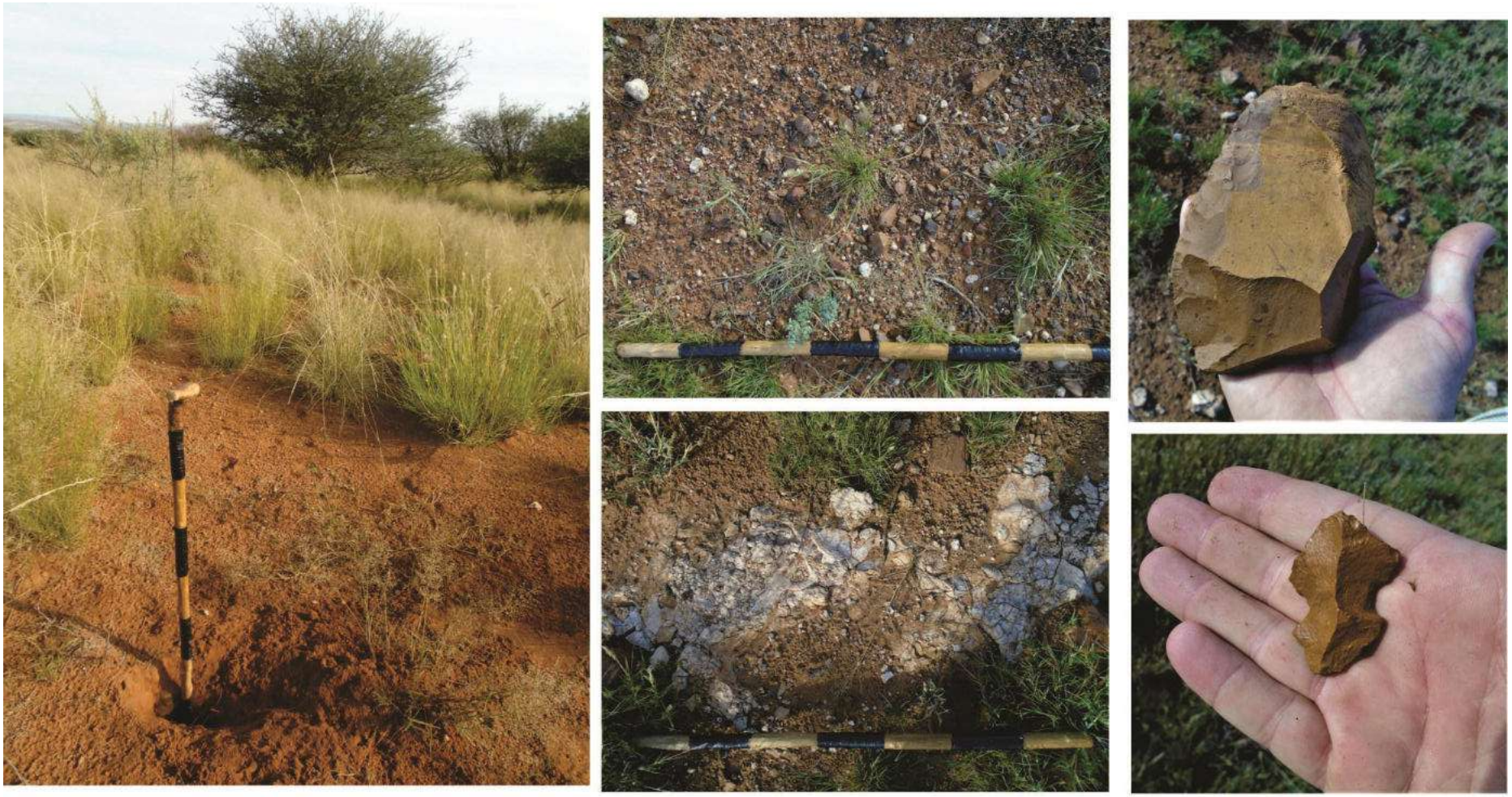


Figure 21. Area 8: sandy substrate with surface gravels and limestone (left & center), MSA core and notched flake (above & below right).
Scale 1 = 10 cm.

APPENDIX F – PLOUGHING CERTIFICATE

agriculture, land reform
& rural development

Department:
Agriculture, Land Reform and Rural Development
REPUBLIC OF SOUTH AFRICA

Directorate: Land and Soil Management, PO Box 2303, Kimberley, 8300
97 Kenilworth road, De Beers, Kimberley, 8301

From: Head of Office - Kimberley
Tel: (053) 807 2613 • **Fax:** (053) 807 2630 • **e-mail:** JanHarmV@daff.gov.za
Enquiries: J.H.Vorster • **Ref:** 19.8.1–NC/-Z1 **Date issued:** 02-06-2022

Permit no. C001 JHV/NC/2022/3

J Loots

Zwemkuil

Po Box 320

Prieska

8940

CULTIVATION OF SOIL APPLICATION IN TERMS OF REGULATION 2 OF ACT 43 OF 1983 (CONSERVATION OF AGRICULTURAL RESOURCES ACT, 1983) CARA.

District Municipality: Pixley ka Seme - **Local Municipality:** Siyathemba

FARM UNIT: Remainder of Portion 2 Zwemkuil 37 & Remainder of Smitskloof 38 - Prieska

With reference to your application in terms of the provision of Regulation 2 of the Conservation of Agricultural Resources Act 1983 (Act 43 of 1983), **permission is hereby granted to cultivate 330 ha in total on the farm area** known Zwemkuil / Smitskloof - Prieska

The permit area of **330 ha is situated within GPS co-ordinates as indicated below**, also refer to map included. The 330 ha excludes the cultivated areas that is indicated as green circles.

Area 1: A1.1 to A1.8

29°25'0.50"S 23° 1'27.34"E and 29°25'1.15"S 23° 1'16.14"E

29°25'7.17"S 23° 1'8.22"E and 29°25'10.87"S 23° 1'19.05"E

29°25'19.74"S 23° 1'26.24"E and 29°25'17.00"S 23° 1'45.57"E

29°25'6.80"S 23° 1'39.14"E and 29°25'8.35"S 23° 1'29.96"E

Area 2: A2.1 to A2.8

29°25'26.34"S 23° 2'54.55"E and 29°25'19.66"S 23° 5'3.77"E

29°25'37.29"S 23° 5'55.28"E and 29°25'53.76"S 23° 5'59.82"E

29°25'59.53"S 23° 5'47.18"E and 29°25'48.69"S 23° 5'8.97"E

29°26'3.81"S 23° 5'2.48"E and 29°26'5.03"S 23° 4'28.05"E

Area 3: A3.1 to A3.10

29°25'31.13"S 23° 1'59.34"E and 29°25'21.87"S 23° 2'10.73"E

29°25'51.78"S 23° 2'59.80"E and 29°26'35.42"S 23° 3'32.86"E

29°27'31.72"S 23° 3'9.40"E and 29°27'15.23"S 23° 2'37.88"E

29°27'0.74"S 23° 2'47.65"E and 29°26'49.35"S 23° 2'41.75"E

29°26'43.48"S 23° 2'18.81"E and 29°25'49.57"S 23° 2'13.72"E

Conditions and/or restrictions:

1. The cultivation is restricted to cash crops
2. Cultivation should also be restricted high potential soils for cultivation (areas of cultivation must exclude the rocky outcrops and 10m horizontal from the natural waterways.

Camp/Land no./Area	Size	Soil depth	Soil form	Soil series	Slope
Area indicated at co-ordinates as provided above.	330 ha	Varied 1.5 m And deeper	Brandvlei Dundee	Orthic A Soft carbonate Orthic A alluvial	Avg 2-3 %

Additional conditions in terms of CARA:

- **In terms of Regulation 7.(1) of the Conservation of Agricultural Resources Act (CARA) Act 43 of 1983,** subject to the provisions of the Water Act, 1956 (Act 54 of 1956), and sub regulation (2) of this regulation, **no land user shall utilize the vegetation in a vlei, marsh or water sponge or within the flood area of a water course or within 10 metres horizontally outside flood area** in a manner that causes or may cause the deterioration of or damage to the natural agricultural resources.
- If any signs of erosion (wind or water) appear a **necessary, soil protection control system must be constructed to** protect the cultivated land on his farm unit effectively against excessive soil loss as a result of erosion through the action of water or wind.

- Irrigation on the property must be done in such a manner that **no salination and/or water logging occur on the above mentioned or adjacent properties.**
- If salination and/or water logging do occur on the property or adjacent properties, the **land user will be held responsible to resolve the salination and/or water logging and any additional measures to prevent the repetition of salination and/or water logging on the above mentioned or adjacent properties.**

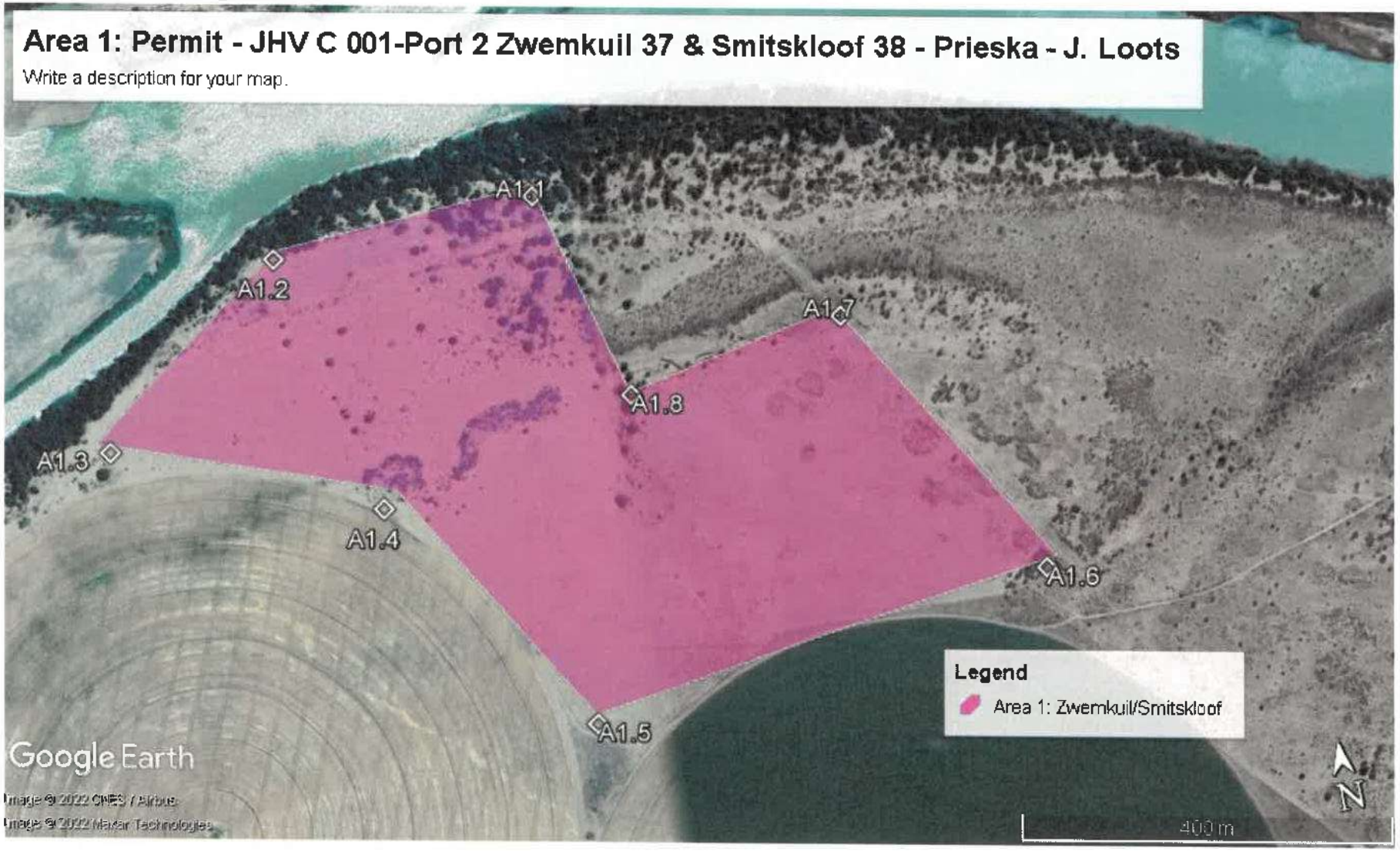
Your attention is drawn to the fact that above mentioned conditions are granted in terms of Act 43 of 1983. Failure to comply with the conditions is an offence and may lead to prosecution. If you experience any problem with the interpretation of this letter or any other problem concerning the above mentioned, do not hesitate to contact our office on the above mentioned address.

Should you feel aggrieved by this decision you may lodge an appeal in writing within 14 days of receipt of this letter to: The Director: Land and Soil Management, Private bag X120, Pretoria. 0001

Yours faithfully,

.....

MS. THEMBISILE MABUZA
CONTROL RESOURCE AUDITOR
ON BEHALF OF: EXECUTIVE OFFICER: ACT NO. 43 OF 1983
DIRECTORATE: LAND and SOIL MANAGEMENT


Area 1: Permit - JHV C 001-Port 2 Zwemkuil 37 & Smitskloof 38 - Prieska - J. Loots
Write a description for your map.
A1.1
A1.2
A1.3
A1.4
A1.5
A1.6
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Legend
Area 1: Zwemkuil/Smitskloof
Google Earth
Image © 2022 CNES / Airbus
Image © 2022 Maxar Technologies
400 m
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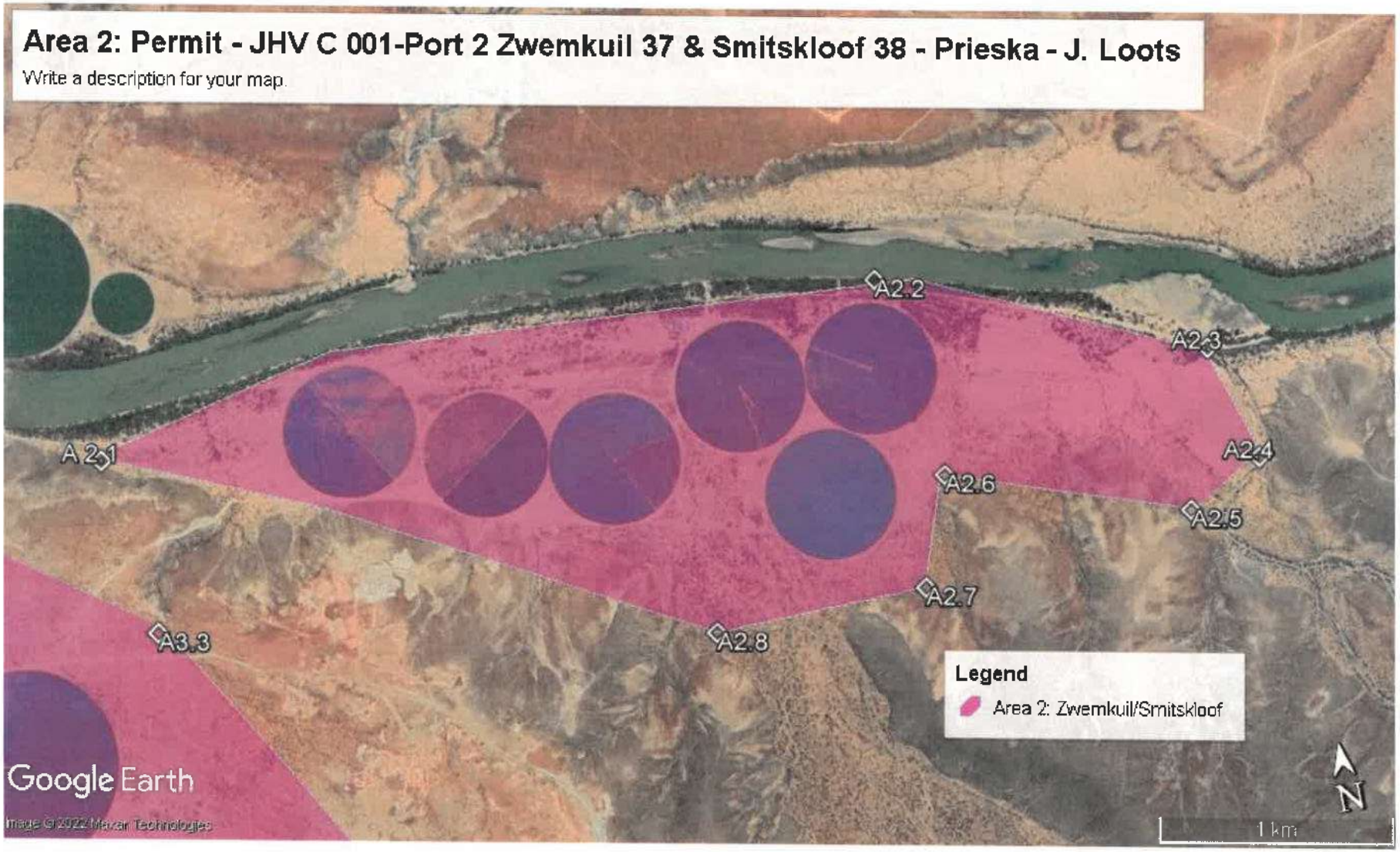
Area 2: Permit - JHV C 001-Port 2 Zwemkuil 37 & Smitskloof 38 - Prieska - J. Loots
Write a description for your map.
A2.2
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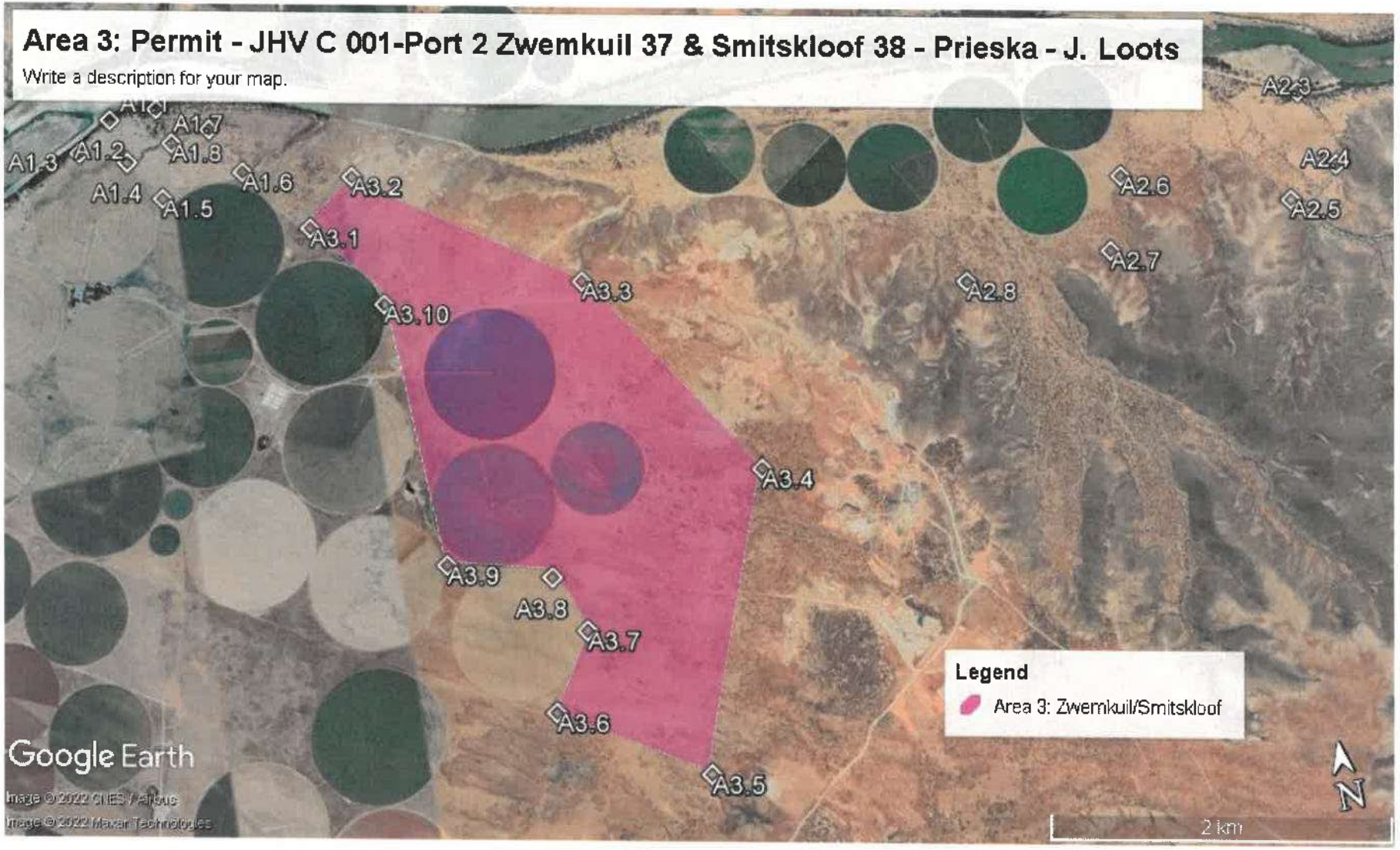
Area 2: Zwemkuil/Smitskloof
Google Earth
Image © 2022 Maxar Technologies
N
1 km


Area 3: Permit - JHV C 001-Port 2 Zwemkuil 37 & Smitskloof 38 - Prieska - J. Loots
Write a description for your map.
A1.1
A1.7
A1.8
A1.3
A1.2
A1.4
A1.5
A1.6
A3.2
A3.1
A3.3
A3.10
A3.4
A3.9
A3.8
A3.7
A3.6
A3.5
A2.3
A2.4
A2.6
A2.5
A2.7
A2.8
Legend
Area 3: Zwemkuil/Smitskloof
Google Earth
N
2 km