DRAFT EIA REPORT FOR THE CLEARING OF VEGETATION ON THE REMAINDER OF FARM NAAUWTESFONTEIN NO. 78, HOPETOWN PREPARED FOR

G.F. STEYTLER

NOVEMBER 2021

Reference: **NC/EIA/12/PIX/THE/HOP1/2021**

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BACKGROUND

Digital Soils Africa (Pty) LTD (DSA) was tasked by Mr. George Frank Steytler to conduct environmental investigations and complete the Environmental Authorisation Application for the authorisation of clearing 269Ha of vegetation on the Remainder of the Farm Naauwtesfontein No. 78, Hopetown 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 Mr. Steytler (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.

Mr. Steytler would like to develop 269Ha of which about 177Ha of vegetation will be cleared to establish pivots for irrigating maize and wheat crops and pasture. Two sites on the same farm were chosen for this development, which will be referred to henceforth as Site A (198Ha in total) and Site B (71Ha in total).

Currently the site host intact vegetation with some evidence of overgrazing. Soil samples were taken and analysed to investigate if the soil is suitable for establishing crops. The soil study indicated that at Site A, the pivot placement does not exceed more than 10% of unsuitable soil in a pivot area. However, Site B has small areas of moderately suitable soils for irrigation, which can be incorporated into pivots, and thus the pivot placement is not affected by suitability.

In terms of the drainage, the A and B horizons of the sites are characteristically sandy and therefore will facilitate good drainage. Most of the soils are very high-potential irrigation soils.

From an environmental point of view, the larger 269Ha area should be under application, although only 177 Ha would most likely be disturbed, the rest of the 92Ha that are located between the proposed pivot 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 (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 do not require additional applications for a Water Use Right. In the future, they might apply for an increase in usage, however, at this stage, it is not required.

A vegetation survey was completed by Dr. van Aardt and according to the species found in the study area, the vegetation units is typical of species from the Kimberley Thronveld (SVk4) and karroid vegetation. The site is not listed as an endanged or protected ecosystem with only the wetland/drainage line as an important ecological feature with ecological function. Another area of concern is the grass dominated shrubland in Site B, due to the presence of high numbers of the protected *Vachellia heamatoxylon.*

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

The Thembelihle Municipality does not have a Spatial Development Framework, but the Pixley Ka Seme District Municipality has a Spatial Development Framework. According to this SDF, the site falls within an area that is rated as a low sensitivity area.

Considering all the maps available and data presented, it must be 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. 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, for example, if the Thembelihle Municipality had an SDF, it would have been considered 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 the plant species found at the site is typical of species from the Kimberley Thornveld (SVk4), which is classified as least threatened and karroid vegetation and is not listed as an endangered or protected ecosystem. Although the vegetation report indicated that the drainage line at Site A might serve as an important ecological feature with ecological functions, the author was not aware of the fact that neigboring farms created the drainage lines to drain their runoff into the centre of Site A and thus artificially created the drainage line and it is not natural. Thus the broad-based, regional/national plans are applicable.

PERSONAL PARTICULARS OF APPLICANT

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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.

	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.
Experience (Seventeen years' experience in environmental law and environmental management)	
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]

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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

The Remainder of Farm Naauwtesfontein No. 78, Hopetown, Northern Cape

REGIONAL SETTING

SITE LOCATION

The site is situated north-west from Hopetown in the Northern Cape (**Site A:** 29° 30' 38.85"S; 23° 56' 40.97"E and **Site B:** 29° 31' 10.72"S; 23° 58 '19.99"E) on the Remainder of Farm Naauwtesfontein No. 78, within the Thembelihle Local Municipal area. The farm can be reached by traveling along the R3112 (old Douglas road) north-west from Hopetown for about 16km until the farm road of Site A is reached.

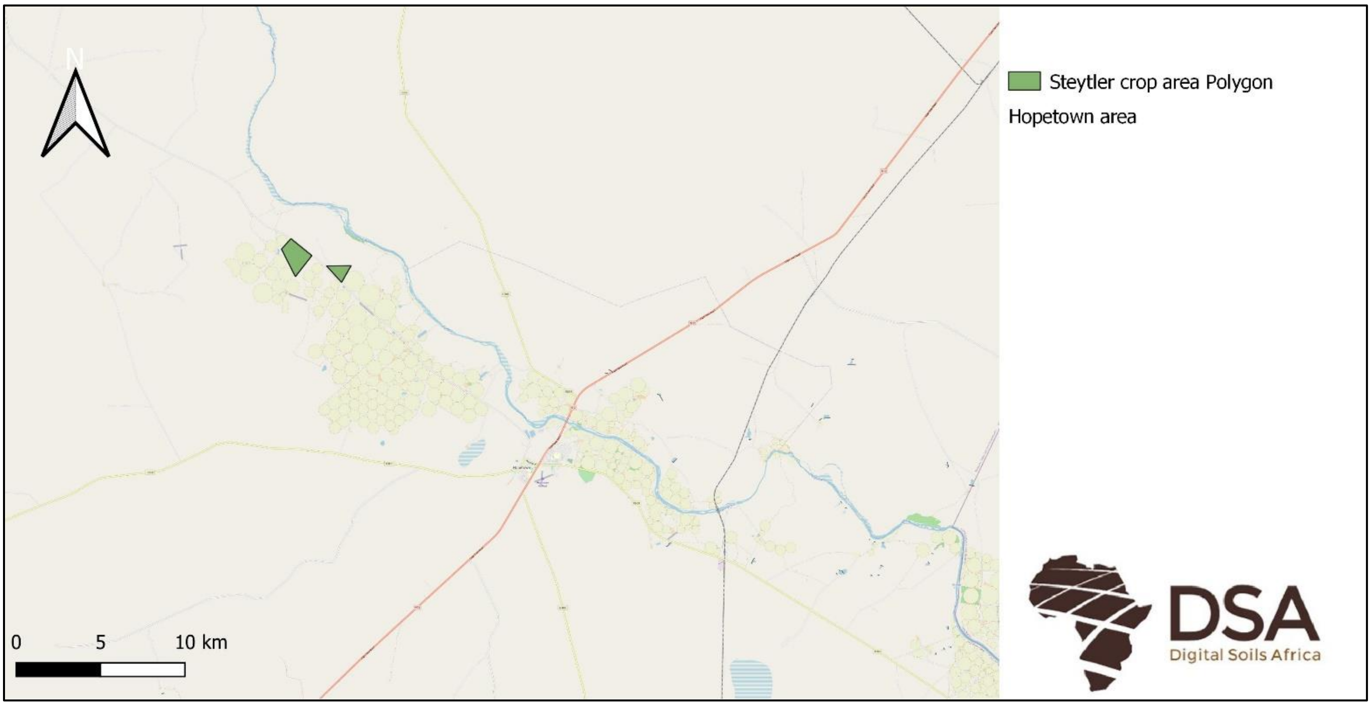

FIGURE 1: SITE LOCATION, ALSO SEE APPENDIX B.

LAND DESCRIPTION / INFORMATION

SURROUNDING AREAS

- Site A is bordered by cultivated land and pivots with crops to the east, south, and west of the site.
- To the north of Site, A is the R3112, across the road is natural veld, used for grazing.
- Site A has a limited connection to other environments, as it is fenced in and the R3112 separates the areas from the Orange River system more than 1.8km from the site.
- Areas to the east, south, and west from Site B are completely transformed by cultivated land and pivots.
- Directly abutting to the north of Site B, is natural veld and representative of veld in the Kimberley Thronveld.
- Site B has a connection to the north with the Kimberley Thronveld.

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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 but the vegetation identified onsite represents high to medium conservation value. The development is situated more than 1.8km from any watercourse 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)
15	GNR 325 – Clearance of an area of 20 hectares or more indigenous vegetation.	Site A: 29° 30' 38.85"S 23° 56' 40.97"E Site B: 29° 31' 10.72"S 23° 58 '19.99"E

PLANNING PHASE

Although 269 Ha are under application, only the pivot areas will be cleared from vegetation to establish crops. Thus, during the planning phase, the location of the pivots must be determined based on soil suitability and environmental factors.

CONSTRUCTION PHASE

The clearance of vegetation will take place simultaneously at Site A and Site B within 2-4 months. The construction phase will result in the clearing of natural veld on the allocated pivot 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 in maize production (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

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season is the single most important factor in crop production in South Africa, soil tillage must be aimed at optimising infiltration and minimising evaporation.

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. However, the laboratory results indicate that the exchangeable sodium percentage (ESP) values are high. Na in relation to other cations is high, thus a possible indication of sodicity, and if not managed correctly, can lead to degradation of soil by reducing the flow of water through soil, which limits leaching and can cause salt to accumulate over time and develop of saline subsoils. It can also cause crusting and sealing on the soil surface, which impedes water infiltration, accelerating erosion and causing structureless soils.

The soil report indicated that this potential risk can be rectified with irrigation and fertilization on soils with adequate drainage, so that the Na can leach out and be replaced with Ca, Ma and K, lowering the ESP.

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.

Once the vegetation is cleared, the soil will be deep ripped, which will further improve drainage, access rocks will be removed, spreading of chicken manure or other organic fertilisers, but also Gipson or lime should be applied to leach out the Na. 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 4 months 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. It is also the intent of the Applicant to rest the crop fields annually through rotating crops. About 200Ha is currently approved and under crop production, the addition of the 269Ha will allow the Applicant to continue to produce 200Ha of crops per annum, but also allowing the alternating camps to rest. It is not the intent of the Applicant to increase crop production to 400Ha per annum. 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, such as deep ripping, removing access rocks, spreading of chicken manure or other organic fertilisers on the land, as well as Gipson or lime to leach out the Na.

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.

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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 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 a ploughing certificate 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	SAHRA was consulted and a Heritage Assessment Study was completed.
Alien and Invasive Species Regulations, 1 August 2014	DEA	A Flora study was completed to establish if any alien or invasive species occurred at the site. The EMP provides alien control mitigation measures.
List of Protected Tree Species under the National Forest Act, 1998 (Act No. 84 of 1998)	Department of Environment, Forestry and Fisheries	A Flora study was completed to establish if there are any protected tree species on site.
National Road Traffic Act, 1996 (Act 93 of 1996)	South African National Road Agency Limited	The Northern Cape Department of Roads and Transport was consulted during the Public Participation Phase.

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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 change of land use and the landowner does not wish to change the land use of the property.

The soil report indicated that crops can be established on at least 177Ha of the site. The vegetation report conducted that the site is situated on the Kimberley Thornveld which has a Least Concern conservation status. The target of conservation is 16% of which only 2% are currently conserved in Vaalbos national park as well as in Sandveld, Bloemhof Dam, and S.A. Lombard Nature Reserves. Some 18% is already transformed, mostly by cultivation (Mucina and Rutherford, 2006).

In light of this, it is recommended that this site be developed into a crop and alternating pasture land, with the benefit of socio-economic improvement and job creation opportunities, while remaining an agricultural unit.

In terms of alternative site layout, 269ha is under investigation as a potential development area. However, the soil report indicated that most of the surveyed area is suitable for irrigation, due to the free-draining soils and cracked rock underlying most profiles.

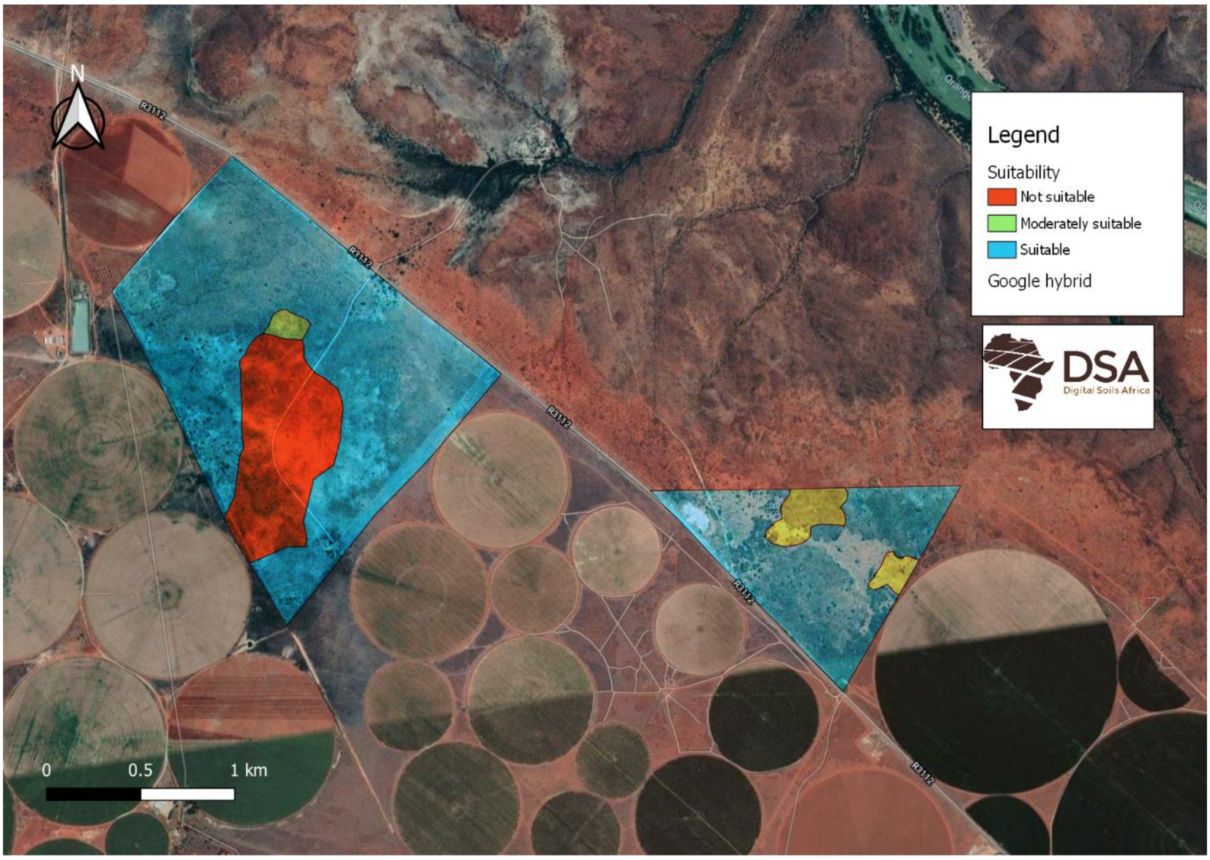

FIGURE 2: SOIL SUITABILITY OF THE STUDY AREA (SOURCE FROM THE SOIL REPORT)

The areas that are not suitable for irrigation (see Figure 2, the red polygon areas) are limited by external drainage. One area is underlain by a hardpan carbonate horizon, which is an indication of water accumulation in arid climates, and the other by hard rock.

Therefore, it was recommended in the soil report that the pivot placement in Site A does not exceed more than 10% of unsuitable soil. Site B only has small areas of moderately suitable soils for irrigation, which can be incorporated into pivot areas and thus the pivot placement is not affected by soil suitability.

Therefore the environmental impacts on soil quality would be too high if pivot placement on Site A was to be placed over more than 10% of the unsuitable soils. Therefore in this EIA Report, the recommendations of the soil scientists would be applied and the best viable alternative site layout option was proposed in the planning phase of this development (see the previous discussion).

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

In terms of the 'no-go' option; if the site is not developed there will be no change (good or bad) to the status of the site; it will remain as-is: an area that is Least Concern, but with both sites that have natural conditions that represent the Kimberley Thornveld used for grazing. Site A has a limited connection to other environments, while Site B has connections to other environments, and if developed would reduce that connection. Considering that Site A & B is directly adjacent to established pivot areas, it will be a continuation of the development on the farm.

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

The EIA will assess the impacts of the 177Ha area only.

NEED AND DESIRABILITY OF THE PROJECT

The purpose of this Environmental Authorisation Application is for the Applicant to obtain permission from the Department to develop 269 ha of which about 177Ha of vegetation will be cleared to establish crops and pasture land, alternating years.

Currently, the Applicant has 200Ha that is used for maize and/or wheat crops. This application, if approved, the addition of the 269Ha will allow the Applicant to continue to produce 177Ha of crops per annum, through crop rotation. It is not the intent of the Applicant to increase crop production to 400Ha per annum, but rather produce crops on one section of the 200Ha, and the rest the other 177Ha and rotate the next year. 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, such as deep ripping, removing access rocks, spreading of chicken manure or other organic fertilisers on the land, as well as Gipson or lime to leach out the Na.

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, reduce 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 crop 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 this year (2020-2021), the International Grains Council (IGC) puts 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).

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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. The Applicant did not indicate that it would be harvested but rather grazed by livestock. Lucerne has excellent qualities for grazing, but it can cause bloat, which can be treated.

In terms of the socio-economic benefit, it is no secret that South Africa has one of the world's highest unemployment rates. The Thembelihle Municipality 2017/2022 IDP indicating that the unemployment rate was about 28%, which is a very good variable in light of the 43% provincial unemployment figure. Whilst this is a good reflection, the IDP indicated that more can be done and the efforts can be directed towards ensuring sustainable jobs.

Therefore, the agricultural sector plays a key role to generate economic activity, create jobs, earn foreign currency and stimulate rural economies in general.

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. Hopetown is a center of irrigation farming.

If this project is approved, it is expected that at least 8-12 previously disadvantage individual employment opportunities on the farm would be created. Although this would seem a small number, for those 8-12 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 of 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 Thembelihle Municipal area and achieving the IDP objective of ensuring sustainable jobs.

NO DEVELOPMENT OF THE SITE

In terms of the 'no-go' option; if the site is not developed there will be no change (good or bad) to the status of the site; it will remain as-is: an area that is Least Concern, but with both sites that have natural conditions that represent the Kimberley Thornveld used for grazing. Site A has a limited connection to other environments, while Site B has connections to other environments, and if developed would reduce that connection. Considering that Site A & B is directly adjacent to established pivot areas, it will be a continuation of the development on the farm.

The development of the site into crop production and pasture in alternating years will have a temporary impact on grazing capacity (during the year of crop production) but will increase the yield production of the land and increase capital revenue for the farm, during the crop production cycle. During the pasture land cycle (or resting phase) the grazing capacity will improve. Thus minor losses will occur in terms of loss of grazing capacity. Such losses will be offset against crop production and will increase job opportunities and the capital value of the property.

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

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

The footprint of the proposed development within the approved site.

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ALTERNATIVE FOOTPRINT CONSIDERED

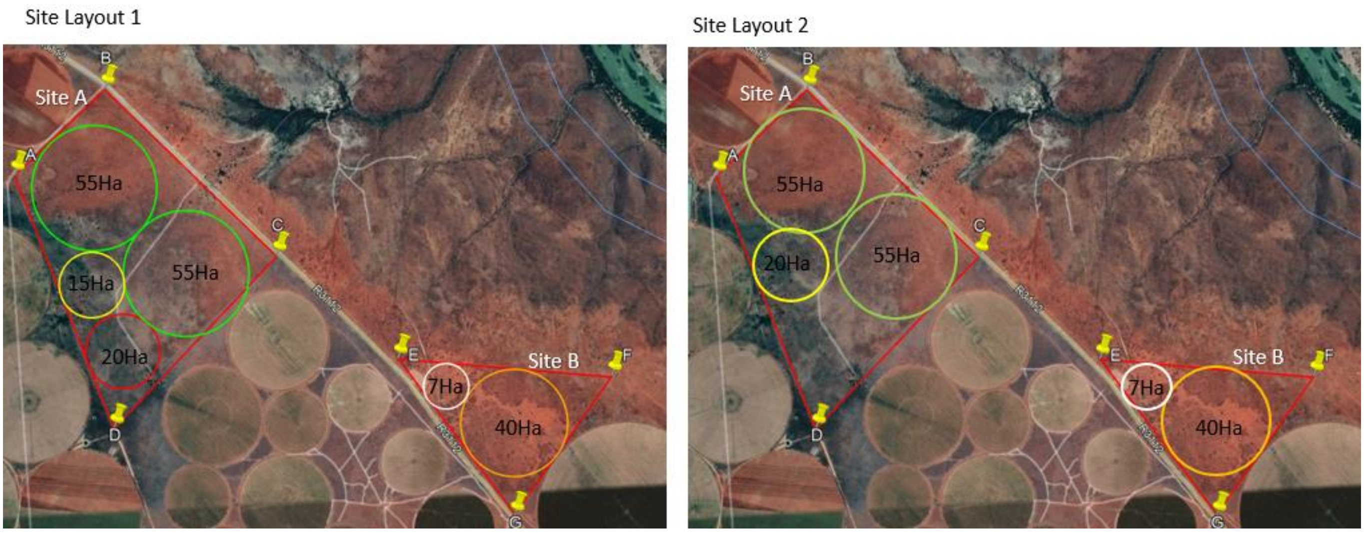

FIGURE 3: SITE LAYOUT 1 IS THE ORIGINAL FOOTPRINT AND SITE LAYOUT BEFORE INVESTIGATIONS, WHILE SITE LAYOUT 2 IS THE PREFERED SITE LAYOUT AND FOOTPRINT PROPOSAL AFTER INVESTIGATIONS.

Initially, 145 Ha on Site A was considered for clearing vegetation and establishing pivots. However, specialist studies conducted during the EIA phase, have indicated that an alternative layout plan or site development plan, should be considered to minimize the impacts on the physical, biological, and socio-economic aspects of the proposed development. It is proposed that Site Layout 2 (see Figure 3) be regarded as the preferred layout plan, reducing the 145 Ha to 130 Ha on Site A.

The soil report and findings were the leading factors in deciding to allocate the pivot areas. Deep soil depths, favoured soil types, and drainage led to the best soil suitability areas. At Site A there is a central section that was identified as not being suitable for irrigation due to potential drainage issues, thus the pivot placement of Site A should not exceed more than 10% of unsuitable soil in a pivot. To achieve this objective, two 55Ha pivots should be placed as close as possible to the boundary of the north-eastern section of the property, as the soils along this portion are the most suited. A 20Ha pivot can be placed directly south of the most northern 55Ha pivot, west from the haul road (see Figure 4). In the soil report, another 20Ha pivot area was identified most south of Site A, however, it is the opinion of the author that this pivot should not be developed as more than 80% of this pivot area will have unsuitable soil.

Site B had small areas of moderately suitable soils for irrigation, while the majority of this site was favourable, thus the pivot placements would not be affected by suitability at Site B. One large pivot area of 40Ha will be placed in the center of Site B, with a smaller 7Ha pivot area north-west from the 40Ha pivot area.

Ultimately, the study area under application is 269 Ha, but if the proposed pivot areas are developed only 177Ha will be cleared from vegetation with the rest of the 92Ha in between the pivot areas of Site A and B will be left undisturbed and can be used as a nursery if plants are identified to be transplanted and conserved.

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FIGURE 4: THE PROPOSED PIVOT AREAS ARE INDICATED BY THE BLUE POLYGONS, WHICH HAVE BEEN OVERLAYED BY THE PIVOT AREAS PROPOSED IN THE SOIL REPORT. THE RED POLYGON REPRESENTS THE UNSUITABLE SOIL SECTION IN THE CENTRE OF SITE A, AS CAN BE SEEN, THE VERY SOUTH PIVOT AREA COVERS ABOUT 80% OF UNSUITABLE SOIL AND THEREFORE SHOULD BE EXCLUDED FROM DEVELOPMENT.

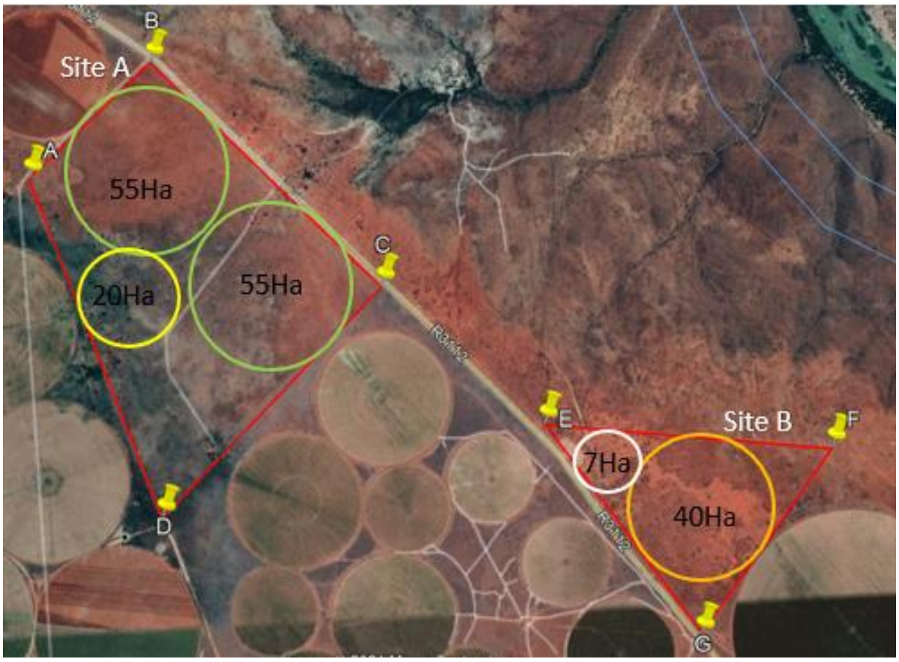

FIGURE 5: PROPOSED LAYOUT OF PIVOTS

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 Diamond Fields Advertiser (DFA) and 2 (two) notice boards were placed at Site A and Site B entrance along the R3112. During the public participation of the Scoping Phase, one comment was received from an I&AP and a request was made to include another neighbour that is not directly abutting, but his pivot area is neighboring the application area. A further concern was raised regarding the natural slope and drainage of water towards the river and this should not be negatively influenced.

No person 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 incorporation in the Draft EIA. Since public participation is underway for the Draft EIA, if any comments are received it will be considered and if needed it will be incorporated in the final EIA.

ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT

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

In terms of the topography, the impact was rated low without mitigation and very low with mitigation for the preferred layout (177Ha), considering the geographical, physical, socio-economic, and heritage aspects.

In terms of geology and palaeontology, there was no impact associated with this proposed development since the proposed development will not transform the geology of the site. In the paleontology report, Dr. Rossouw indicated that no fossils (Quaternary) or fossil exposures were observed in the footprint areas. The footprints are not considered palaeontologically or archaeologically vulnerable and are assigned a site rating of Generally Protected C.

In terms of the soil, three attributes were considered (soil properties, soil erosion, and soil pollution). In terms of the soil properties, the soils of the study area are quite deep with most of the soils ranging from 1.01-2 m in depth. The

Coega soils were associated with the 0-0.5 m soil depths and represent mostly soils not suitable for irrigation. According to the soil report, the Cation Exchange Capacity (CEC) is extremely low (2.63-4.38 cmol(+)/kg), this, in turn, has a pronounced effect on the Exchangeable Sodium Percentage (ESP). The ESP is very high and especially high for red apedal soil. Since ESP is a percentage of the Na to CEC, the low CEC can exaggerate the ESP. An exaggerated ESP is supported by the low Electrical Conductivity of the soils. The irrigation threshold of EC for water is 400 mS/m. These soils can be rectified with irrigation and fertilization on soils with adequate drainage, the Na should leach out and be replaced with Ca, Ma and K, lowering the ESP.

Thus, the main concern was the Na that was high in relation to other cations, which could lead to sodicity. However, as indicated above, the exchangeable sodium percentage (ESP) values are high, thus, it indicates that sodicity is not a general threat to irrigation on this site. On these soils, the risk of sodicity can be rectified with irrigation and fertilization and Na should leach out and be replaced with Ca, Ma and K, lowering the ESP. To achieve this, the soil will be deep ripped once the harvest is cleared, the spreading of chicken manure or other organic fertilizers, but also Gipson or lime should be applied to leach out the Na.

Considering the physical, biological, and socio-economic aspects, the findings were sufficiently conclusive to propose an alternative layout for this development, in terms of placing the pivot areas on Site A and avoid placing pivots on Coega (unsuitable soil). In terms of the soil properties, the impact on the preferred layout was rated low-moderate without mitigation and reduced to 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. Incorrect application of pesticides could physically and biological change the soil composition which will ultimately impact the health of the area.

In terms of land use, the activities on this portion of land will change once every two years from grazing to crops (due to the crop rotation method that will be applied, producing crops one year, resting it the next). Thus 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 low without mitigation and reduced to very low with mitigation for the preferred layout (177Ha), considering the geographical, physical, biological, socio-economic, and heritage aspects.

In terms of the flora, a vegetation report was completed by Dr. van Aardt and the species found in the study area is typical of species from the Kimberley Thronveld (SVk4) and karroid vegetation. The site is not listed as an endangered or protected ecosystem with only the wetland/drainage line as an important ecological feature with ecological function. After investigation, it was found that is not pristine and it is an artificial drainage line that hosts invaded species (*Prosopis glandulosa* and *Tamarix ramosissima*), but also the protected *Babiana hypogaea*. Another area of concern is the grass-dominated shrubland in Site B, due to the presence of high numbers of the protected *Vachellia heamatoxylon.* Four vegetation units and two vegetation units were classified in Site A and B respectively, all of which

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had a medium conservation value, except for vegetation unit 4 in Site A (shrub-veld dominated by grasses) that had a high conservation value.

In terms of connectivity, Dr. van Aardt indicated that Site A has no to very limited connection to any natural vegetation due to the existing land-uses surrounding the site. Site B is however connected to the natural vegetation of SVk4 on the north-eastern and north-western boundaries but since the southern boundaries are bordered by agricultural land and the R3112 abuts the site, the connectivity is very limited.

The impact on the vegetation was rated moderate-high without mitigation and reduced to moderate with mitigation during the construction phase since natural vegetation will be permanently removed. The impact is reduced to low-moderate once in operation, considering the geographical, physical, biological, socio-economic, and heritage aspects.

In terms of the fauna, the highest impact will be at the construction phase, when the habitat is permanently removed and was rated moderate-high without mitigation and reduced to low-moderate with mitigation for the preferred layout (177Ha), 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.

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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 with or without mitigation, based on the findings of the heritage report. Dr. Rossouw indicated that there are no indications of prehistoric structures or rock art or aboveground evidence of graves or historical structures older than 60 years within the confines of the footprints. The proposed pivot development at Sites A and B will primarily affect geologically recent and culturally sterile soils (unconsolidated wind-blown sand). Once in operation, the impact is reduced to insignificant.

CONCLUDING STATEMENT

From the above, it is concluded that the preferred site layout is considered for the development. Therefore, only the 177 Ha area on the Remainder of Farm Naauwtesfontein No. 78 (Site Layout 2 Figure 3) will be regarded as the area for environmental assessment. All the impacts and risks identified including the nature of the impacts, the significance, the consequence, the extent, duration, and probability of the impacts are discussed in full detail in the section below.

ENVIRONMENTAL IMPACT ASSESSMENT

METHODOLOGY OF IMPACT ASSESSMENT

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

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

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

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

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

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

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

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

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

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

Impacts will be assessed according to the criteria listed below:

TABLE 2: IMPACT ASSESSMENT TABLE

Criteria	Description	Rating	
Spatial Extent	Whether the impact will occur on a scale limited to the immediate site of the proposed activity, local	None/Insignificant Site	0 1

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	area and immediate communities and settlements, sub-regional (municipal), regional (provincial), or national scale.	Local Sub-Regional Regional	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).

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

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

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

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

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

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

ENVIRONMENT

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

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

1. The environmental impact assessment rating,
2. Specific mitigation measures and guidelines for the development to proceed in the most environmentally sustainable manner,

3. Relevant specialist reports identified during this scoping phase,
4. Maps,
5. Interested and Affected Party comments and objections (if any), and
6. Any additional information is required by the 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.

RAINFALL & TEMPERATURE

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. Hopetown has a summer rainfall between October to May.

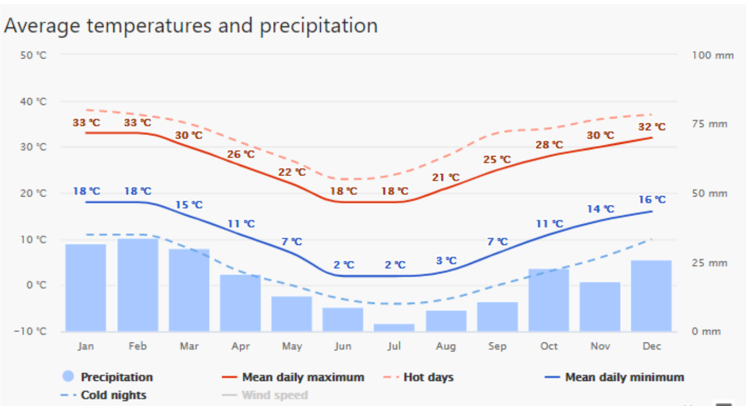

FIGURE 6: AVERAGE TEMPERATURES AND PRECIPITATION (SOURCE METEOBLUE)

Daily mean maximum temperatures range between 33.1°C and 35°C and daily mean minimum temperatures between 0.1°C and 2°C. January-February is the hottest months of the year and June-July the coldest.

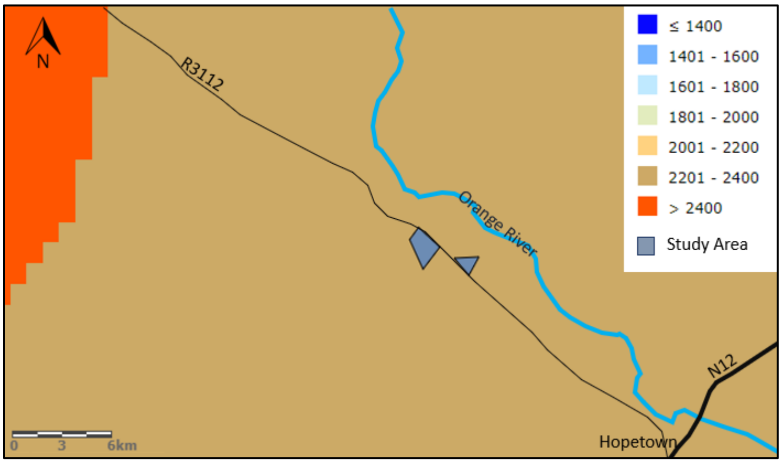

FIGURE 7: EVAPORATION EXPERIENCED ANNUALLY ACCORDING TO THE AGIS COMPREHENSIVE ATLAS

The proposed farm area falls within an area where the annual evaporation is high, between 2201-2400mm.

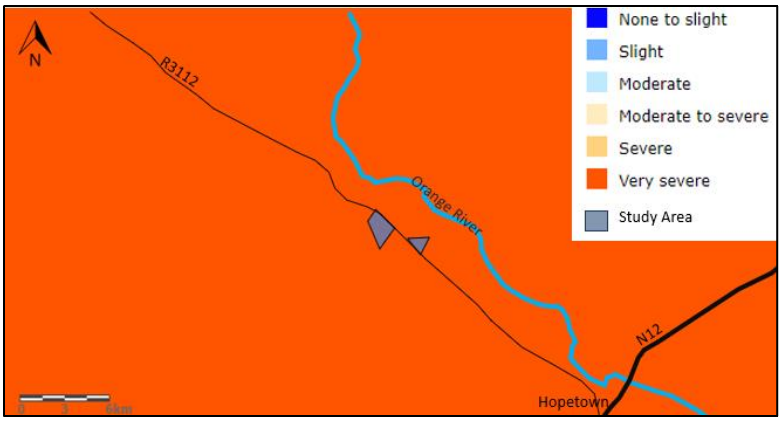

FIGURE 8: MOISTURE AVAILABILITY EXPERIENCED ANNUALLY ACCORDING TO THE AGIS COMPREHENSIVE ATLAS

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

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

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WIND REGIMES

The prevailing wind directions are predominantly east-north-easterlies and north-easterlies as well as south-westerlies and west-south-westerlies, 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 and predominant winds in winter being easterlies. Generally, wind speeds are also stronger during night-time compared to daytime conditions.

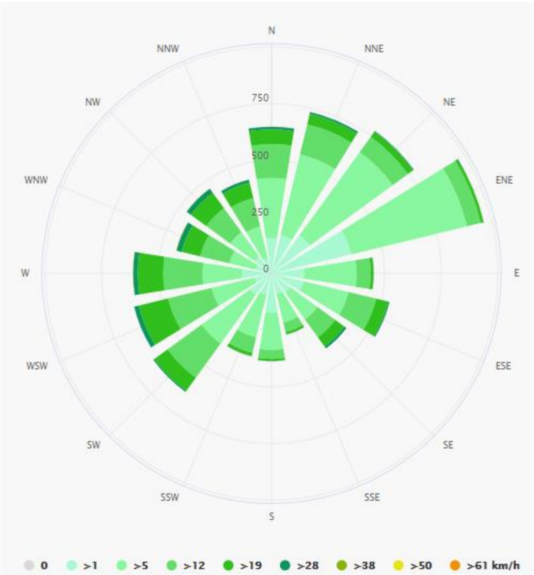

FIGURE 9: WIND ROSE OF HOPETOWN AREA (SOURCE METEOBLUE)

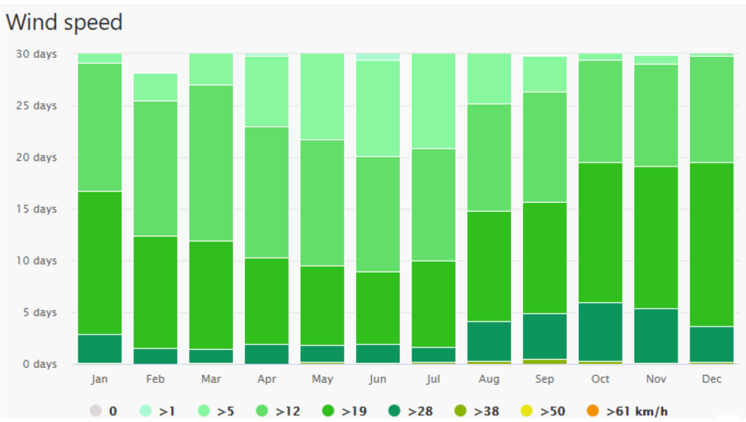

FIGURE 10: WINDSPEED OF HOPETOWN AREA (SOURCE METEOBLUE)

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TOPOGRAPHY

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

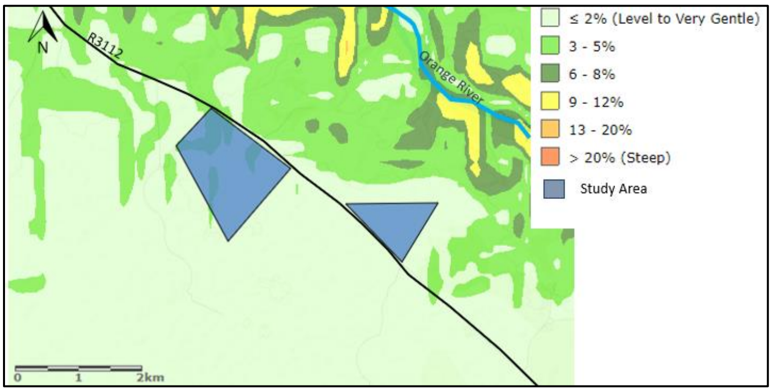

FIGURE 11: THE SLOPE PROFILE OF THE STUDY AREA ACCORDING TO AGIS

Site B is level with slopes ranging ≤2%. The majority of Site A is level with slopes ranging ≤2%, with sections in the northern area of slopes ranging 3-5% according to AGIS. This is in accordance with the findings in the soil report, which indicated that the topography of the area was relatively flat with the majority of the area having an elevation of between 1114m and 1082m.

The only area where a decrease in elevation can be seen is on the north-eastern side towards the river. The slope is northeast and drainage will occur in the north-eastern direction. Although a slope was present, it was insignificant due to the slope being too level. It can thus be concluded that farms close to the study area would possibly not be affected by drainage.

Small areas situated in the middle of Site A had a southern slope. The drainage would be to the riverside (northeast). Site A & B both showed a downward movement of the slope.

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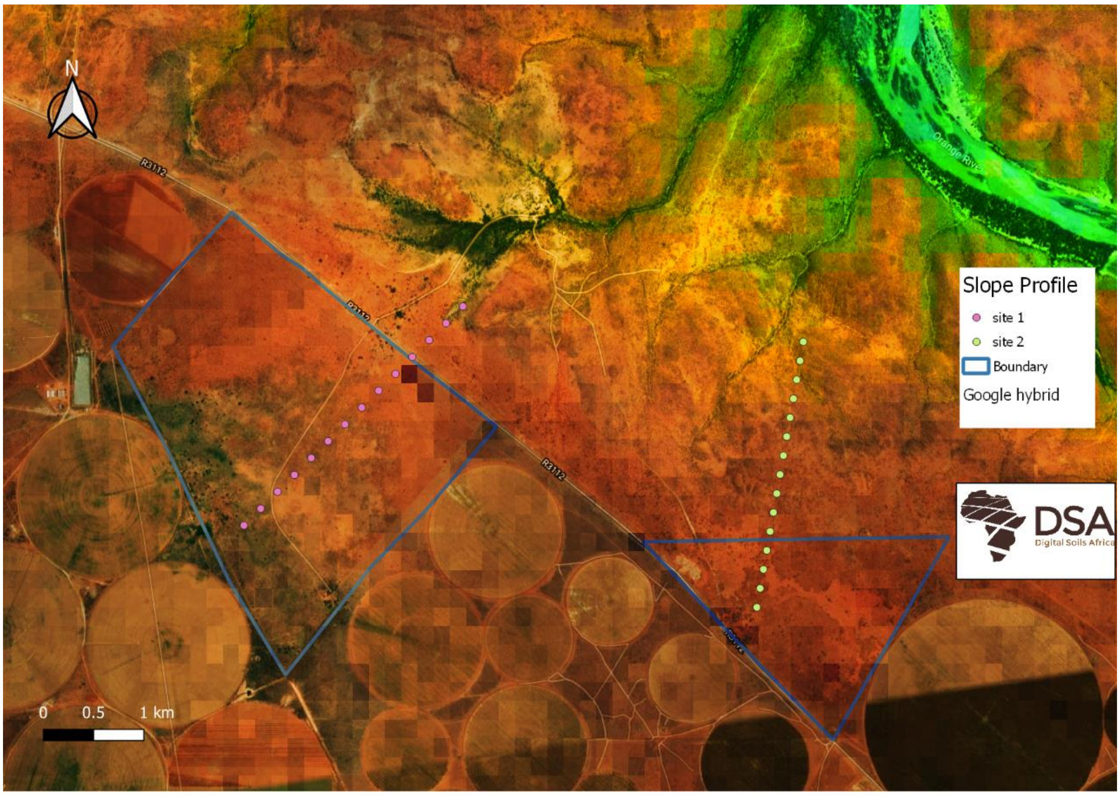

FIGURE 12: DIGITAL ELEVATION MODEL (SOIL REPORT). THE DOTTED LINES INDICATE THE DIRECTION OF DRAINAGE TOWARDS THE ORANGE RIVER.

Direct Impacts on the topography

Construction Phase:

During the construction phase, clearance of vegetation and ploughing of topsoil will take place simultaneously at Site A and Site B within 2-4 months. 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 phases, therefore there will not be a need to construct additional roads. Since the clearing of vegetation and ploughing of topsoil will not impact the height and form of the landscape, and since no cuttings will be necessary on the access roads, the impact on the topography during the construction phase is rated insignificant.

Operational Phase:

During the operational phase, the crops will be established, which will slightly elevate the perceived topography of the site, due to the height of the crops as it grows. However, the crops are seasonal, and the Applicant intends to rotate crops annually. Thus alternative years there will be crops on-site and pasture land the next. The very limited height increase in the landscape every alternative year 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 toilet (especially during harvest seasons), beacons and/or farming signs, but will have a limited impact. This interference will be similar to the impacts that farm residences and associated infrastructure pose in the landscape.

Indirect Impacts on the topography

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

Cumulative Impacts on the topography

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

Impact on the topography

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Site Specific	1	Site Specific	1	Site Specific	1	Site Specific	1
Duration	Short Term	1	Short Term	1	Permanent	4	Permanent	4
Intensity	Low	2	Very Low	1	Low	2	Very Low	1
Probability	Likely	3	Probable	2	Likely	3	Probable	2
Cumulative Impact	Very Low		Very Low		Low		Low	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Very Low**	**12**	**Insignificant**	**6**	**Low**	**21**	**Very Low**	**12**

Extent to which impacts can be reversed	Negative impacts can be mitigated through the proper establishment of crops and managing the topsoil.

GEOLOGY & PALAEONTOLOGY

Geology

During an interval of some 150 million years, from Late Carboniferous through to Early Jurassic times, deposition of a very thick succession of Karoo Supergroup sediments took place within several intra-continental basins in the Northern Cape. The most extensive of these was the Main Karoo Basin. This basin now occupies the southern half of the province and in ancient Karoo times, it was situated within the interior of the Supercontinent Pangaea.

According to the 1:250 000 geological map 2922 Prieska (Council for Geoscience, Pretoria), the area around Hopetown is underlain at depth by Precambrian lavas of the Allanridge Formation (Ventersdorp Group, *Ra*) as well as Dwyka tillites (Mbizane Formation, *C-Pd*) and basal Ecca mudrocks (Whitehall Formation, *Ppw*) of the Karoo Supergroup. The basement lavas and Karoo sediments are largely overlain by Late Cenozoic (Quaternary) deposits made up of calcretes, surface limestone (Qc) and Kalahari Group wind-blown sand (Qs) in the vicinity of the study area.

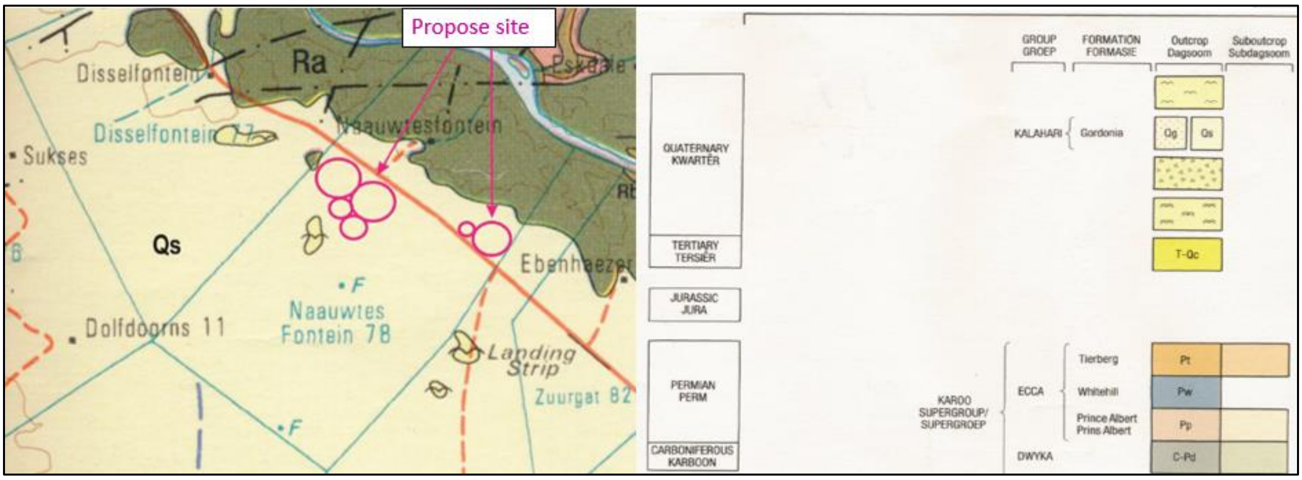

FIGURE 13: 1:250 000 GEOLOGICAL MAP 2922 PRIESKA (COUNCIL FOR GEOSCIENCE, PRETORIA), THE SITE IS INDICATED BY THE PINK POLYGONS.

The clearing of vegetation and establishment of crops and pasture will not impact the geology of the site.

Palaeontology

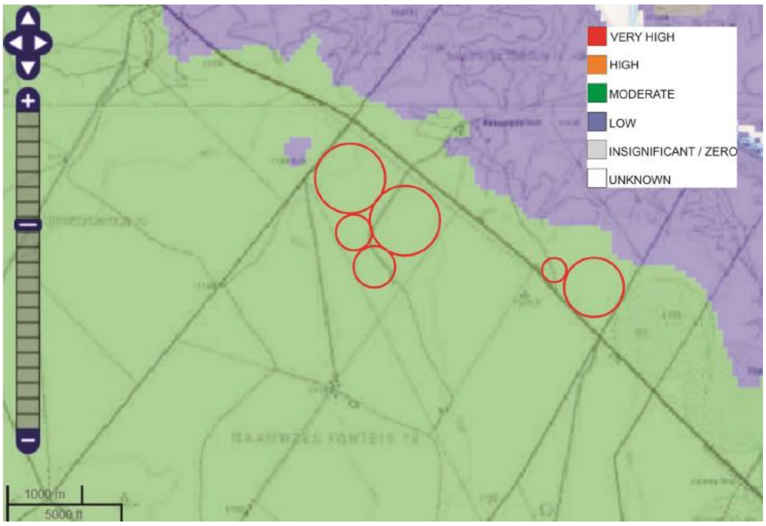

FIGURE 14: SAHRIS PALAEOSENSITIVITY MAP OF THE STUDY AREA (PAPAEO FIELD SERVICES, 2021).

According to Dr. Rossouw from Palaeo Field Services, downcutting and incision by the Orange River indicate that the region is underlain by Precambrian, Ventersdopr Supergroup Lavas (Allanridge Formation, *Ra*), which is composed of resistant-weathering, dark green lavas and associated pyroclastic rocks. Outcropping further southeast of the study area, the Ventersdorp lavas are unconformably overlain by Dwyka Group tillites of the Mbizane Formation (*C-Pd*), a largely heterolithic unit recognised in the upper part of the Dwyka Group of the Karoo Supergroup. It represents valley and inlet fill deposits left behind on Ventersdorp basement rocks by retreating glaciers about 300 million years ago. These Dwyka-aged palaeovalleys bear evidence of glaciated pavements, consisting of well-preserved polished surfaces striations on basement rocks, which abound throughout the area. 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 full report can be viewed in Appendix E.

In terms of paleontology, Dr. Rossouw indicated in his report that no fossils (Quaternary) or fossil exposure were observed within the footprint area. No impact is expected, but the potential occurrence can never be fully excluded.

SOILS

SOIL PROPERTIES:

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

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

A soil survey was conducted to determine whether the land would be suitable for the cultivation of crops. The soil forms found included, Coega, Glenrosa, Kimberley, Olienhout, Nkonkoni, and Plooysburg. The Nkonkoni, Glenrosa, Olienhout, and Kimberley soil forms were generally considered suitable for irrigation, while portions of the Nkonkoni, Glenrosa, and Plooysburg soil forms were only moderately suitable due to the depth of limiting material. The Coega soil form and portion of the Olienhout soil forms were considered not suitable for irrigation.

The Nkonkoni (97 ha) and the Plooysburg (65 ha) soil forms are the dominant soil forms in the study area (see Figure 15). The Kimberley soil form was found in the northern and southern sides of the study areas and covered approximately 57 ha. The Glenrosa soil form (36 ha) was observed in the northern and eastern sides. The Coega and Olienhout soil forms occurred the least in the study area with the Coega covering 21 ha and the Olienhout 9 ha.

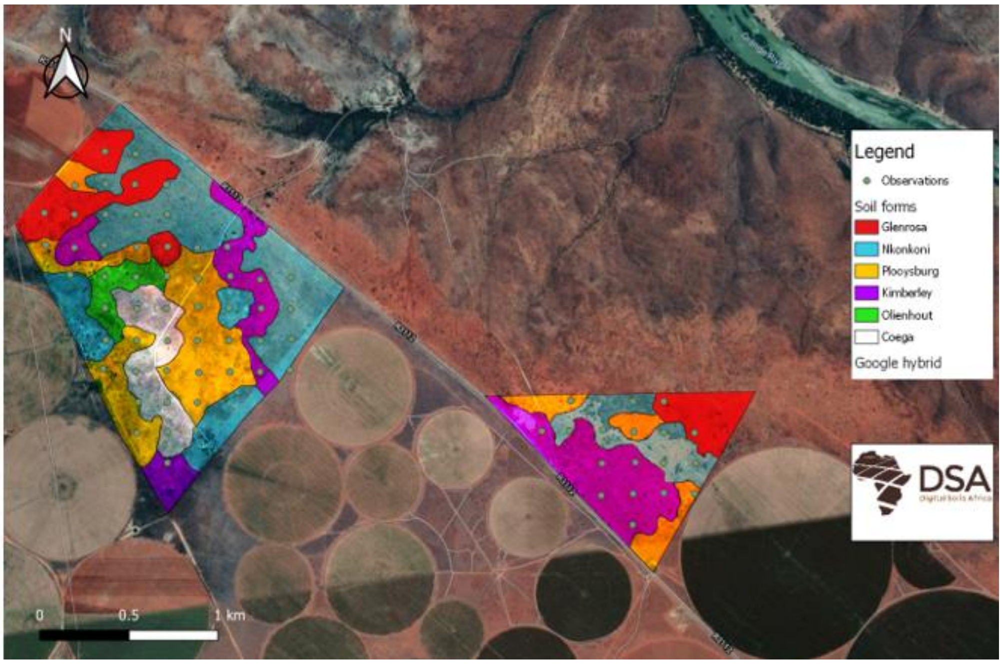

FIGURE 15: SOIL FORMS OF THE STUDY AREA (SOURCE SOIL REPORT)

According to the soil report, the soils of the study area are quite deep with most of the soils ranging from 1.01-2 m in depth. The Coega soils were associated with the 0-0.5 m soil depths and represent mostly soils not suitable for irrigation.

The only restricting layers were hard carbonate and the lithic horizons. The hard carbonate was found within the Coega, Plooysburg, and Olienhout soil forms, while the lithic was found within the Nkonkoni and Glenrosa soil forms.

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The Lithic horizon had a restricting layer at 800 mm depths at certain profiles where the TLB did not go further. Upon further inspection of the profiles, it was found that the lithic horizon could be ripped and thus giving way to depths more suitable for irrigation.

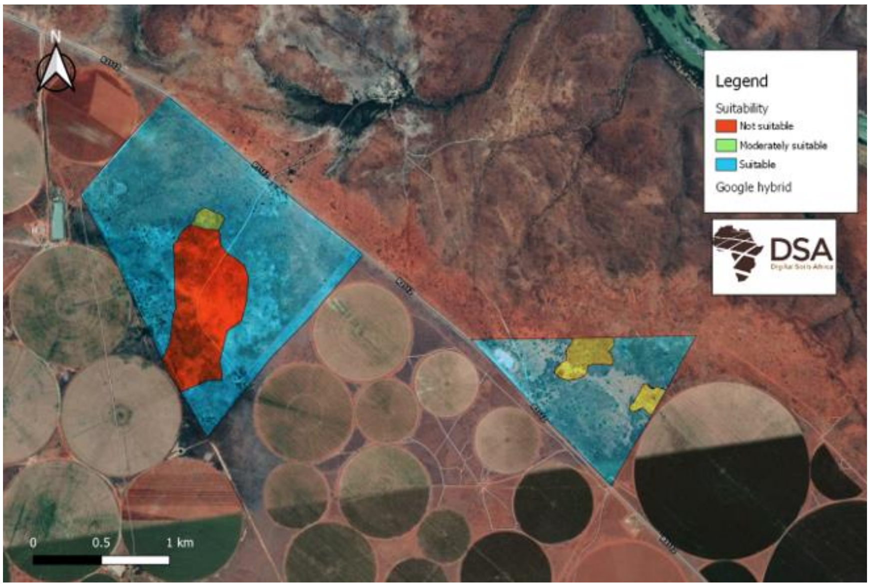

FIGURE 16: SUITABILITY AREAS FOR CROP PRODUCTION (SOIL REPORT)

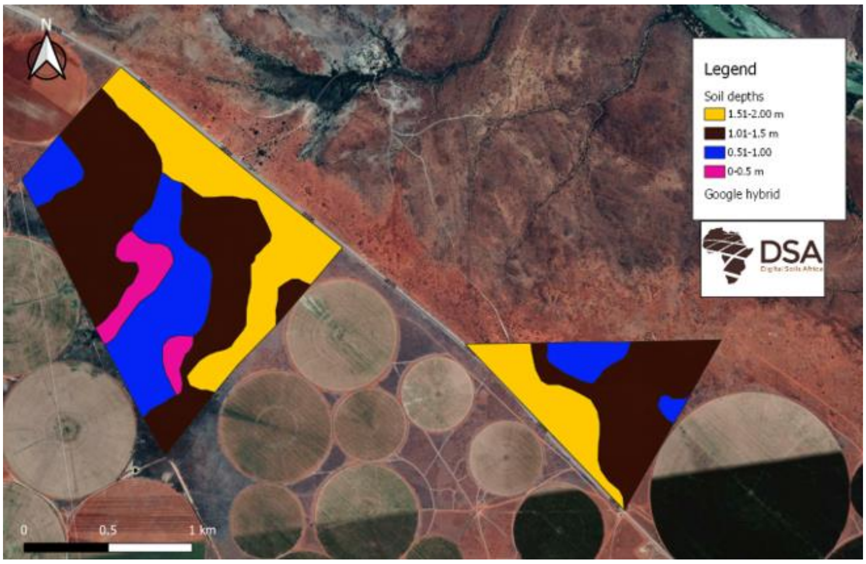

FIGURE 17: SOIL DEPTH AT THE STUDY AREA (SOIL REPORT)

Chemical analysis of the soil was done and was found the A and B horizons are chemically very similar. The pH is slightly acidic and ranges from 5.56 to 5.94, indicating that there is no salinity evident from the pH values. The pH values can be altered from a fertility perspective. The Cation Exchange Capacity (CEC) is extremely low (2.63-4.38 cmol(+)/kg), this, in turn, has a pronounced effect on the Exchangeable Sodium Percentage (ESP). The ESP is very high and especially high for a red apedal soil. Since ESP is a percentage of the Na to CEC, the low CEC can exaggerate the ESP. An exaggerated ESP is supported by the low Electrical Conductivity of the soils. The irrigation threshold of EC for water is 400 mS/m. These soils can be rectified with irrigation and fertilization on soils with adequate drainage, the Na should leach out and be replaced with Ca, Ma and K, lowering the ESP.

Clay percentages are generally low and very sandy. Most soils will have good drainage, but soil water holding capacity and fertility will be low and will 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, provided there is sufficient physical drainage. The texture results show that in general, the soils do have sufficient drainage.

Ultimately the soil report concluded that most of the surveyed area is suitable for irrigation, due to the free-draining soils and cracked rock underlying most profiles. Both areas not suitable for irrigation are limited by external drainage.

The soil report recommended that in Site A, the pivot placement does not exceed more than 10% of unsuitable soil in a pivot. Since Site B has small areas of moderately suitable soils for irrigation, these can be incorporated into pivots, and thus the pivot placement is not affected by suitability.

Ultimately the conclusion is that about 177Ha is suitable for cultivation, according to the norms and standards provided by the Northern Cape Department of Agriculture.

Direct Impacts on the soil

Construction Phase:

The construction phase is effectively the clearing of vegetation, plowing of soil, and planting of crops. The clearance of vegetation will take place simultaneously at Site A and Site B within 2-4 months. According to the soil report, the A and B horizons are characteristically sandy and therefore will facilitate good drainage. The major concern is the exchangeable sodium percentage (ESP) values that are high.

Na in relation to other cations is high, thus a possible indication of sodicity, and if not managed correctly, can lead to degradation of soil by reducing the flow of water through soil, which limits leaching and can cause salt to accumulate over time and develop of saline subsoils. It can also cause crusting and sealing on the soil surface, which impedes water infiltration, accelerating erosion and causing structureless soils.

If the soil is not managed according to the mitigation measures, there is a risk of soil degradation but the soil report indicated that this potential risk can be rectified with irrigation and fertilization on soils with adequate drainage, so that the Na can leach out and be replaced with Ca, Ma and K, lowering the ESP.

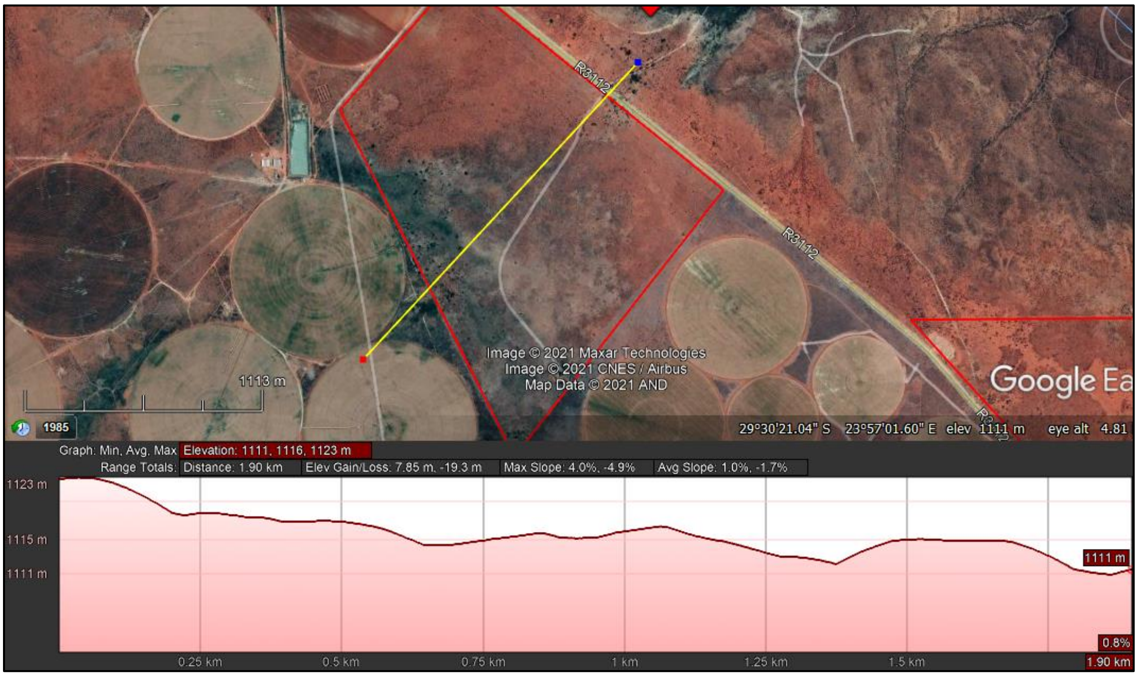

FIGURE 18: TOPOGRAPHICAL DIAGRAM OF SITE A WHICH ILLUSTRATES THE DRAINAGE DIRECTION FROM SOUTHWEST TO NORTHEAST. AS CAN BE SEEN ON THE CROSS-CUT DIAGRAM, THERE MIGHT BE A POTENTIAL IMPACT OF ABUTTING FARMS DRAINING TOWARDS THE PROPOSED SITE.

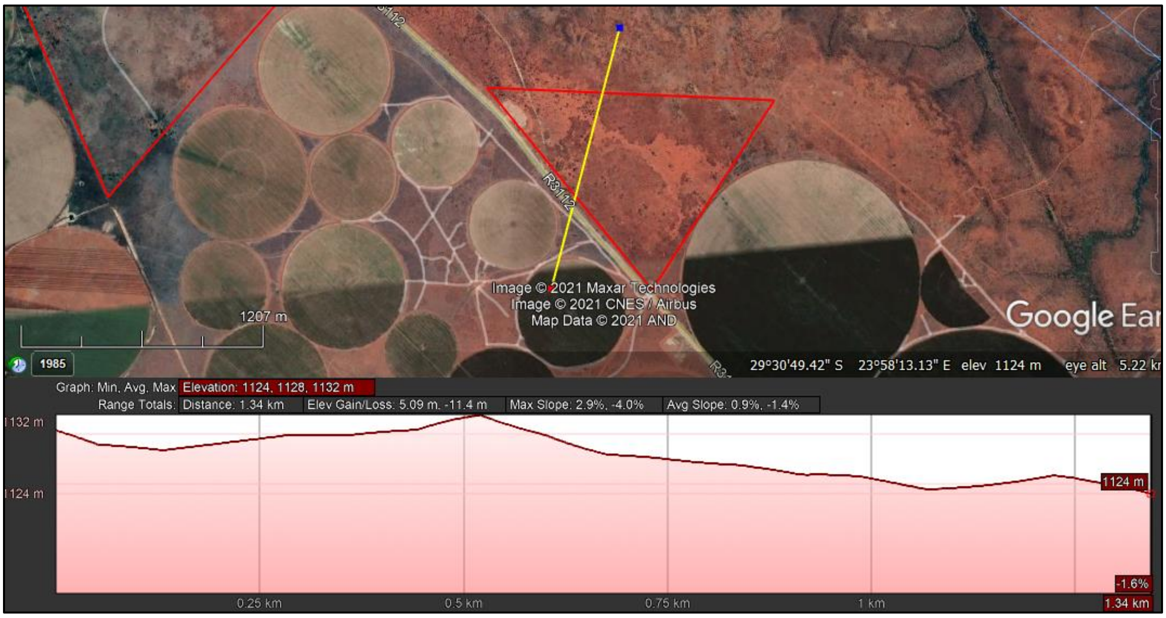

FIGURE 19: TOPOGRAPHICAL DIAGRAM OF SITE B WHICH ILLUSTRATES THE DRAINAGE DIRECTION FROM SOUTHWEST TO NORTHEAST. AS CAN BE SEEN ON THE CROSS-CUT DIAGRAM, THERE WILL NOT BE A POTENTIAL IMPACT OF ABUTTING FARMS DRAINING TOWARDS THE PROPOSED SITE.

With mitigation measures, the direct impact on the soil 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.

Operational Phase:

The operational phase is the phase where soil management must take place to ensure that pivot areas producing crops continue to produce a harvest and does not lead to degradation of the soil or soil on abutting farm areas. After about 4 months 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. It is also the intent of the Applicant to rest the crop fields annually through rotating crops. About 200Ha is currently approved and under crop production, the addition of the 269Ha will allow the Applicant to continue to produce 200Ha of crops per annum, but also allowing the alternating camps to rest. It is not the intent of the Applicant to increase crop production to 400Ha per annum. 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, such as deep ripping, removing access rocks, spreading of chicken manure or other organic fertilisers on the land, as well as Gipson or lime to leach out the Na.

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:

Soils that have high ESP values are a possible indication of sodicity if not managed correctly and can lead to soil degradation, which can lead to low agricultural profitability and could result in loss of income and investment to the farmer, but also the loss of employment to those contracted to work on the farm. Thus, the indirect impact of the loss of soil properties due to mismanagement, is 1) reduced income from the crop production which could ultimately lead to 2) the loss of employment.

If the soil is not managed it could reduce the flow of water through soil, which limits leaching and can cause salt to accumulate over time and development of saline subsoils. It can also cause crusting and sealing on the soil surface, which impedes water infiltration, accelerating erosion and causing structureless soils at the site.

Drainage is away from abutting neighboring crops and they should not experience an indirect impact or financial loss or employment loss. 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, Site A is flanked by pivot areas of neighbouring farms, except to the northeast of the site. During the Scoping Phase public participation, a neighbor raised a concern regarding the natural slope of their site and drainage of water towards Site A and ultimately towards the river. This might potentially be a problem for the Applicant if water from abutting farms drains into the applied site and cumulatively, added irrigated water that drains towards the Orange River. This cumulative impact will be discussed in more detail under the heading ‘Water’.

In terms of soil properties, the cumulative draining of water to Site A from abutting properties could result in waterlogging at the site, which occurs whenever the soil profile or the root zone of a plant becomes saturated that there is insufficient oxygen in the pore space for plant roots to be able to adequately respire. Waterlogged and inundated areas contribute recharge to saline aquifers, and are very susceptible to water erosion, and are prone to soil structure decline if cultivated or stocked when too wet (Soil Quality, 2021).

The soil report indicated that most of the soils have good free-draining soils and cracked rock underlying most profiles, thus the drainage is good and the soil water holding capacity is low. The mid-section on Site A is however underlain by a hardpan carbonate horizon and other hard rock, which is an indication of water accumulation in arid climates. If water from abutting neighbours is received it will likely accumulate in this portion of Site A, which is excluded from being cultivated according to the site layout plan, thus the Applicant should not experience a cumulative impact.

According to the soil report, drainage will take place on Site A towards the northeast, and thus it is not expected that irrigation and drainage will cumulatively contribute to water accumulating on the center section of Site A as a result of this project (see Figure 18) and therefore not contribute to the soil degradation risk. The same applies to Site B.

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The Applicant will have to monitor the situation at the site and specifically the 55Ha pivot areas on Site A. If waterlogging on the pivot areas is noted, this impact can be mitigated. Options might vary from shallow surface drains to more intensive drainage using wide-spaced furrows.

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 vineyard. Soils susceptible to water erosion are normally silty, are weakly structured, have low organic contents, and have poor internal drainage.

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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 Nkonkoni soil form has medium potential for wind erosion and a high potential for water erosion. The Plooysburg soil form has a low potential for wind erosion and medium potential for water erosion. The Kimberley soil form has medium potential for wind- and water erosion.

The types of erosion can include:

- Sheet erosion (water erosion), which 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. The predicted soil loss is considered very low according to the AGIS atlas.

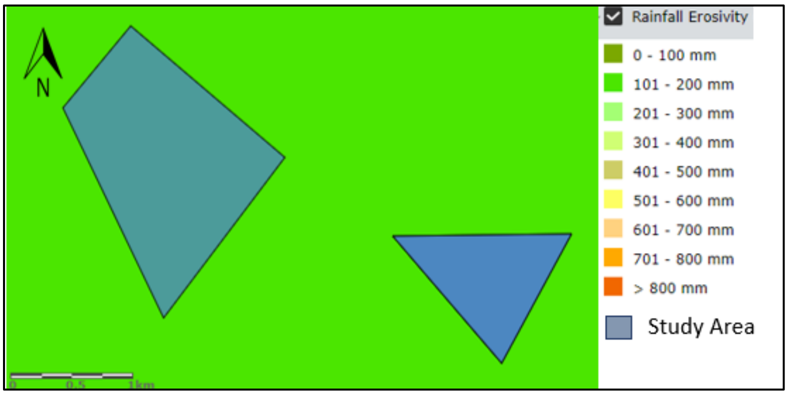

FIGURE 20: PREDICTED SOIL LOSS OF THE STUDY AREA AND GREATER SURROUNDS (AGIS COMPREHENSIVE ATLAS)

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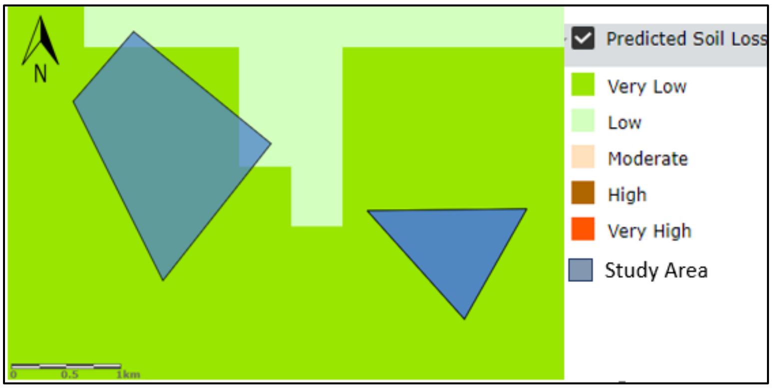

FIGURE 21: PREDICTED SOIL LOSS (AGIS COMPREHENSIVE ATLAS)

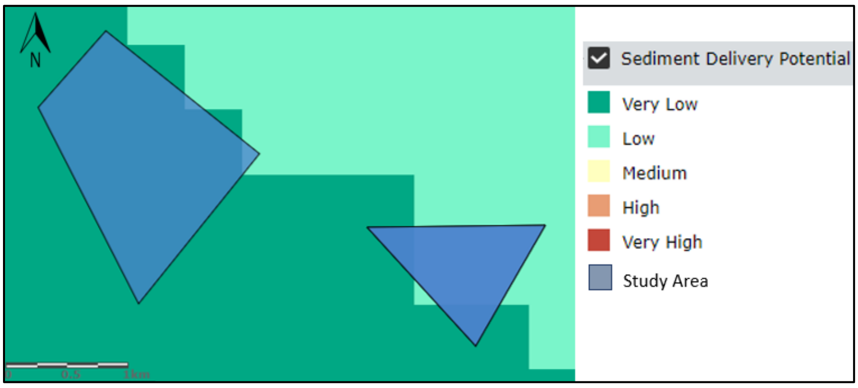

FIGURE 22: SEDIMENT DELIVERY POTENTIAL OF THE STUDY AREA AND GREATER SURROUNDS (AGIS COMPREHENSIVE ATLAS). THE SITE FALLS WITHIN AN AREA THAT IS CLASSIFIED AS VERY LOW TO LOW SEDIMENT DELIVERY POTENTIAL.

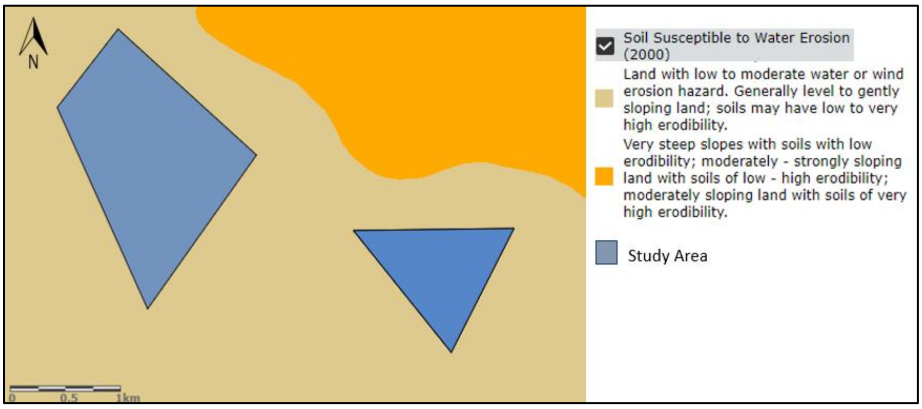

FIGURE 23: SOILS SUSCEPTIBLE TO WATER EROSION OF THE STUDY AREA AND GREATER SURROUNDS (AGIS COMPREHENSIVE ATLAS). THE SITE FALL WITHIN AN AREA THE IS CLASSIFIED AS LAND WITH LOW TO MODERATE WATER OR WIND EROSION HAZARD. GENERALLY, LEVEL TO GENTLY SLOPING LAND.

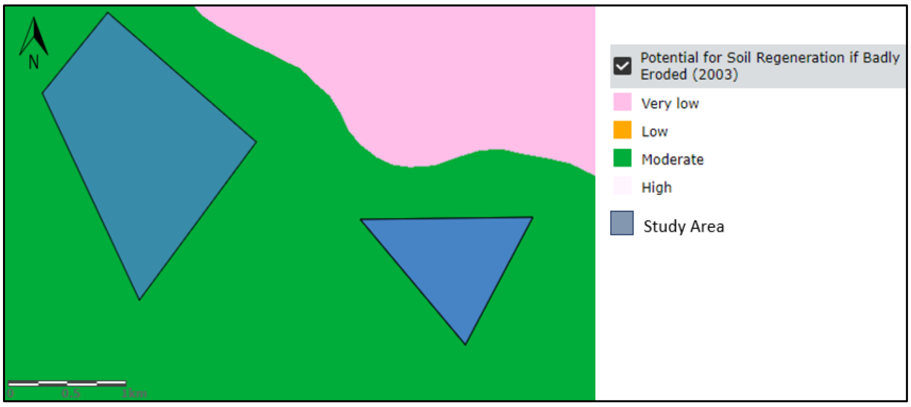

FIGURE 24: POTENTIAL FOR SOIL REGENERATION IF BADLY ERODED OF THE STUDY AREA AND GREATER SURROUNDS (AGIS COMPREHENSIVE ATLAS). THE SITE FALLS WITHIN AN AREA THE IS CLASSIFIED AS LAND THAT HAS A MODERATE POTENTIAL FOR SOIL REGENERATION.

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.

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.

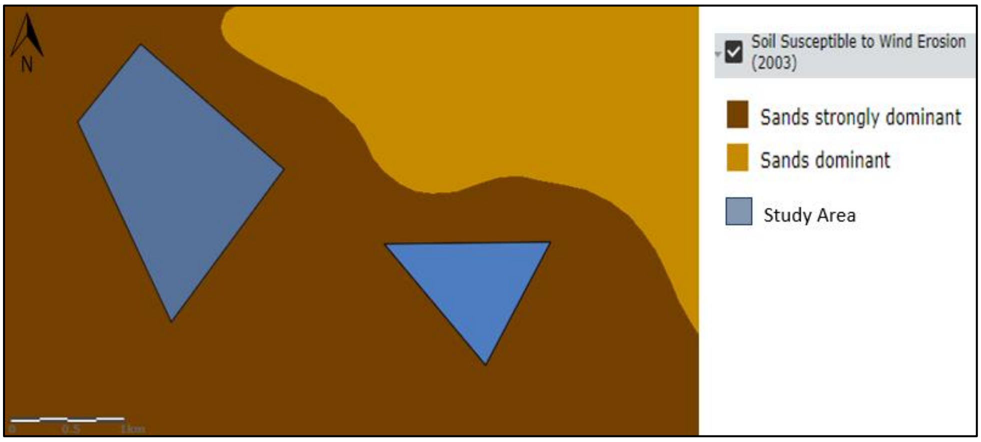

FIGURE 25: WIND EROSION SUSCEPTIBILITY OF SOILS IN THE STUDY AND SURROUNDING AREA (AGIS COMPREHENSIVE ATLAS). THE SITE FALLS WITHIN AN AREA THAT HAS LOAMY SANDS THAT IS STRONGLY DOMINANT.

To verify the literature review, fieldwork was conducted and according to the soil report, the Cation Exchange Capacity (CEC) is extremely low (2.63-4.38 cmol(+)/kg), this, in turn, has a pronounced effect on the Exchangeable Sodium Percentage (ESP). The ESP is very high and especially high for red apedal soil. Since ESP is a percentage of the Na to CEC, the low CEC can exaggerate the ESP. An exaggerated ESP is supported by the low Electrical Conductivity of the soils. The irrigation threshold of EC for water is 400 mS/m. These soils can be rectified with irrigation and fertilization on soils with adequate drainage, the Na should leach out and be replaced with Ca, Ma and K, lowering the ESP. Considering the above, there is a risk of wind and water erosion at the sites.

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 simultaneously at Site A and Site B within 2-4 months and the site will be prepared with an irrigation system.

The clearing of vegetation will not cause depressions or change in natural topography and will follow the natural incline of the area, which will reduce the erosion impact further since the site is already relatively flat 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 in 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 reducing 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 fall out on the crops. In the case study, if dust had an impact on the photosynthesis of the maize, it did not result in a smaller harvest, 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 whether the dust will or will not have an impact on harvest yields.

High dust levels can however introduce harmful fungus and mold and can cause mass infection and 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, mold 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 resulted dust generation will be the highest risk due to the clearance of vegetation. With the predominant winds in summer being westerlies, there is a slight chance of silt being deposited into the Orange River system during summer periods when the harvest is completed and the pivot areas are ploughed. The cumulative impact as a result of immediately abutting crop areas will be more pronounce regarding this potential impact, however considering the large distance of over 2.6 km from Site A, and over 1.7km from Site B to the Orange river respectively, and the fact that the areas between the sites 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.

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

Regarding the possible use of pesticides to control fungus, mold, mites, and weeds, another negative, indirect environmental impact is the possible degradation of the soil and water quality, depending on the chemical reactions and sensitivity of toxins from the receiving environment. To mitigate the impact, genetically manipulated crops are planted, which have significantly reduced the risk of fungus, mold, 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, no erosion was noted on the site or the abutting farm south of Site A. It is the opinion of the author that the cumulative impact on erosion is limited and with proper soil management the risk of increased erosion is low.

Regarding the cumulative impact on wind erosion and effectively dust fall out, will depend on the harvest seasons and crops. If areas on neighboring farms are harvesting at the same time (e.g. maize, wheat, etc.) then cumulatively exposed areas will increase, and should strong winds be experienced during such times could intensify the impact. The addition of the proposed 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

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site. No chemicals or hazardous substances will be stored at the site, any fertilizers or pesticides will be stored off-site at the farm shed.

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

Due to the limited amount of vehicles that will be used on the site the worst-case scenario would lead to very small hydrocarbon spills that will penetrate the soil immediately and will percolate to lower levels. The 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 occur. The impact is rated low under worst-case scenario conditions and insignificant under normal circumstances due to the limited spills anticipated in the study area.

In terms of sewage, a chemical toilet should be provided at the study site once clearance commences, to prevent the surroundings from being used for ablutions. Due to the small number of people anticipated being onsite during the construction phase (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 people. 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, 2 (two) chemical toilets must be provided, one toilet for every 10 people, and can be removed from the site once the harvest season is over.

As previously discussed, the main concern was the Na that was high in relation to other cations, which could lead to sodicity. However, the exchangeable sodium percentage (ESP) values are high, thus, it indicates that sodicity is not a general threat to irrigation on this site. On these soils the risk of sodicity can be rectified with irrigation and fertilization and Na should leach out and be replaced with Ca, Ma and K, lowering the ESP. To achieve this, the soil will be deep ripped once the harvest is cleared, the spreading of chicken manure or other organic fertilizers, but also Gipson or lime should be applied to leach out the Na. Thus fertilization will occur and considering the good drainage of the soil could migrate through the soil that can lead to organic pollution of surface water systems (the enrichment of surface water due to an increase in nitrates, phosphates, ammonium, etc.) due to the likely lateral drainage of the system. This will be discussed further under the heading 'Water'.

In terms of pesticides, the Applicant indicated that years ago when they first started with the maize production they had massive problems with the stalkborer (*Busseola fusca*), which lead to 80% crop damage. They have since changed to genetically modified crops which have completed eliminated the stalkborer infestation. With the change to genetically modified crops, they rarely have 2-3% damage on the entire maize crops, thus the use of pesticides has decreased considerably.

In terms of pathogens, the Applicant indicated that during wet years (usually once every 5 years) they do sometimes have a struggle with the *Fusarium* fungus in the lower-lying areas on 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.

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

- Spray on-time
  On-time spraying will help protect the crops 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.
- 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 crops grow. Also, depending on the pest, product use, and climate will determine spraying the whole crop 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 westerlies and easterly winds, since the Orange River or abutting crops on the neighboring farm is in the direct path of these winds. The label instructions must always be followed.

- 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.

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

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

<u>Indirect Impacts on the soil pollution</u>

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

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

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

Soil pollution caused by pesticides can also kill beneficial soil microorganisms and reduce soil fertility. This will lead to a financial impact and can ultimately cause the die-off of the 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 on surrounding farms. Many pesticides have been measures in South African waters (Quinn *et al,* 2011). Pesticides in the aquatic environment have the potential to affect all end-users, including both humans and wildlife. On its own, the proposed application would not have a high impact, but cumulatively, pesticides in the environment can have detrimental impacts. 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 for occupational exposure but also end-used exposure (Quinn *et al,* 2011), and a few studies have reported the levels of insecticides in wildlife species. Pesticides have been detected in wild bird species, as well as in indigenous fish species, indicating pesticide contamination within various habitats. The usefulness of pesticides cannot be denied, however, the negative effects on the environment and human health can also not be ignored. In South Africa, several environmental and anthropogenic factors have to be considered before the impact of large-scale (cumulative) pesticide use can be assessed (Quinn *et al,* 2011).

South Africa, and specifically the Northern Cape, is a water-poor region and there is a fine balance between the economic benefits of exporting agricultural products against the loss of water through crop irrigation and water quality degradation. As discussed by Quinn *et al*. (2011), to ensure sufficient dilution of all agrochemicals in South Africa to an acceptable water quality level (used in a typical farming situation applying current-use pesticides), is

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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 easterlies at the risk of drift spray towards the Oranje Rivier, the same applies for westerlies (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.							

LAND USE AND LAND CAPABILITY

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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 to the south and west of Site A are used for commercial irrigation. Overall the site itself can be mostly described as an area with a mix of shrubland and unimproved natural grassland.

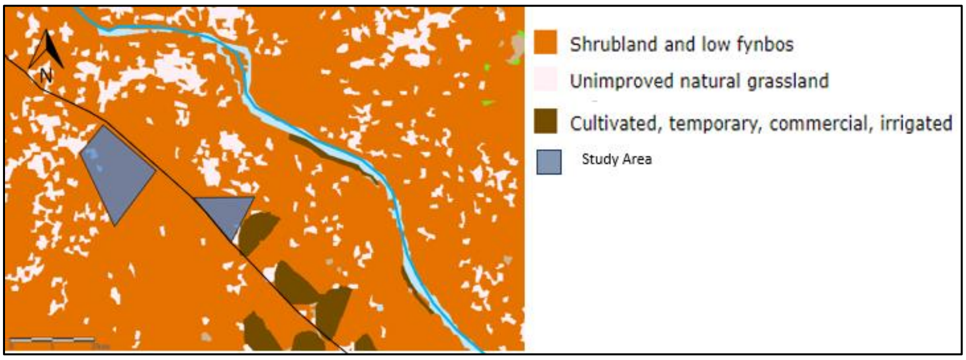

FIGURE 26: LAND COVER CLASSIFICATION ACCORDING TO AGIS

At the proposed site (Site A and B) maize and wheat will be planted, rotating with lucerne the following year and so forth. Lucerne will be planted on alternative years during the rest period for the land. The Applicant did not indicate that it would be harvested but rather grazed by livestock.

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

In comparison with livestock production in South Africa, only 70% of agricultural land in South Africa can be utlilized for livestock and game, and species are found in all provinces, with high concentrations in the eastern higher rainfall regions. Statistics in 2010 indicated that only 13.6 million beef cattle, 1.4 million dairy cattle, 24.6 million sheep, 7 million goats, 3 million game species, 1.1 million pigs, 113 million broilers, 31.8 million layers, and 1.6 million ostriches (Meissner *et al*., 2013). In relation to field crops and horticulture, livestock products increased from 42% to 47% of gross agricultural value, mainly due to the rise in demand in the consumer market, particularly for meat. The sector has always been a major employer, but the employment rate has declined steadily since 2000 because of increased minimum wages, fewer commercial farmers, and increased property size.

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

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

Thus, from the above, livestock farming will continue, but will be more intensified in the alternating years.

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 low conservation status of the site and the zoning, a change in agricultural practice would not detrimentally affect the ecological value of the property concerned, but would rather boost the economic status thereof when establishing crops, alternating with grazing. 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 into crop production would also not compromise the needs and the wellbeing of future generations.

Direct Impacts on Land use

Construction Phase:

The stripping of topsoil and clearing of the vegetation, establishing the irrigation system and the planting of maize or wheat (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). However, the following year lucerne will be planted and grazed, thus the impact on grazing will be temporary, alternating each year.

Overall, the land use of the property will not change but remain agricultural use. The change in agricultural activities (grazing to crops) will, however, be offset against the net profits of the maize and wheat production, which the landowner had weighed up against the current GDP produced by the grazing unit of the natural veld. The GDP for maize and wheat will be substantially larger than those generated by the current grazing capacity of the site and with the establishment of lucerne, the grazing capacity will increase.

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 (92 Ha).

To mitigate this potential impact during the construction phase, the planning of the pivot 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

The Applicant intends to rest the crop fields annually through rotating crops. About 200Ha is currently approved and under crop production, the addition of the 269Ha will allow the Applicant to continue to produce 177Ha (pivot area identified in the site layout plan) of crops per annum, but also allowing the alternating camps to rest. It is not the intent of the Applicant to increase crop production to 400Ha per annum. 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, such as deep ripping, removing access rocks, spreading of chicken manure or other organic fertilisers on the land, as well as Gipson or lime to leach out the Na.

Thus, 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.

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 very low, but without mitigation, the impact on land use is rated low.

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 lessor extent environmentally.

From an economical point of view, the expected R5.8 million annual income, the 9 employment opportunities during the construction phase, 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 reduce to moderate (negative) without mitigation and the result of failed crops.

From an environmental point of view, about 177Ha of natural veld will be disturbed and transformed into the pivot areas, however, the vegetation report completed by Dr. van Aardt, indicated that the plant species found at the site is typical of species from the Kimberley Thornveld (SVk4), which is classified as least threatened and karroid vegetation and is not listed as an endangered or protected ecosystem. Although the vegetation report indicated that the drainage line at Site A might serve as an important ecological feature with ecological functions, the author was not aware of the fact that neigboring farms created the drainage lines to drain their runoff into the centre of Site A and thus artificially created the drainage line and it is not natural.

Another area of concern, according to Dr. van Aardt, is the grass dominated shrubland Site B, due to the presence of high numbers of the protected *Vachellia haematoxylon*.

As a recommendation, Dr. van Aardt indicated that most of the areas surrounding the study area are already transformed and it is therefore recommended that most of the geophytes be transplanted in other natural areas. Several large trees of the protected *Vachellia heamatoxylon* and *V. erioloba* were found at the study site. Dr. van Aardt recommends that effort must be made to protect as many as possible of these species. Permits need to be obtained before any of the protected and specially protected species can be removed. No red data species were found to be present in the study area. All alien invasive species, especially the *Prosopis glandulosa* and *Tamarix ramosissima* should be removed and eradicated from the site as a high priority.

Therefore the transformation of this unit into pivots will not lead to the degradation of a protected or endangered ecosystem, but if approved to the removal of several protected plant species. However, since the connectivity is already compromised, it is better from an environmental point of view to develop this section, rather than another more intact portion of land. From an environmental point of view, the impact is rated low with mitigation but increase to low-moderate without mitigation.

Cumulative Impact on the land use

Cumulatively, if crops are established, it would increase the total area under cultivation in this region by about 177Ha, 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	Short Term	1	Short Term	1	Short Term	1	Short Term	1
Intensity	Medium	4	Low	2	Medium	4	Low	2
Probability	Likely	3	Likely	3	Likely	3	Likely	3
Cumulative Impact	None		None		None		None	
Status	Negative		Negative		Negative		Negative	
Confidence	High		High		High		High	
Significance	**Low**	**18**	**Very Low**	**12**	**Low**	**18**	**Very Low**	**12**
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 the Kimberley Thronveld (SVk4) vegetation type and a vegetation survey was completed by Dr. van Aardt. According to the vegetation report, four different vegetation units were identified at Site A, and two different vegetation types at Site B.

Site A:

Vegetation unit 1 is not regarded as pristine and is seen as invaded due to the presence of *Prosopis glandulosa* and *Tamarix ramosissima* and other alien invasive and problem plants. However, this area is considered an area with high ecological sensitivity due to the area being a wetland/drainage line with an important ecosystem function. The presence of the protected *Babiana hypogaea* further supports this. The vegetation report indicated that this unit is a medium conservation priority.

Vegetation unit 2 is in a natural state containing vegetation typical of karoo veld. This vegetation is dominated by the presence of *Eriocephalus ericoides*, *Lasiosiphon polycephalus, Pentzia incana, Melolobium* microphyllum*, M. canescens* and various species of *Lycium*. There are also various grasses mostly from the genus *Stipagrostis* present in this vegetation unit. This vegetation unit has a medium conservation value due to the natural state thereof, and the presence of *Boophone distica* and *Brunsvigia* sp., *Ruschia spinosa, Vachellia haematoxylon* and *Pelargoium nanum*. The low cover abundance of the alien invasive *Prosopis glandulosa* has little effect on the natural state of this vegetation unit at present. The vegetation report indicated that this unit is a medium conservation priority.

Vegetation unit 3 is dominated by shrubs such as *Rhigozum trichotomum* and *Sengalia mellifera* indicating possible historical overgrazing, which can also be regarded as natural with a medium conservation value. This unit also contains protected species such as *Ruschia spinosa* and *Jamesbrittenia pinnatifida*. The vegetation report indicated that this unit is a medium conservation priority.

Vegetation unit 4 can be seen as shrub-veld dominated by grasses such as *Aristida congesta, Eragrostis lehmanniana* and *Stipagrostis namaquensis.* Other shrubs include Ericephalus ericoides, Osteospermum leptolobum and several species of *Asparagus* and *Lycium*. Two protected tree species (*Vachellia haematoxylon* and *V. erioloba*) are also present in this vegetation unit. Although only a few individuals of *V. erioloba* were found, *V. haematoxylon* were much more prominent and numerous. Other protected species includes *Boophone disticha* and the specially protected *Harpagophytum procumbens* subsp. *procumbens.* The vegetation report indicated that this unit is a high conservation priority.

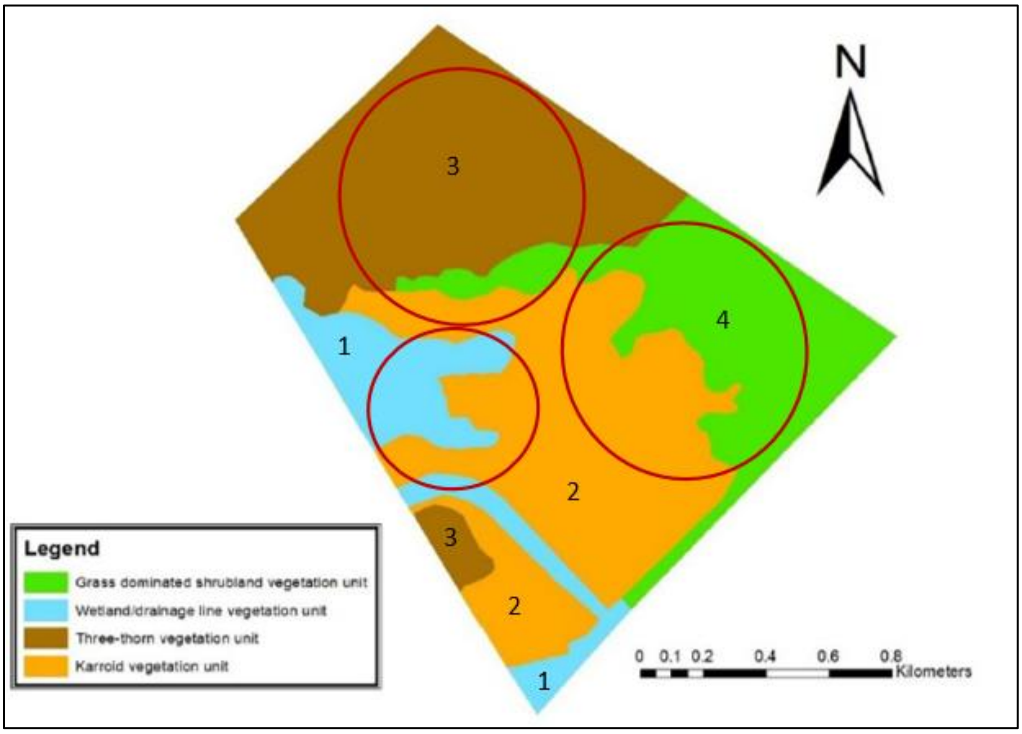

FIGURE 27: VEGETATION UNITS OF THE SITE A ACCORDING TO THE VEGETATION SURVEY REPORT. THE RED CIRCLES INDICATE THE PROPOSED PIVOT AREAS.

Site B

<u>Vegetation unit 1</u> is seen as natural with a medium conservation priority. This vegetation unit is similar to vegetation unit 3 in Site A. The species composition is also similar and in a natural state with a medium conservation priority. Dominated shrubs include *Rhigozum trichotomum* and *Senegalis mellifera* indicating possible historical overgrazing. This unit also contains protected species such as *Ruschia spinosa, Plinthis karroicus, Boophone diticha, Harpagophytum procumbens* subsp. *procumbens* and *Jamesbrittenia pinnatifida*. This vegetation unit contains vegetation typical of karoo veld. The vegetation report indicated that this unit is a medium conservation priority.

<u>Vegetation unit 2</u> ismostly dominated by the grass *Aristida congesta* with *Eragrostis lehmanniana, Stipagrotis uniplumis* and *Setaria verti-cilliata*. The dominant shrubs include *Lasiosiphon polycephalus, Lycium bosciifolium, L. cinerieum, Asparagus suaveolens, A. capensis, Chrysocoma cilliata* and *Eriocephalus ericoides.* Protected species in this unit include *Ruschia spinosa, Boophone disticha, Vachellia heamatoxylon* and *Harpagophytum procumbens* subsp. *procumbens.* The vegetation report indicated that this unit is a medium conservation priority.

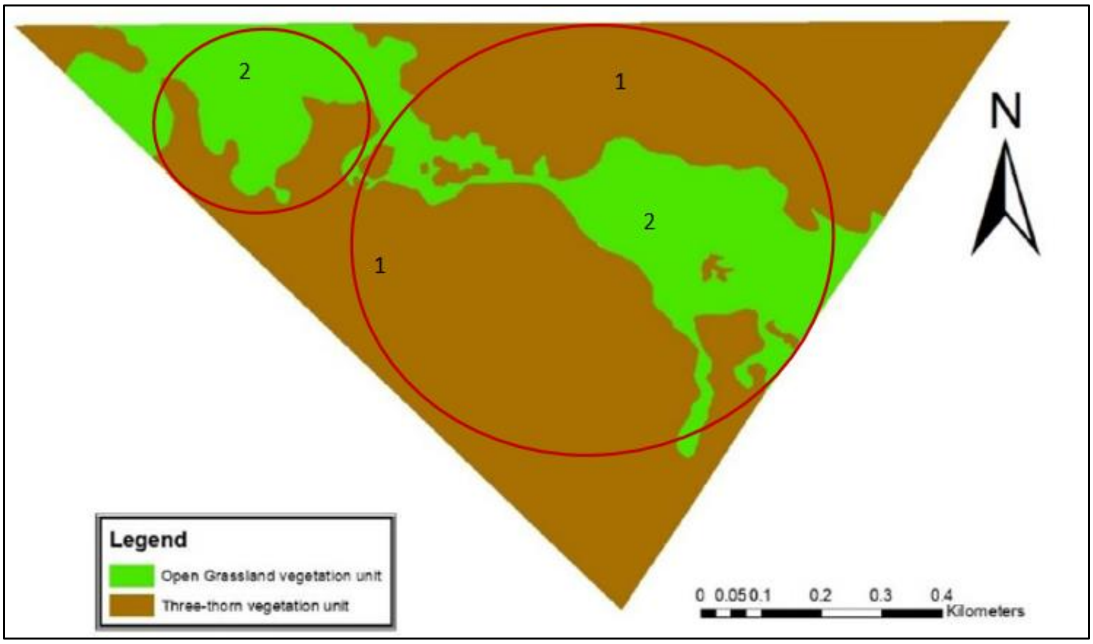

FIGURE 28: VEGETATION UNITS OF THE SITE B ACCORDING TO THE VEGETATION SURVEY REPORT. THE RED CIRCLES INDICATE THE PROPOSED PIVOT AREAS.

According to the report completed by Dr. van Aardt, the species found in the abovementioned vegetation units is typical of species from the Kimberley Thronveld (SVk4) and karroid vegetation. The site is not listed as an endanged or protected ecosystem with only the wetland/drainage line as an important ecological feature with ecological function. Another area of concern is the grass dominated shrubland in Site B, due to the presence of high numbers of the protected *Vachellia heamatoxylon.*

In terms of connectivity, Dr. van Aardt indicated that Site A has no to very limited connection to any natural vegetation due to the existing land-uses surrounding the site. Site B is however connected to the natural vegetation of SVk4 on the north-eastern and north-western boundaries but since the southern boundaries are bordered by agricultural land and the R3112 abuts the site, the connectivity is very limited.

What was interesting to find from the two specialist studies completed (soil and vegetation) for this site and more specifically Site A, was that the soil report did not find any soil indicating the presence of a wetland, however, at Site A a wetland/drainage line vegetation unit was classified. If the soil is considered, the areas where the vegetation report identified the wetland/drainage line vegetation have a limiting factor of hard carbonate layer at about 0.5-1m deep. Considering the feedback from the abutting neighbour during the Scoping Phase public participation, that they have constructed drainage lines on their property to drain into this particular site, it is not surprising that wetland/drainage line vegetation has succeeded in establishing. If sufficient water from abutting croplands accumulates for enough time in this area the hard carbonate layer will limit drainage and the soil will become saturated for longer periods, resulting in vegetation preferring saturated soils.

The vegetation report did indicate that this vegetation unit (1) of Site A contains individuals of the declared alien invader tree species *Prosopis glandulosa* and *Tamarix ramosissima* that displace many native species. From an

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ecological perspective, the area has a medium conservation value due to the invasion. Although the vegetation report indicated that it is an important ecosystem functioning due to it being a drainage line and is therefore regarded as having a high ecological sensitivity, it is clear from the soil report, feedback from I&AP's, and the presence of invader trees that this is an artificial drainage line due to anthropogenic action. On the other hand, the presence of the protected *Babiana hypogaea* does indicate that the ecosystem is adapting and as an offset, the areas outside of the proposed pivot areas on Site A, can be cleared from alien invaders and drainage can be directed towards the center area of Site A that is excluded from being developed to allow for similar microhabitat and establishing of *Babiana hypogaea*.

The full vegetation report can be viewed in the appendix attached.




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FIGURE 29: VEGETATION FOUND AT THE SITE AT SITE A

FIGURE 30: VEGETATION FOUND AT THE SITE AT SITE A

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 pivot areas for crop production, thus the removal of natural vegetation will be permanent and to the extent of about 177Ha.

According to the Red List of South African Plants compiled by SANBI (2020) no red data species could be found for the study area. Below is the list identified by Dr. van Aardt of species found onsite:

TABLE 3: PROTECTED AND SPECIALLY PROTECTED SPECIES (VEGETATION REPORT).

	Northern Cape Nature Conservation Act	
Species	**Schedule 1 Specially protected**	**Schedule 2 Protected**
Anacampseros filamentosa		X
Babiana hypogaea		X
Boophone disticha		X
Brunsvigia sp		X
Harpagophytum procumbens subsp. *procumbens*	X	
Jamesbrittenia pinnatifida		X
Pelargonium nanum	X	
Plinthus karooicus		X
Ruschia spinosa		X
Vachellia erioloba		X
Vachellia haematoxylon		X

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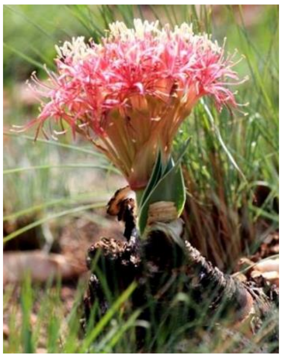
As a recommendation, Dr. van Aardt indicated that most of the areas surrounding the study area are already transformed and it is therefore recommended that most of the geophytes be transplanted in other natural areas. Several large trees of the protected *Vachellia heamatoxylon* and *V. erioloba* were found at the study site. Dr. van Aardt recommends that effort must be made to protect as many as possible of these species. Permits need to be obtained before any of the protected and specially protected species can be removed. No red data species were found to be present in the study area. All alien invasive species, especially the *Prosopis glandulosa* and *Tamarix ramosissima* should be removed and eradicated from the site as a high priority.



Vachellia heamatoxylon *Vachellia erioloba* *Babiana hypogaea*



Boophone distica *Brunsvigia* sp *Harpagophytum procumbens* subsp. *procumbens*



Jamesbrittenia pinnatifida *Pelargoium nanum* *Ruschia spinosa*

Prosopis glandulosa (alien species) *Tamarix ramosissima*

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

The area 92 Ha around the pivot areas that will not be cleared and if for whatever reason the crops are not successful, the probability of the site being rehabilitated to represent Kimberley Thronveld vegetation will be possible since the surrounding area would have ensured that there are a sufficient percentage of vegetation surface cover and over time, other species will migrate on the rehabilitated land and eventually the Kimberley Thronveld vegetation will through natural succession migrate into the rehabilitated pivot areas. The success of rehabilitation will however not be passive, but active planting and irrigation of species representative of the Kimberley Thronveld 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 medium, due to the fairly large portion of the area to be disturbed and 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 geophytes, obtain the permits that need to be obtained, and the alien eradication plan, the significance level is rated moderate, without any mitigation the impact increase to moderate-high. Once in operation, the impact is reduced to low-moderate.

ALIEN VEGETATION CONTROL

Prosopis glandulosa

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

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

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

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

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

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

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

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

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

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

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

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

<u>Tamarix ramosissima</u>

All species are facultative phreatophytes that can use both surface and groundwater. The presence of numerous trees along riparian corridors or around desert springs can seriously reduce underground water tables and surface water availability, drying up wetlands, and reducing flows. Roots extract salts from deep soil layers and excrete it from the leaves. Salt is deposited on the soil surface with leaf litter. The increased salinity of the upper soil profile inhibits the growth, survival, and recruitment of desirable native vegetation. Although some animals will seek cover or nest in Tamarix thickets, most wildlife does not consume Tamarix foliage, fruits, or seeds. Tamarix species can increase flooding in riparian areas by narrowing channel width. In addition, the plants are flammable and can introduce fire into wetland and riparian communities that are not adapted to periodic burning (DiTomaso *et al*, 2013).

According to DiTomaso *et al* (2013), the following control methods can be implemented:

Mechanical (pulling, cutting, disking): include mowing, burning, chopping, chaining, and disking. However, these methods usually only suppress this species temporarily and will not eradicate infestations. Tamarisk is also able to resprout vigorously from the root crown following mechanical control methods. These methods can be labor-intensive and expensive and maybe more effective on small infestations.

Hand pulling can be an effective way to control tamarisk in situations where plants are small, where access is difficult, or where herbicides cannot be used.

Mowing is occasionally useful to reduce the volume of tamarisk before treatment with herbicide, especially in sites where prescribed burning is not feasible. However, a single cutting of tamarisk is ineffective, because tamarisks resprout vigorously. By comparison, cutting combined with herbicide treatment can be a very effective integrated approach.

In addition, cutting tamarisk can reduce consumption of groundwater, through the removal of transpiring leaves. Heavy equipment can be used to remove entire plants. However, this is expensive, and any fragments that move into the water column may resprout and form new populations. This technique also causes considerable soil disturbance and ecosystem disruption. A root plow pulled by a bulldozer has become a standard method for tamarisk control, providing good to excellent control. Root plowing is most effective when the soil is relatively dry and when combined with follow-up treatments such as hand grubbing resprouts or applying herbicides. Root plowing may affect desirable vegetation and could lead to wind erosion.

Cultural: Cattle, goats, and sheep will graze tamarisk plants if desirable vegetation is lacking, however it has little nutritional value and cattle will only graze young seedlings early in the year. Goats might be able to control dense stands of tamarisk where little native vegetation is present, particularly if the stands are cut or burned first, with goats eating the regrowth.

As a stand-alone strategy, burning has not been successful. Tamarisk is generally top-killed by burning, but plants readily resprout from the remaining root crown and adventitious buds on the lateral roots. Repeated yearly burns can suppress tamarisk and kill some of the plants after 3 to 4 years. Furthermore, burning may suppress tamarisk infestations by eliminating the closed canopy, slowing the rate of invasion, and allowing desirable vegetation to respond, thereby increasing biodiversity. Prescribed burns can be followed up with herbicide treatments to control resprouting plants. One strategy is to cut 20 to 25% of the largest tamarisk plants in stands several months before burning to create enough dry ground fuel to carry a fire efficacy, burning should be conducted during the hottest part of summer, when plants experience the greatest water stress.

Biological: The release of the tamarisk leaf beetle (*Diorhabda carinulata*) from China has made significant impacts on many populations of tamarisk. This insect feeds on the leaves of tamarisk and slowly reduces plant vigor. Tamarisk does not usually die from a single defoliation from tamarisk beetles, and it can resprout within several weeks of defoliation. Repeated defoliation of individual tamarisk trees can lead to severe dieback the next season and death of the tree within several years. Data indicate that 4 years of defoliation can result in about 60% mortality.

Biological control will not eradicate tamarisk but it has the potential to suppress tamarisk populations by 75 to 85%. The insect spreads rapidly but is poorly adapted.

Chemical control: There are various products, such as: Triclopyr Garlon 3A, Garlon 4 Ultra, Pathfinder II of which cut stump treatments can be very effective. Cut stems horizontally at or near ground level, and immediately apply herbicide solution to cover the outer 20% of the stump face. Follow-up treatment of resprouts with this mixture will be necessary. This mixture is selective and will not injure desirable grasses.

Glyphosate Rodeo, Aquamaster which provides only partial control of Tamarix species, because the herbicide precipitates out when in contact with divalent and trivalent salts, the salty excretions on the foliar glands will reduce the effectiveness of glyphosate. Foliar treatment with glyphosate will probably be most effective if applied shortly after a rainfall event

Imazapyr Arsenal AC, Habitat, Stalker, Chopper, Polaris is the most widely used herbicide to control Tamarix. Both conventional and low volume applications can give good control.

Glyphosate is nonselective. Spot treatments can be made using a drizzle gun. Plants should not be removed for at least 2 years to ensure good control.

As with all chemicals, it is important to read the manufacturers' labels and material safety data sheets before using it.

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Indirect impact due to the removal of vegetation

Construction & Operational Phase

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

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

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

Cumulative Impact on the Flora

The clearing of 177Ha of natural vegetation will ultimately contribute to the total areas cleared in the region for the establishment of cultivated lands. Since the area to the north and northeast of the study area hosts natural veld and the fact that the site is not considered an endangered or protected ecosystem the cumulative impact on clearing of vegetation is rated low.

Impact on the flora

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	Site Specific	1	Site Specific	1	Site Specific	1	Site Specific	1
Duration	Permanent	4	Permanent	4	Permanent	4	Permanent	4
Intensity	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 to the north and northeast 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 92 Ha area between the pivot areas and control alien vegetation.							

FAUNA

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

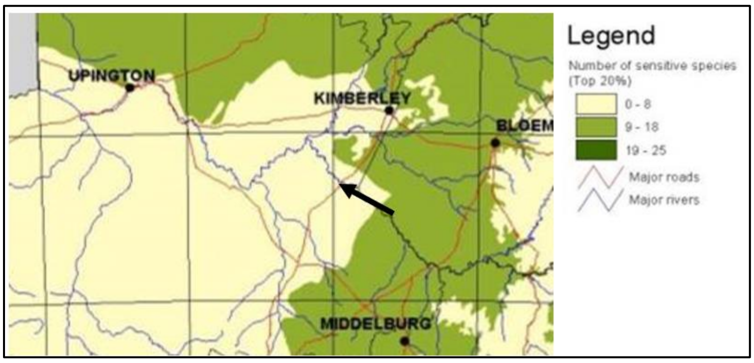

FIGURE 32: SENSITIVE MAMMAL SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

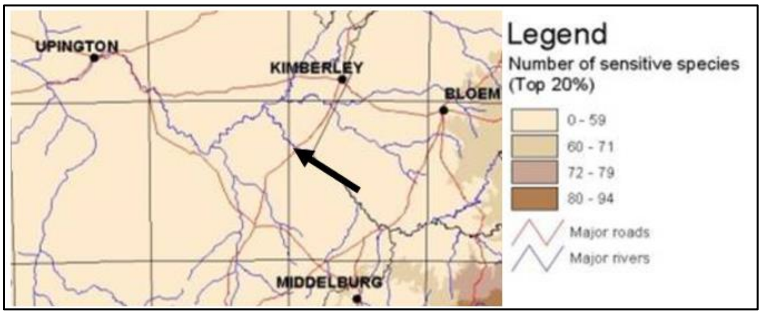

FIGURE 33: SENSITIVE BIRD SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

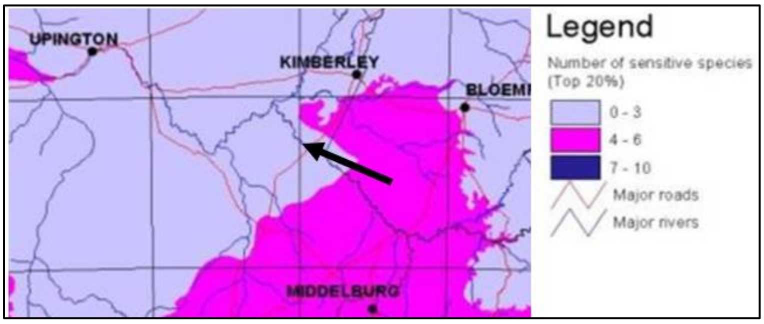

FIGURE 34: SENSITIVE REPTILE SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

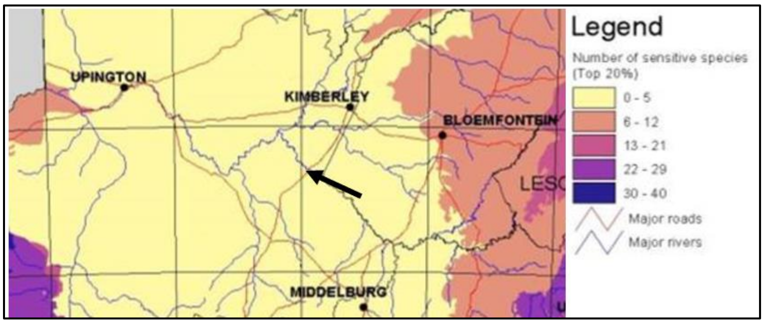

FIGURE 35: SENSITIVE BUTTERFLY SPECIES IN THE REGION. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

The occurrence of faunal species within the proposed area is likely, however, it is farm properties and generally fenced-in camps, which 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, steenbok (*Raphicerus campestris*), springbok (*Antidorcas marsupialis*) 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*).

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 and 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.

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 north of both Sites A & B is still in a natural condition, however, Site A is it is fenced and the R3112 separates the area from the closest drainage line that is about 500m northeast from Site A and the Orange River system that is more than 2.6km from the site. The rest of Site A is surrounded by cultivated land, thus Site A's ecological connectivity has been impacted even before development.

Site B has the most potential if connectivity. Although the site is also directly abutting cultivated areas to the south, east, and west, it is not separated towards the north from the Orange River system which is more than 1.7km from the site, and the closest drainage line of about 450m north from Site B that could provide a corridor for migration.

Overall, the study area, in its current status, is already 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 specific micro-habitat to a specific faunal species. The conclusion was that the site does not represent an endangered or protected ecosystem, thus it is highly unlikely that the destruction of habitat will lead to the impact on any specific faunal species that is dependent on a specific micro-habitat for survival or occurrence.

In terms of fish, amphibians, and most crustaceans, they would be restricted to aquatic environments, and since there are no water features the proposed development will not impact these animals or their movement. The artificial drainage line might host some amphibians, but since the center section of Site A will not be developed and most likely additional artificial drainage lines would have to be constructed, means that the habitat will not be destroyed, just relocated on Site A.

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

Most of the noises would be low-pitched and would have a lesser impact on animals than what high-pitched noises would have since their hearing systems are much more sensitive to the latter. This will cause animals to vacate the study site during 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, 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. On the day of inspection, game was noted on abutting cultivated lands that were being harvested.

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, 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 pivot areas, the impact is done. Future cultivation and harvesting will not increase the impact unless pivot 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 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 seed.

The length of time between similar crops also requires management with regards to 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 insects 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 for 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.

The Applicant indicated that years ago when they first started with the maize production they had massive problems with the stalkborer (*Busseola fusca*), which lead to 80% crop damage. They have since changed to genetically modified crops which have completed eliminated the stalkborer infestation. With the change to genetically modified crops, they rarely have 2-3% damage on the entire maize crops.

In terms of pathogens, the Applicant indicated that during wet years (usually once every 5 years) they do sometimes have a struggle with the *Fusarium* fungus in the lower-lying areas on 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.

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 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 practiced, and cost-effective methods of disease prevention.

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

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

In the unlikely event that 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.

<u>Cumulative Impact on fauna</u>

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 177Ha will be transformed within this region.

Considering the location of the study site, the abutting area north of Site A & B hosts similar habitat and due to the topography will not be transformed into croplands. If certain species were to be affected by the proposed development of 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 impediment of animal migration, thus no cumulative impact is expected in this regard. The overall cumulative impact is rated low with mitigation.

Impact on the Fauna

	CONSTRUCTION (no mitigation)	WEIGHT	CONSTRUCTION (with mitigation)	WEIGHT	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT
Extent	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.

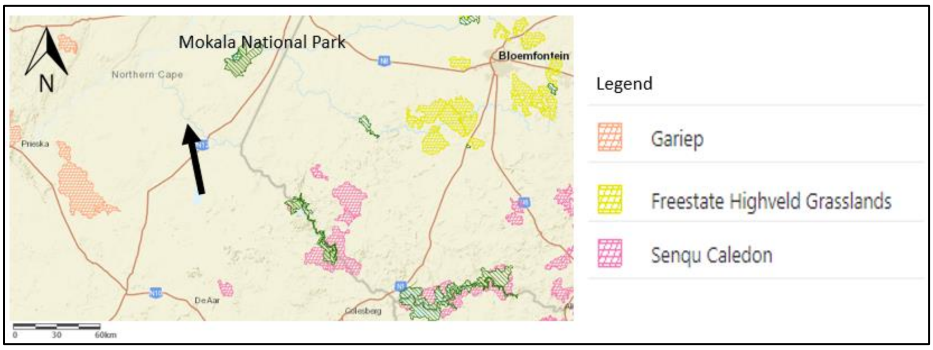

FIGURE 36: THE NATIONAL PROTECTED AREAS EXPANSION STRATEGY (NPAES) INDICATES THAT THE GARIEP FOCUS AREA, THE SENQU CALEDON FOCUS AREA AND THE MOKALA NATIONAL PARK IS SITUATED MORE THAN 60KM FROM THE SITE.

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

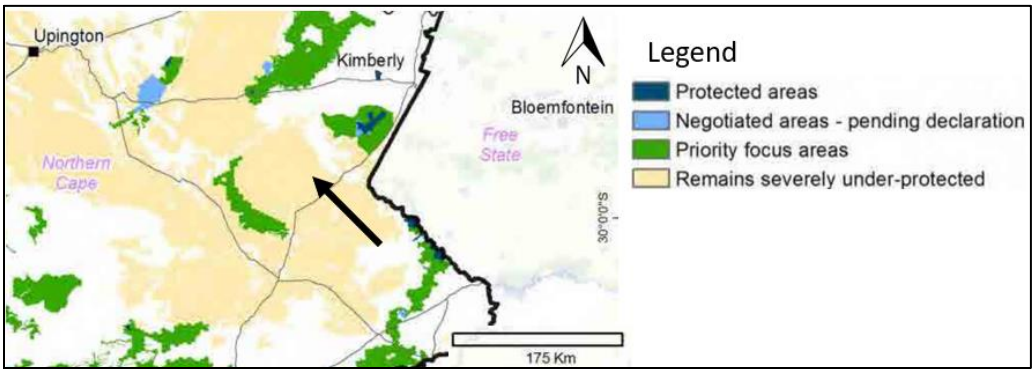

FIGURE 37: PRIORITY AREAS FOR THE PROTECTED AREA EXPANSION IN THE NORTHERN CAPE (BELFOUR ET AL. 2016).

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 does not fall within a Terrestrial CBA 1 or 2, or ecological support area, but within other natural areas. Critically Biodiversity Areas (CBA) play an important role in supporting ecological processes. This is particularly the case with riparian areas, some key catchment areas, and key pieces of corridors. CBA areas should preferably not be further developed, no further intensification of land-use activities should be permitted and they should be prioritised for rehabilitation, where possible.

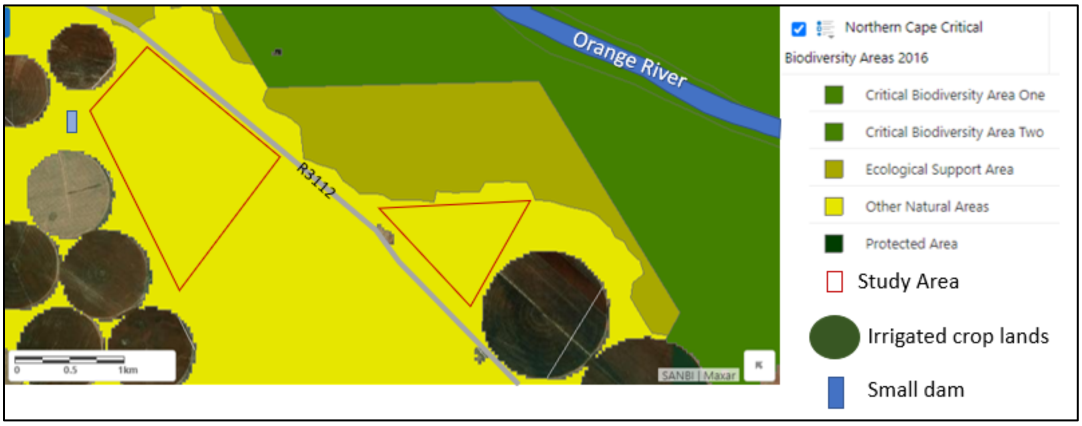

FIGURE 38: THE SITE FALLS WITHIN 'OTHER NATURAL AREAS' ACCORDING TO THE BGIS OF THE NORTHERN CAPE BIODIVERSITY CONSERVATION PLAN.

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

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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.

TABLE 4: 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.

The Thembelihle Municipality does not have a Spatial Development Framework, but the Pixley Ka Seme District Municipality has a Spatial Development Framework. According to this SDF, the site falls within an area that is rated as a low sensitivity area, according to the Sensitivity Map (see Figure 39).

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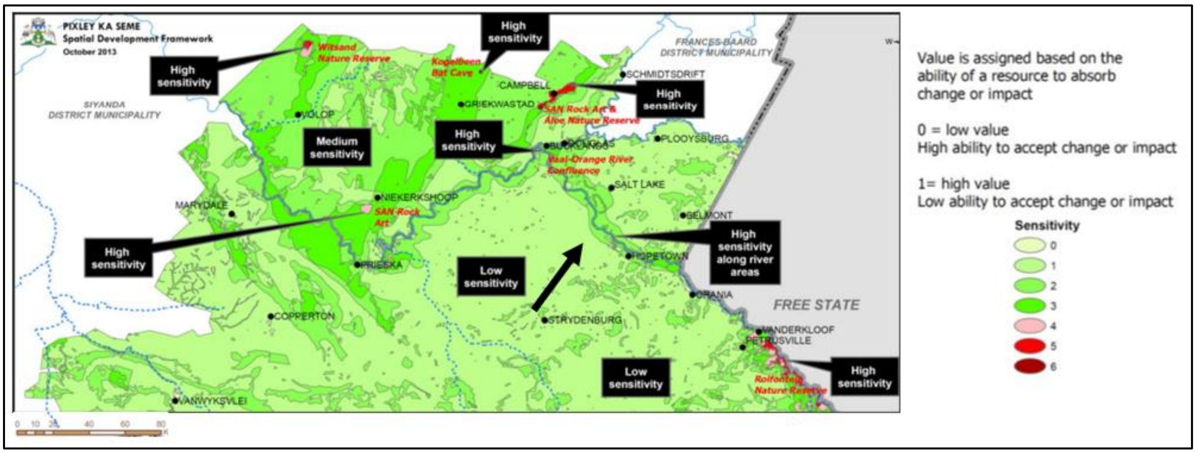

FIGURE 39: SENSITIVITY MAP OF THE PIXLEY KA SEME DISTRICT MUNICIPALITY. THE BLACK ARROW INDICATES THE LOCATION OF THE SITE.

Conservation of the unique Karoo landscape and fauna and flora is very important to maintain the environmental quality and resources in the Pixley Ka Seme District. The conservation of an area must be seen as a form of land use and such land areas must be carefully managed to ensure it remains a viable resource for the future. The sensitivity map of the Pixley Ka Seme District Municipality provides a guideline for the effective management and conservation of the high sensitivity areas and care should always be taken to adhere to environmentally sustainable use of these areas to ensure the biodiversity of the areas.

Considering all the maps available and data presented, it must be 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. 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, for example, if the Thembelihle Municipality had an SDF, it would have been considered 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 the onsite verification is therefore essential. According to the vegetation survey report, the onsite investigations confirmed that the plant species found at the site is typical of species from the Kimberley Thornveld (SVk4), which is classified as least threatened and karroid vegetation and is not listed as an endangered or protected ecosystem. Although the vegetation report indicated that the drainage line at Site A might serve as an important ecological feature with ecological functions, the author was not aware of the fact that neigboring farms created the drainage lines to drain their runoff into the centre of Site A and thus artificially created the drainage line and it is not natural. Thus the broad-based, regional/national plans are applicable.

Since the clearing of vegetation and essentially destroying about 177 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 simultaneously at Site A and Site B within 2-4 months from commencement of the project and irrigation systems will be installed and the site prepared for the planting of crops. Thus from a flora perspective, several protected species were found, but no red data species were found. No endangered or protected ecosystems were found, the area has a limited connection to other environments with natural conditions that represent the Kimberley Thornveld.

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, steenbok (*Raphicerus campestris*), springbok (*Antidorcas marsupialis*) 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*), but not to say that any of the other important listed species does not occur at the site since no formal fauna survey was conducted.

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 hinders 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 Site A is more than 2.6 km southwest, and Site B is more than 1.7 km southwest of the Orange River, and over 500m from the closest drainage line to the northeast and 450m to the north respectively from the sites. Animals can therefore use the riparian zone of the river and drainage lines to relocate to other areas northeast 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 92 Ha between the pivot 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 disrupting the movement of migrating animals or even plant species. On the other hand, studies have shown that some endemic faunal species prefer transformed lands and could have a positive impact on such species populations. Both Sites A and B are surrounded by cultivated land and if developed it will seem like a continuation of abutting sites. As indicated above, the fences at 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 hosted 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 productions 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, 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 mitigation 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. To the knowledge of the author, there are no mines near the proposed site to contribute toward the cumulative impact.

The proposed crop development will contribute 177 Ha of destroying natural habitat to the cumulative impact, but if the off-set plan is implemented, soil managed, and mitigation measures listed in the Environmental Management Plan are followed, it is conclusion is that the cumulative impacts on the biodiversity and ecosystem function on the site would be of low-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	Medium		Low-Medium		Medium		Low-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 92 Ha between pivot areas and control 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 D33G. The National Freshwater Ecosystems Priority Areas (NFEPA) identifies important catchments based on the presence of important biota or the degree of riverine degradation. The important catchment areas are then classified as Freshwater Ecosystem Protection Areas (FEPA's).

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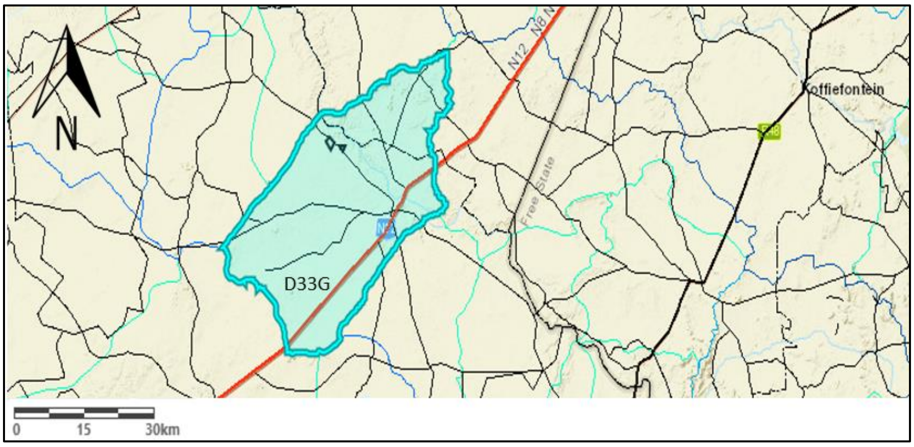

FIGURE 40: QUATERNARY CATCHMENT OF THE SITE IS D33G.

The site is located within a Fish Support Area of the *Barbus anoplus*. The back fish symbol on the map (see Figure 41) 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 both Sites A and B do not host any water feature (wetland, natural drainage line, stream, or river) and are situated more than 1.7km and 2.6km from the Orange River respectively. Site A is situated about 500 southwest of the nearest drainage line, but the R3112 separates the site from the drainage line and Site B is about 450m south of the nearest drainage line. Thus, there is no impact expected on the *Barbus anoplus* fish sanctuary.

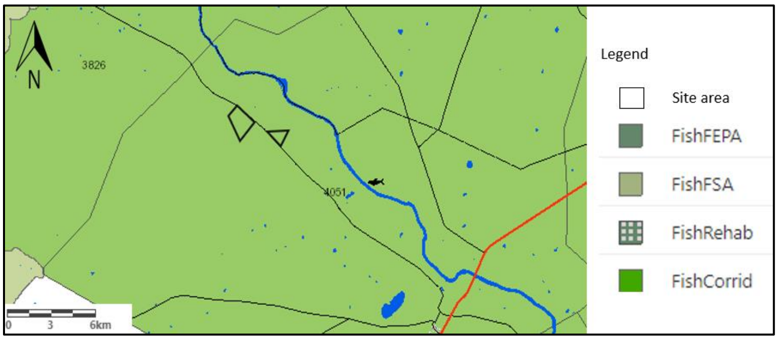

FIGURE 41: THE SITE FALLS WITHIN A FISH SUPPORT AREA.

The site is situated within the Eastern Kalahari Bushveld Group 3 wetland vegetation group.

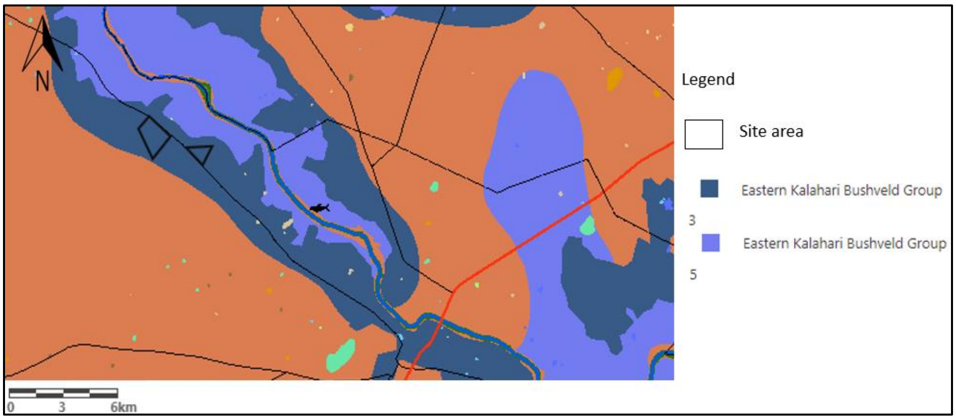

FIGURE 42: THE SITE FALLS WITHIN THE EASTERN KALAHARI BUSHVELD GROUP 3 VEGETATION GROUP.

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

Direct Impact on the watercourses

Construction and Operational Phase:

During the construction phase, the natural vegetation will be removed from 177Ha and topsoil will be ploughed, and during the operational phase the harvesting of crops and establishing of new crops/lucerne will result in similar impacts as the construction phase. 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.

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. The natural drainage of both Sites A and B is northeast.

Site A is situated about 500m southwest of the nearest drainage line that eventually (2.6 km further) drains into the Orange River. In terms of surface runoff, the R3112 sever the site off and it is expected that any surface runoff that might contain silt will drain into the road reserve and away from the drainage lines. Surface runoff is however, highly unlikely, considering the sandy soil with easy drainage and the low rainfall this area generally receives.

Site B is situated about 450m south of the nearest drainage line that eventually (1.6 Km further) drains into the Orange River. In terms of surface runoff, the path is not impeded but considering the sandy soil and low rainfall, it is unlikely that the impact of possible silt transport as a result of clearing vegetation will impact the Orange River.

Furthermore, the 1.6km area and drainage lines are well established with natural vegetation, thus the limited 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. Due to the far distance (>1.6km) from the Orange River, it is highly unlikely that any TSS (Total Suspended Solids) and TDS (Total Dissolved Solids) increase will be experienced. 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:

As discussed in detail under the Soil Report, the clay percentages are generally low and very sandy. Most soils in the study area will have good drainage, but soil water holding capacity and fertility will be low and will require good management. Since the soils are generally sandy, the soil depth would be the biggest contributing factor to drainage.

The main concern was the Na that was high in relation to other cations, which could lead to sodicity and if not managed correctly, can lead to degradation of soil by reducing the flow of water through soil, which limits leaching and can cause salt to accumulate over time and develop of saline subsoils. It can also cause crusting and sealing on the soil surface, which impedes water infiltration, accelerating erosion and causing structureless soils.

However, the laboratory results indicate that the chemical parameters are manageable. The Cation Exchange Capacity (CEC) is extremely low (2.63-4.38 cmol(+)/kg), this, in turn, has a pronounced effect on the Exchangeable Sodium Percentage (ESP). The ESP is very high and especially high for a red apedal soil. Since ESP is a percentage of the Na to CEC, the low CEC can exaggerate the ESP. An exaggerated ESP is supported by the low Electrical Conductivity of the soils. The irrigation threshold of EC for water is 400 mS/m. These soils can be rectified with irrigation and fertilization on soils with adequate drainage, the Na should leach out if lime or Gipson is applied to the soil and be replaced with Ca, Ma and K, lowering the ESP.

An indirect impact could be ultimately the leaching of Na into the drainage lines and eventually into the Orange River. Dr. Bouwer who conducted the soil report indicated that the total amount of Na in the soils found in the study area is extremely low because of the relationship between Na and the cations, and the amount that would leach out will be very limited and will not have an indirect impact on the Orange River. Cumulatively, surrounding farms could however contribute to a larger impact.

In terms of reduction in the ecological reserve, abstraction of water is always a potential indirect impact if new croplands are established and more water is abstracted from a system that would sustain the ecology. 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.

With mitigation, the impact is rated 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.

During the Scoping Phase public participation, a neighbor raised a concern regarding the natural slope of their site and drainage of water towards Site A and ultimately towards the river. This might potentially be a problem for the Applicant if water from abutting farms drains into the applied site and cumulatively, added irrigated water that contains Na and other chemicals/fertilizers/etc. that drains towards the Orange River.

If water from neighboring farms accumulates on the proposed center section on Site A, it will cumulatively drain towards the northeast. The Orange River is over 2.6km from Site A, and the nearest drainage line is about 500m northeast of Site A. In terms of the Na that will be leached, this impact was discussed above and the proposed development will not add any significant amounts of Na to the Orange River system. If cumulative water drainage is a potential problem for the Applicant on the site, drainage channels might be constructed to divert water away from pivots areas, but the general drainage will remain towards the drainage lines.

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 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 177 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 abutting neighbour's farmhouse about which is more than 1.6 km south of the proposed 20Ha pivot area on Site A that is separated by the neighbours own pivot areas. 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 generating 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, harversting, and ploughing.

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 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. However, traffic on the R3112, especially trucks, will intermittently increase noise levels to approximately 65-70dB along the road. 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 more than 1.6 km from the site, it is unlikely that it will cause any disturbance or nuisance to the neighboring farmhouse. 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 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 1.6 km south of the proposed pivot area on Site A and thus the noise levels raised through the bulldozer, trucks, 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 apparently are similar 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 tranquility 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

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6001

There are no other activities such as mining, wind turbines, factories, processing plants, etc. in the immediate or within a 1km radius of the farm. Thus the only source of noise is existing farming activities and traffic along the R3112.

This farming operation can add to the noise impact experience through the combined surrounding farming activities and trafficking but since this is a fairly small operation that is in line with abutting land-use practices to which people have become accustomed, the cumulative impact is thus rated very 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	Very Low		Very Low		Very Low		Very 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 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 9 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 at strategic areas to encourage workers to use them.

In terms of the system structure, poles (made from wood or reinforced concrete), fences, and the irrigation system that is installed could create some waste such as plastic/steel pipes or cutoffs, drippers, etc. All of the above have to potential to become waste due to offcuts of product, or broken fixtures, etc. A skip can be placed at Site A and B 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. Considering the limited number of people, at least 1 chemical toilet 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 Site A and B have been established with crops, 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.

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.

During the operational phase, 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.

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 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, mining, processing plants, human settlements, abattoir, etc. in the immediate vicinity that could cumulatively contribute to the waste impact of the area.

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, and road infrastructure, the current surrounding landscape can be viewed as impacted.

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 areas surrounding Site A to the east, south, and west are completely transformed due to agricultural activities. To the north, across the R3112, is natural veld. Likewise, the areas surrounding Site B to the east, south, and west are also completely transformed, but the north is natural veld and representative of veld in the Kimberley Thronveld. However, Site A has limited connection to other environments, whilst Site B has a connection to the north with the Kimberley Thronveld.

With the removal of vegetation and establishment of crops, the anthropogenic impact will be evident, especially along the R3112, but 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.

FIGURE 43: TRANSFORMED AREAS TO THE SOUTH, WEST AND EAST AND MORE INTACT AREAS TO THE NORTHEAST OF BOTH SITE A AND B.

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 or crops (harvested) will be a continuous cycle. During the cycle, the pivot areas will temporarily change from texture (vegetated/rough to bare/smooth) and color (green/brown to red) of the cleared out areas and will increase onsite visibility due to the proximity of the R3112, but as the crops are established the onsite visuals will be absorbed into the landscape and will fit in with the surrounding land use. It would most likely appear as an extension to existing pivot areas. This will be a continued impact during the operational phase, as summer and winter crops are planted or lucerne for alternating years.

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.

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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 177Ha of the natural veld is cleared to establish pivot areas for 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.

None of these types of activities occurs near or around the site, except for the Eskom line along the R3112. 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 site is situated northwest from Hopetown and is reached by traveling along the R3112 from Hopetown for about 15km until the farm road is reached. The existing access roads on the farm and the R3112 will be used. The existing farm road is a private road that is only used by the landowner and the Applicant. This road carries a very low traffic count and the farm roads are in fairly good condition in terms of structural integrity.

FIGURE 44: THE ENTRANCE OF THE R3112 ROAD AT SITE A – LINE OF SIGHT IS GOOD IN BOTH DIRECTIONS.

FIGURE 45: THE ENTRANCE OF THE R3112 ROAD AT SITE B – LINE OF SIGHT IS GOOD IN BOTH DIRECTIONS.

Direct Impact

Construction & Operational Phase:

It will be required that heavy vehicle signs should be erected on both sides of the R3112 near the entrance of Site A and Site B, as per the specifications of the District Roads Engineer to increase safety standards, especially during harvest season.

The maintenance on the farm road will be the responsibility of the Applicant, as per the agreement in the past and since no complaint during the public participation was received it is presumed that the landowner does not have any objections regarding the use of the farm road.

The R3112 will be used to transport harvest crops to the relevant markets. The R3112 is a provincial road and 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 R3112, 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 very 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 R3112, 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 may result in the need to cart crops on Saturday mornings, this will reduce the small impact to be 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 R3112 road is not known, however, it is a provincial road, thus it is expected to carry sufficient volumes of traffic. There are no other activities, other than farming that cumulatively contribute to the vehicle load on the R3112. This activity will add heavy vehicle loads to the R3112 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. However, considering the annual harvest, the possible cumulative impact is rated very 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		Very 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) constructing the irrigation infrastructure, or 4) 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 Thembelihle 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. While the Thembelihle Municipality 2017/2022 IDP indicating that the unemployment rate was about 28%, which is a very good variable in light of the 43% provincial unemployment figure, by creating employment in the agricultural section is a step towards ensuring sustainable jobs. The agricultural industry plays a key role to generate economic activity, create jobs, earn foreign currency and stimulate rural economies in general.

It is thus clear that the proposed crop production, as proposed by the Applicant, will contribute to a small portion of the economic growth within the Thembelihle Municipal area. This development will not only benefit the Applicant but will also create job opportunities for 9-20 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 between each other. The Applicant will therefore employ local community members known to the farming community, which is in line with current farming practices.

<u>Direct Impact</u>

<u>Construction Phase:</u>

During the construction phase, the development will provide 9 employment opportunities (1 will be for skilled employment and 8 for un-skilled), whether it is renting a bulldozer from a local company, employing workers to 1) remove the vegetation, 2) constructing the irrigation infrastructure, or 3) fencing the camps, etc. It is expected that the value of the employment opportunities during the construction phase will be about R1 00 000/year.

Currently about 200Ha is under crop production, the addition of the 177Ha will allow the Applicant to continue to produce just under 200Ha of crops per annum, but also allowing the alternating camps to rest. It is not the intent of the Applicant to increase crop production to 400Ha per annum. Thus, no additional downstream employment or 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. will benefit from this project. Rather those companies already benefitting from the existing crop production will continue to benefit. Overall the impact during the construction phase is rated very low (positive) due to the small amount of additional staff that will benefit.

Operational Phase:

Once in operation, it is expected that the annual income generated by the crops will be about R5.8 million. During the operational phase 20 permanent employment opportunities will be created, of which 100% will be for previously disadvantaged people. 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.

The establishment of the additional 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 solely 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, however will be gained in the following year when the fields are rested. The crop production is 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 between 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, 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 their neighbors is important to have immediate access to help and assistance, and farmers should have schedule 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 reduce to low (positive) without mitigation.

<u>Indirect Impact</u>

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

Currently, the site is not near any tourist destinations, but it is on route to Douglas, and tourists or holiday-makers will make use of the R3112 traveling between the towns, however, there are not many tourist attraction areas within this region. Thus from a tourism point of view, the potential socio-economic impact will be very low (negative).

The site will be visible along the R3112, but as discussed under the heading 'Visual Impact' will not cause a significant and permanent impact on the tranquility of the area and the impact is rated very low with mitigation.

<u>Cumulative Impact</u>

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 as previously indicated the Applicant intends to rest the crop fields annually through rotating crops. Thus the addition of 177 Ha will not add to the total crops produced per annum and thus the not increase competing land use.

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	

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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 the 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 Sites A and B are located on fairly low topography terrain with limited outcrop visibility. The terrain is capped by a well-developed calcareous soil and unconsolidated windblown sand with a thickness of >80cm. No evidence was found of *in situ* Stone Age material or capped assemblages within the sandy substrate. No fossils (Quaternary) or fossil exposures were observed in the footprint areas. There are no indications of prehistoric structures or rock art or aboveground evidence of graves or historical structures older than 60 years within the confines of the footprints. The proposed pivot development at Sites A and B will primarily affect geologically recent and culturally sterile soils (unconsolidated wind-blown sand). The footprints are not considered palaeontologically or archaeologically vulnerable and are assigned a site rating of Generally Protected C.

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.

<u>Direct Impact</u>

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

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.

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- 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 counseling to 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 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	Low	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

Currently, the Applicant has 200Ha that is used for maize and/or wheat crops. This application, if approved, the addition of the 269Ha will allow the Applicant to continue to produce 177Ha of crops per annum, through crop rotation. It is not the intent of the Applicant to increase crop production to 400Ha per annum, but rather produce crops on one section of the 200Ha, and the rest the other 177Ha and rotate the next year. 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, such as deep ripping, removing access rocks, spreading of chicken manure or other organic fertilisers on the land, as well as Gipson or lime to leach out the Na.

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 on the pivot 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 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 soil, 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 be 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 providing 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, that there should be no reason to prevent the proposed development from being approved.

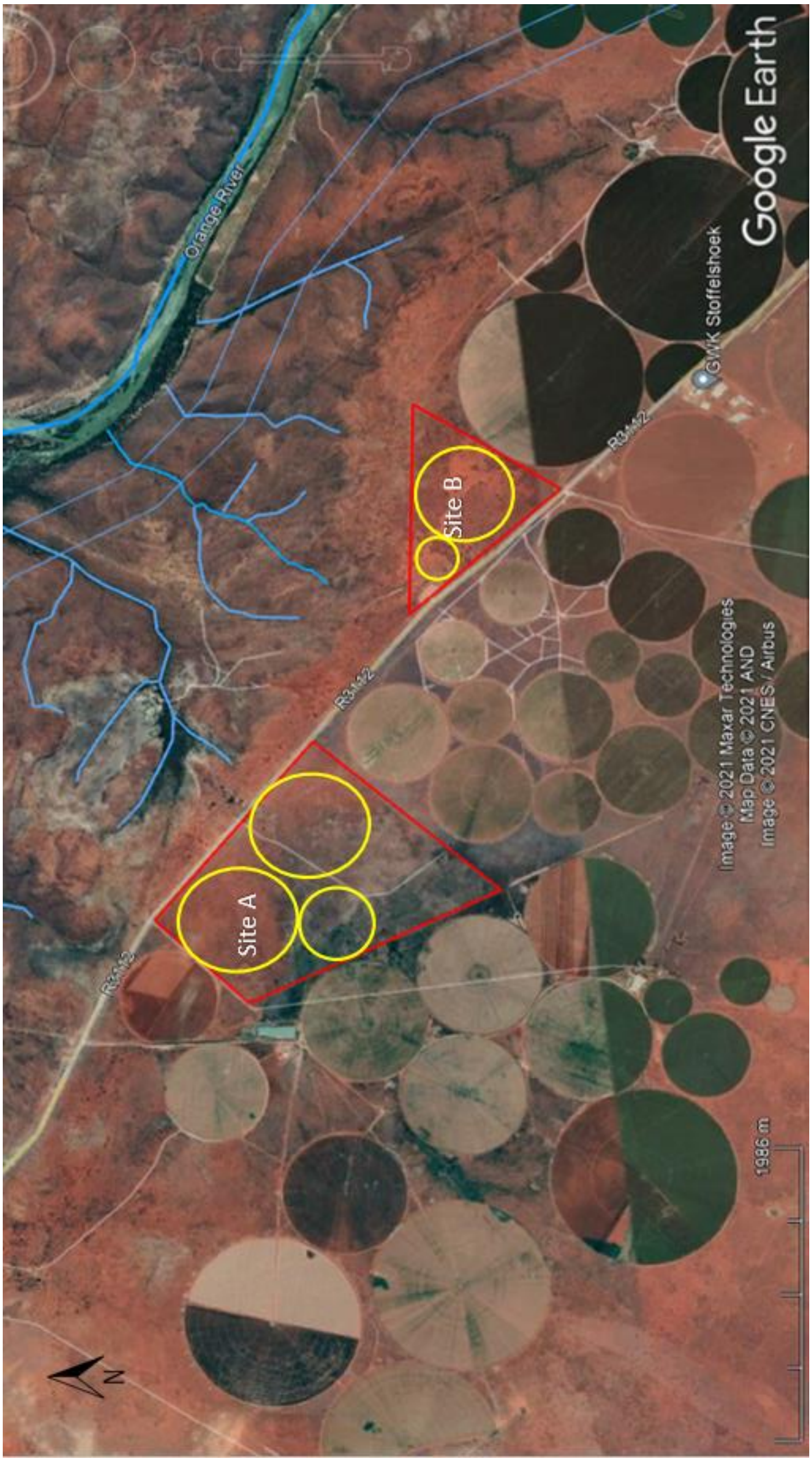

FIGURE 46: ENVIRONMENTAL SENSITIVITY MAP. THE BLUE LINE REPRESENTS DRAINAGE LINES AND THE ORANGE RIVER, THE RED POLYGONS THE PROPOSED SITE, AND THE YELLOW CIRCLES THE PROPOSED PIVOT AREAS.

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RECOMMENDATIONS FROM SPECIALISTS

Soil survey: Digital Soils Africa

The A and B horizons are characteristically sandy and therefore will facilitate good drainage. Most of the soils are very high-potential irrigation soils. 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 high. Thus, it indicates that although sodicity is not a general threat to irrigation on this site, Na in relation to other cations is high. On these soils this can be rectified with irrigation and fertilization on soils with adequate drainage, the Na should leach out and be replaced with Ca, Ma and K, lowering the ESP. This is confirmed by the very low ECe values.

It is recommended that in Area 1, the pivot placement does not exceed more than 10% of unsuitable soil in a pivot. Since Area 2 has small areas of moderately suitable soils for irrigation, these can be incorporated into pivots, and thus the pivot placement is not affected by suitability.

Flora Survey: Sparaxis Environmental

Most of the areas surrounding the study area are already transformed and it is therefore recommended that most of the geophytes be transplanted in other natural areas. Several large trees of the protected *Vachellia heamatoxylon* and *V. erioloba* were found at the study site. Dr. van Aardt recommends that effort must be made to protect as many as possible of these species. Permits need to be obtained before any of the protected and specially protected species can be removed. No red data species were found to be present in the study area. All alien invasive species, especially the *Prosopis glandulosa* and *Tamarix ramosissima* should be removed and eradicated from the site as a high priority.

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.

<u>Archaeological Chance Finds Protocol for Developer:</u>

- 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

Although the soil map indicated that Site A can host a 15Ha and 20 Ha additional to two 55Ha pivot areas after the recommendations were considered the layout of Site A had to be adjusted to only include the two 55Ha pivot areas and one 20 Ha pivot area to exclude the unsuitable area for irrigation.

It is, therefore, the opinion of the EAP that 269 Ha on the Remainder of Farm Naauwtesfontein No. 78 be approved, but only 177Ha for clearing of vegetation to establish crops, and the remaining areas surrounding the pivot areas and the center section of Site A (as indicated on the soil maps which total to 92 Ha) be excluded from vegetation clearing and establishing pivots. 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

- 269Ha be approved, but only 177Ha of the area be approved for pivot establishment and vegetation clearing and the remaining 92Ha be used as part of the environmental offset plan to plant vegetation that can be transplanted removed from the Remainder of Farm Naauwtesfontein No. 78.
- Site layout 2 be the preferred option for pivot planning and the center section of Site A, as per the soil report, be excluded from the clearing of vegetation.
- Vegetation clearing and crop establishment should only be approved for Site A and Site B.
- Crop rotation strategy and irrigation scheduling be implemented. 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 29 June 2021 for 3 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

11 November 2021
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 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.

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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 2022**

Botha
Chairperson

Chief Executive Officer

To verify this certificate scan this code

EAPASA
Unit 19 Oxford Office Park
3 Bauhinia Street
Highveld Techno Park
Centurion
0157
Tel. (+27) 12 880 2154

Environmental Assessment Practitioners Association of South Africa

Advancing environmental assessment practice in South Africa

Email: registrar@eapasa.org / Website: www.eapasa.org

Mrs Natalia Sharp
9 Peter Graham Ave
Glen Hurd
Port Elizabeth
6045

Sent by email to: natsharp@icloud.com

Dear Mrs Sharp

Registered Environmental Assessment Practitioner: Number 2020/230
Natalia Sharp : South African ID 7908120007080

The Environmental Assessment Practitioners Association of South Africa (EAPASA) herewith certifies that Natalia Sharp is a Registered Environmental Assessment Practitioner (EAP) 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).

Your registration is duly authorised by EAPASA as the single Registration Authority for EAPs in South Africa (appointed as per Regulation No. 104, Gazette No. 41434 of 8 February 2018, in terms of section 24H(3)(a) of the NEMA). Your status as a Registered EAP is displayed in the 'EAP Register' - please find your name and contact email address at

https://registration.eapasa.org/registered-practitioners

Your registration is effective for a period of five years from 07 February 2020, and expires on 07 February 2025. The renewal of your registration in 2025 will be contingent on you having met the requirements of EAPASA's Continuing Professional Development (CPD) policy during each year of registration.

As a Registered EAP you are required to uphold the EAPASA Code of Ethical Conduct and Practice in your professional endeavours, towards the goal of quality assurance in environmental assessment practice.

Please accept my congratulations on your registration.

Best regards

RCHill

Dr Richard Hill
Registrar
Date: 07 February 2020

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 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.

A J Coetzee
VISEKANSELIER/VICE-CHANCELLOR

G. N van Wyk.
DEKAAN/DEAN

BLOEMFONTEIN
2001-03-16
[illegible]

REGISTRATEUR/REGISTRAR

12/4/2019

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

BLOEMFONTEIN
[illegible]
[illegible]

REGISTRATEUR/REGISTRAR

Date: 10/4/2019

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

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.

VISEKANSELIER/VICE-CHANCELLOR

DEKAAN/DEAN

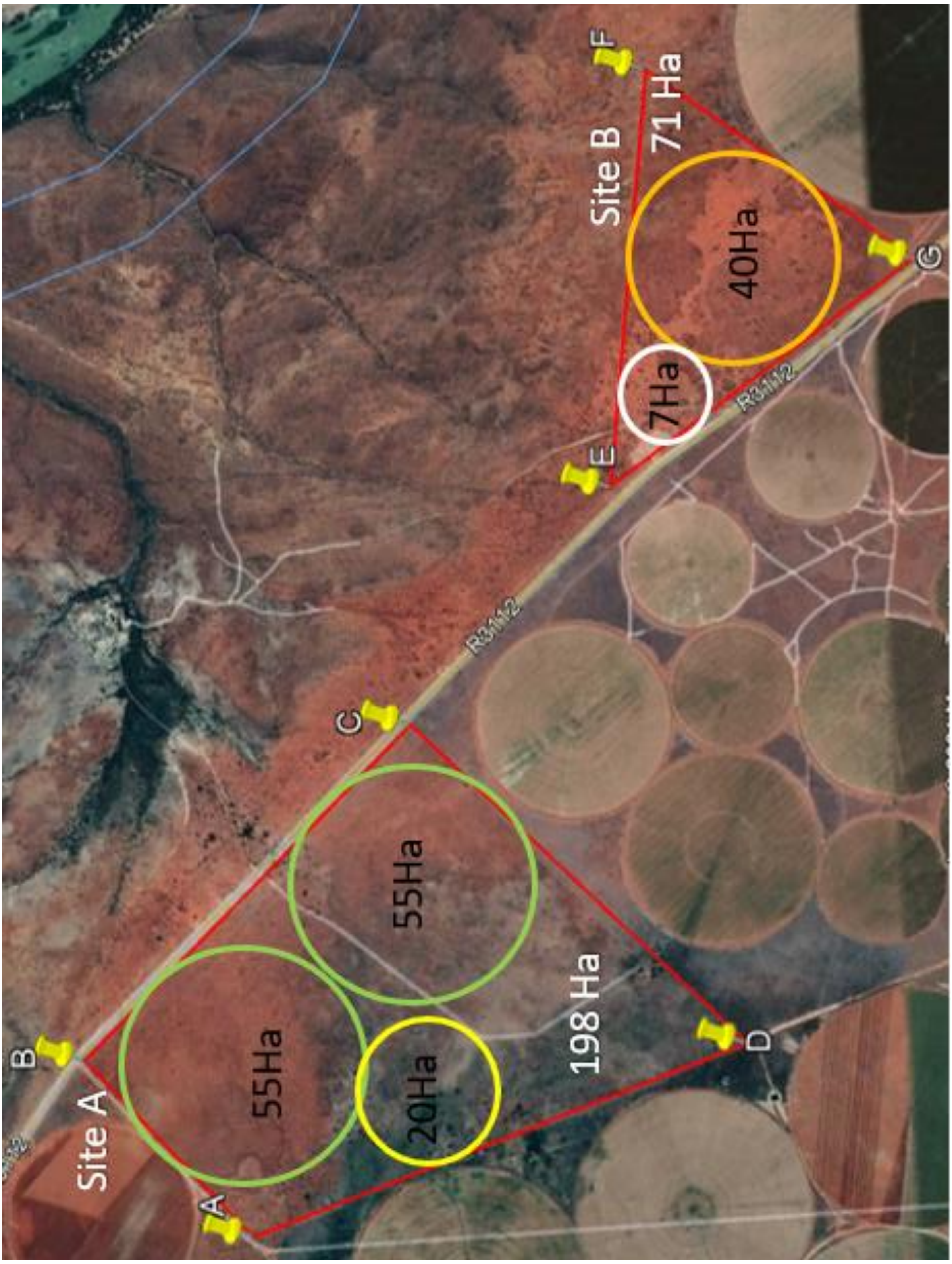
100+
UV-UFS
1904 - 2004

REGISTRATEUR/REGISTRAR

BLOEMFONTEIN

12/4/2019

APPENDIX B – SITE PLAN



1 Kemsley Street
Gqeberha
6001

Coordinates of the site

	Site A
A	29° 30’ 28.13”S 23° 56’ 9.65”E
B	29° 30’ 7.73”S 23° 56’ 30.13”E
C	29° 30’ 40.38”S 23° 57’ 16.54”E
D	29° 31’ 20.77”S 23° 56’ 39.93”E
	Site B
E	29° 31’ 0.18”S 23° 57’ 48.92”E
F	29° 31’ 59.66”S 23° 58’ 42.51”E
G	29° 31’ 31.84”S 23° 58’ 21.44”E

Site A: 198 Ha
Site B: 71 Ha

List of SGID of the properties under application:

C03300000000007800000

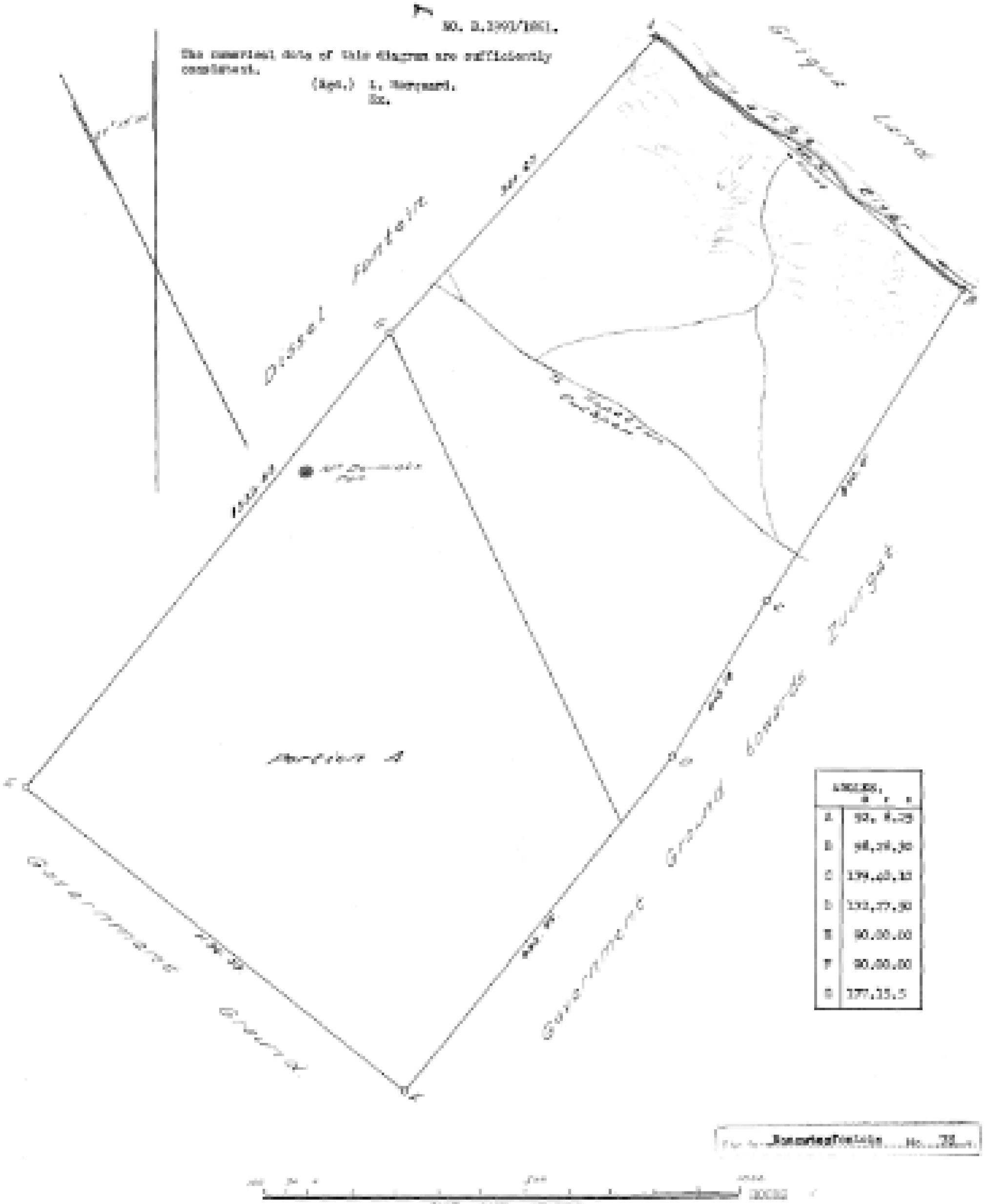
www.dsafrica.co.za natalie@dsafrica.co.za

1 Kemsley Street
Gqeberha
6001

NO. D.3991/1861.

The numerical data of this diagram are sufficiently consistent.

(Sgd.) L. Marquard.
Sx.



ANGLES.	
A	92. 8.23
B	98.24.30
C	174.40.10
D	132.37.30
E	90.00.00
F	90.00.00
G	177.15.5

[illegible] Zoutpansfontein No. 72.

CAPE LAND MEASURE.

H A A U W T E R F O N T E I N.

The above Figure A. B. C. D. E. F. G. represents a Piece of Government Ground Known as "HAAUWTER FONTEIN" in Extent 4568 Morgen 413 Square Roods, situate in the Fieldcornetcy De Kaap Division of Hope Town.

Bounded East by the Orange River.
South " Government Ground,
West " Government Ground and
North " Dissel Fontein.

Surveyed on the Spot
by me
(Sgd.) W. F. J. von Ludwig.
Govt. Land Surveyor.
Hope Town.
March 1861.

Copied from diagram forming
[illegible] T313a [illegible] Ho.Q.1[D]-61
[illegible] 11.12.1861.

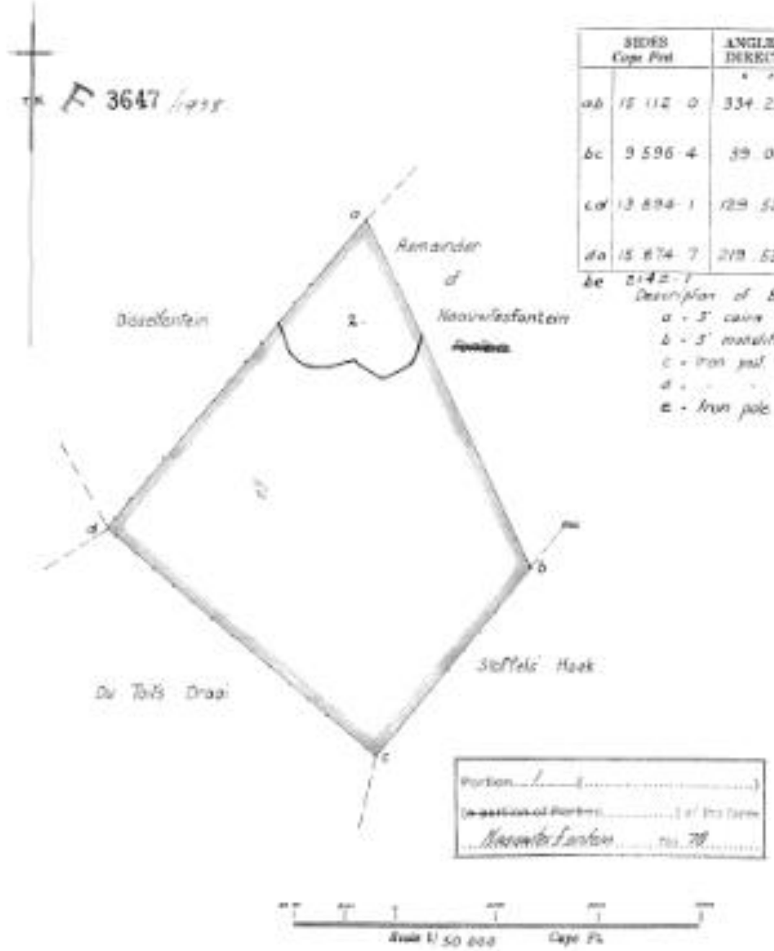
29.1.1963

61/98

1 Kemsley Street
Gqeberha
6001

Approved [signature] Surveyor-General. 11.2.1939

F 3647 /1939



SIDES Cape Feet		ANGLES OF DIRECTION	SYSTEM Local Y CO-ORDINATES X		
ab	15 112·0	334 25 50	a	+ 7 870·4	+ 32·7
bc	9 596·4	39 00 01	b	+ 1 348·0	+ 13 664·7
cd	13 894·1	129 52 42	c	+ 7 387·3	+ 21 122·5
da	15 874·7	219 53 00	d	+ 16 049·7	+ 12 214·2
be	2142·1		e	00·0	+ 12000·0

Description of Beacons:
a - 3' cairn over iron peg.
b - 3' monolith planted in ground.
c - Iron post. Witness pegs at 15' on c-b + c-d.
d - " " " " " " " d-c + d-a.
e - Iron pole.

The figure a b c d represents 2034·3442 Morgen —— Square Feet of land, called

PORTION A

~~portion~~ of the farm ~~[illegible]~~ Nooutesfontein which is referred to hereunder,
situate in the Field Cornetcy of De Hoop DIVISION of HOPE TOWN
PROVINCE of CAPE of GOOD HOPE.

Surveyed in May 1938 by me [signature] Land Surveyor.

This diagram is annexed to Transfer Deed No. 7756 dated 21 July, 1939 in favour of Frederick J. Gerber Registrar of Deeds.	The original diagram is No. 1993/1861 annexed to Title Deed No. Ho.Q.1°61 dated 11·12·1861 ~~in favour of~~ No. L.2° 170.	S.G. File No. G.5280. Survey Records No. R909/1938 BEACONS ACKNOWLEDGED

Form G.

SHEET 6

APPENDIX C – PUBLIC PARTICIPATION

Two Notice Boards were erected along the proposed boundary next to the R3112, on 27 August 2021 in accordance to NEMA Regulations. Below is an aerial photo indicating the location of placing the boards. The red polygon represents the study area under application, while the blue drop pins represent the location of the boards.

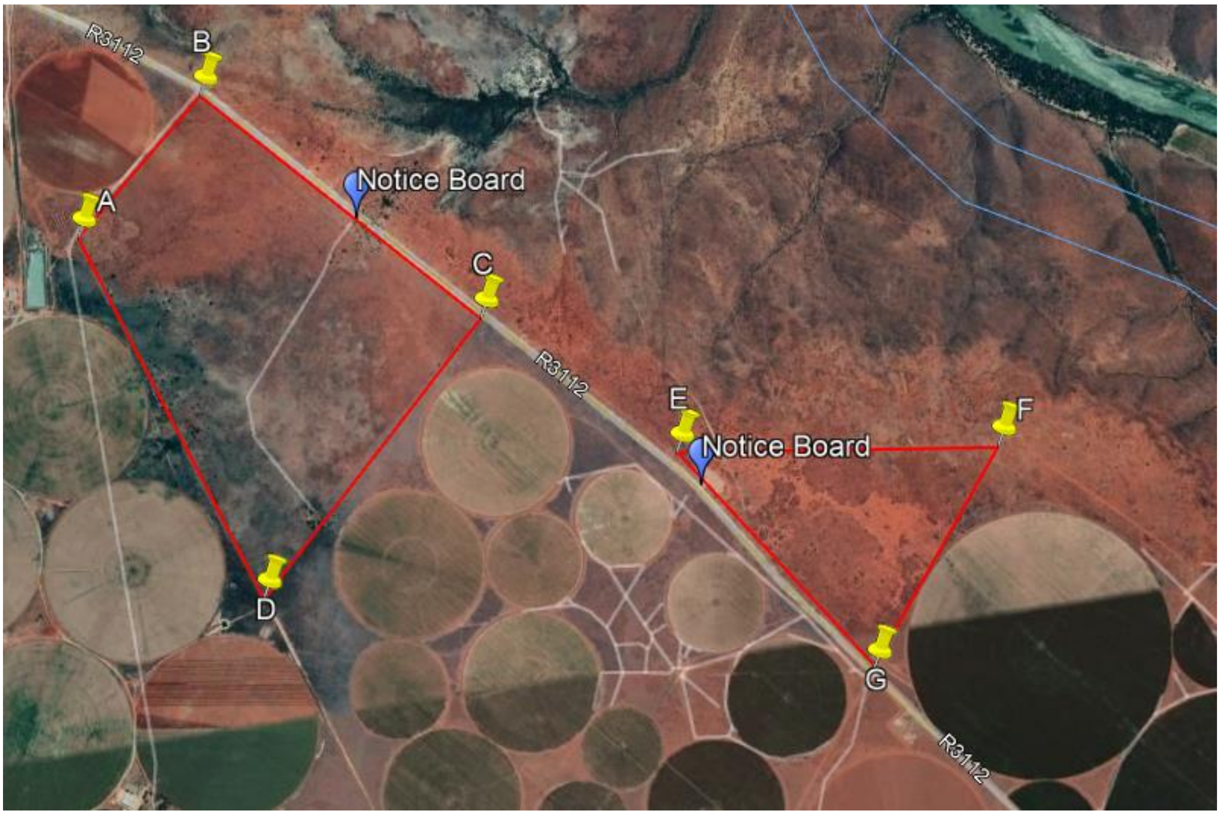


FIGURE 47: THE RED POLYGON REPRESENTS THE STUDY AREA UNDER APPLICATION, WHILE THE BLUE DROP PINS REPRESENT THE LOCATION OF THE TWO NOTICE BOARDS.

Response for potential I&AP's was requested to be submitted by 27 September 2021 and those who registered / commented will be recorded in the I&AP registry.

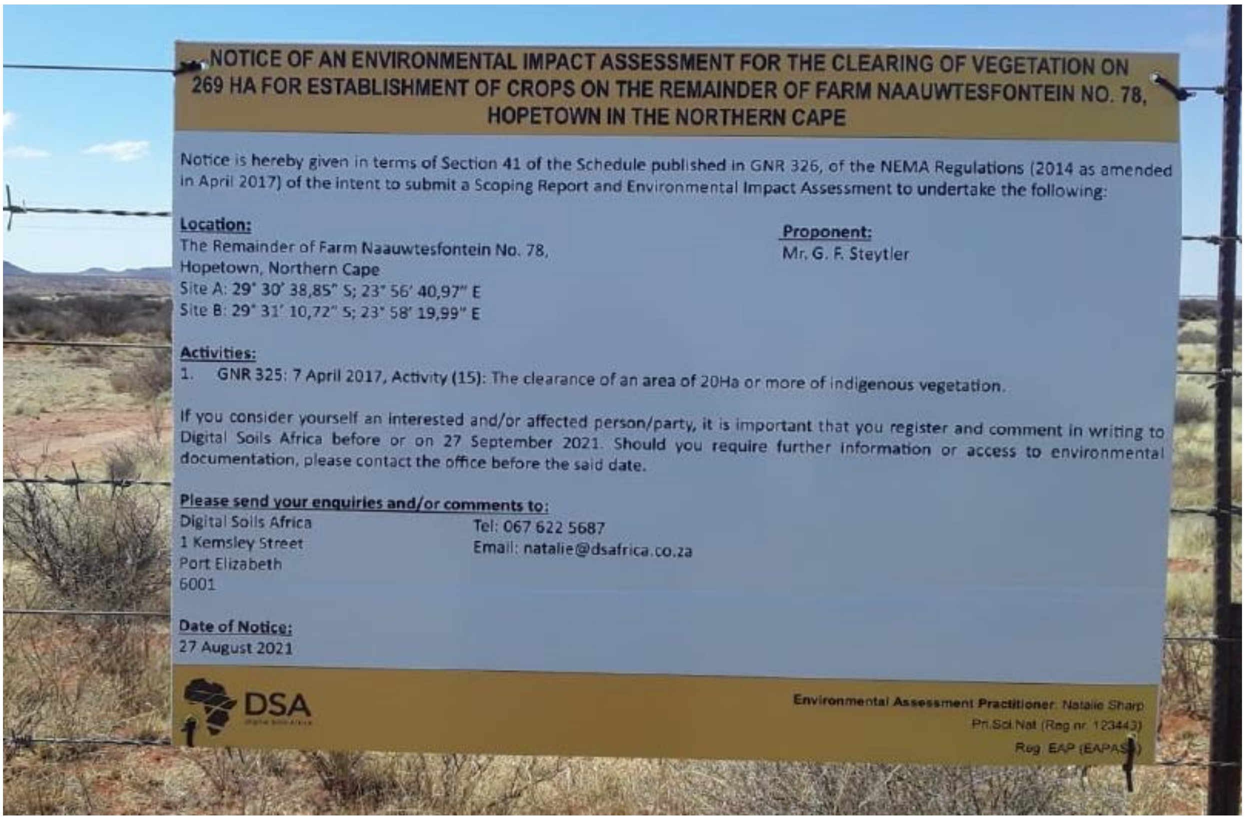
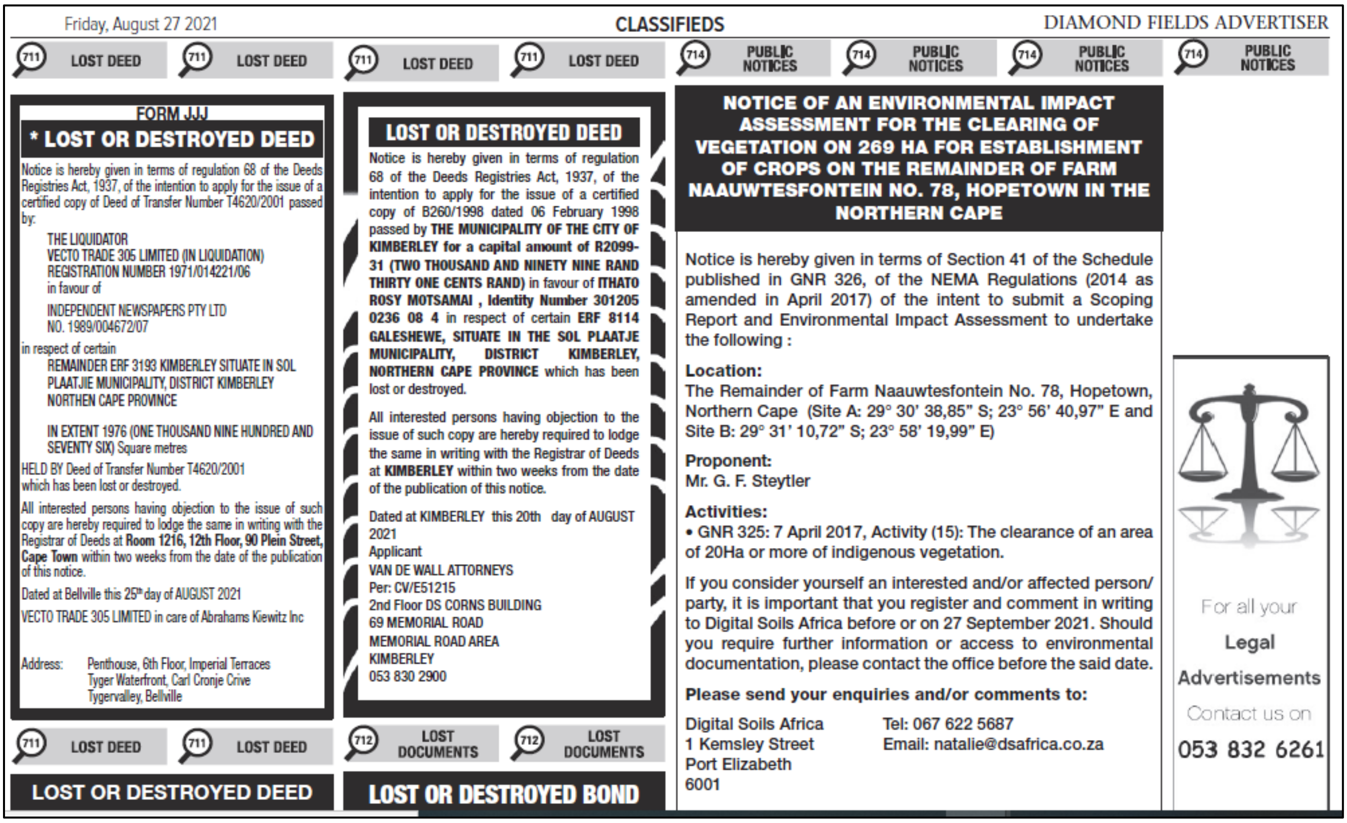



FIGURE 48: NOTICE BOARD THAT WAS PLACED ABUTTING THE SITE ALONG THE R3112 AT SITE A AND SITE B.

Public Participation advert placement in the Diamond Fields Advertiser (DFA) Newspaper in accordance with the NEMA Regulations, on 27 August 2021, time to register is given until 27 September 2021.

1 Kemsley Street
Gqeberha
6001



Friday, August 27 2021

CLASSIFIEDS

DIAMOND FIELDS ADVERTISER

711 LOST DEED | 711 LOST DEED | 711 LOST DEED | 711 LOST DEED | 714 PUBLIC NOTICES | 714 PUBLIC NOTICES | 714 PUBLIC NOTICES | 714 PUBLIC NOTICES

FORM JJJ

*** LOST OR DESTROYED DEED**

Notice is hereby given in terms of regulation 68 of the Deeds Registries Act, 1937, of the intention to apply for the issue of a certified copy of Deed of Transfer Number T4620/2001 passed by:

THE LIQUIDATOR
VECTO TRADE 305 LIMITED (IN LIQUIDATION)
REGISTRATION NUMBER 1971/014221/06
in favour of

INDEPENDENT NEWSPAPERS PTY LTD
NO. 1989/004672/07

in respect of certain
REMAINDER ERF 3193 KIMBERLEY SITUATE IN SOL PLAATJIE MUNICIPALITY, DISTRICT KIMBERLEY
NORTHEN CAPE PROVINCE

IN EXTENT 1976 (ONE THOUSAND NINE HUNDRED AND SEVENTY SIX) Square metres

HELD BY Deed of Transfer Number T4620/2001
which has been lost or destroyed.

All interested persons having objection to the issue of such copy are hereby required to lodge the same in writing with the Registrar of Deeds at **Room 1216, 12th Floor, 90 Plein Street, Cape Town** within two weeks from the date of the publication of this notice.

Dated at Bellville this 25th day of AUGUST 2021

VECTO TRADE 305 LIMITED in care of Abrahams Kiewitz Inc

Address: Penthouse, 6th Floor, Imperial Terraces
Tyger Waterfront, Carl Cronje Crive
Tygervalley, Bellville

LOST OR DESTROYED DEED

Notice is hereby given in terms of regulation 68 of the Deeds Registries Act, 1937, of the intention to apply for the issue of a certified copy of B260/1998 dated 06 February 1998 passed by **THE MUNICIPALITY OF THE CITY OF KIMBERLEY for a capital amount of R2099-31 (TWO THOUSAND AND NINETY NINE RAND THIRTY ONE CENTS RAND)** in favour of **ITHATO ROSY MOTSAMAI , Identity Number 301205 0236 08 4** in respect of certain **ERF 8114 GALESHEWE, SITUATE IN THE SOL PLAATJE MUNICIPALITY, DISTRICT KIMBERLEY, NORTHERN CAPE PROVINCE** which has been lost or destroyed.

All interested persons having objection to the issue of such copy are hereby required to lodge the same in writing with the Registrar of Deeds at **KIMBERLEY** within two weeks from the date of the publication of this notice.

Dated at KIMBERLEY this 20th day of AUGUST 2021
Applicant
VAN DE WALL ATTORNEYS
Per: CV/E51215
2nd Floor DS CORNS BUILDING
69 MEMORIAL ROAD
MEMORIAL ROAD AREA
KIMBERLEY
053 830 2900

NOTICE OF AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE CLEARING OF VEGETATION ON 269 HA FOR ESTABLISHMENT OF CROPS ON THE REMAINDER OF FARM NAAUWTESFONTEIN NO. 78, HOPETOWN IN THE NORTHERN CAPE

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:
The Remainder of Farm Naauwtesfontein No. 78, Hopetown, Northern Cape (Site A: 29° 30' 38,85" S; 23° 56' 40,97" E and Site B: 29° 31' 10,72" S; 23° 58' 19,99" E)

Proponent:
Mr. G. F. Steytler

Activities:
• GNR 325: 7 April 2017, Activity (15): The clearance of an area of 20Ha or more of indigenous vegetation.

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 27 September 2021. 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

For all your
Legal
Advertisements
Contact us on
053 832 6261

711 LOST DEED | 711 LOST DEED | 712 LOST DOCUMENTS | 712 LOST DOCUMENTS

LOST OR DESTROYED DEED

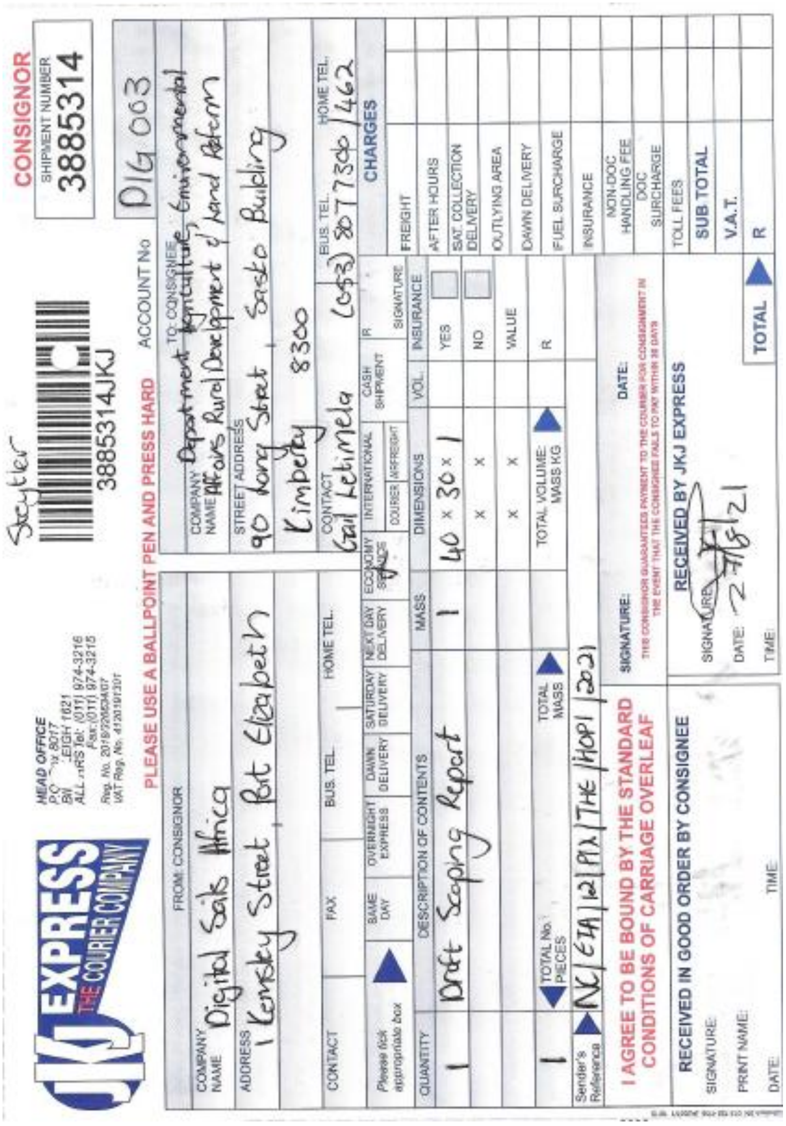
LOST OR DESTROYED BOND

FIGURE 49: TEARSHEET FROM THE DFA NEWSPAPER.

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

1 Kemsley Street
Gqeberha
6001

Proof of Full Scoping Report couriered to Department of Agriculture, Environmental Affairs, Rural Development, and Land Reform:



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 :
Dipatlisiso :
Imibuzo : I Gwija
Navrae :

Reference :
Tshupelo :
Isalathiso : NC/EIA/12/PIXTHE/HOP1/2021
Verwysing :

Date :
Leshupelo : 07th October 2021
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: CLEARING OF VEGETATIION FOR THE ESTABLISHEMENT OF CROP FARMINIG ON THE REMAINDER OF FARM NAAUWTESFONTEIN NO 78 IN HOPETOWN: THEMBELIHLE LOCAL MUNCIPALITY, PIXLEY KA SEME DISTRICT MUNICIPALITY.

The Department confirms having receipted the **final scoping report** for the abovementioned project on the 07th October 2021 as required in terms of the Environmental Impact Assessment Regulations, 2014 as amended.

The reference number for this project is: NC/EIA/12/PIX/THE/HOP1/2021. 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. I Gwija** and can be contacted at this numbers, Cell: **060 9898 441 or 053 631 0601**.

Regards

Gletimela

G. Letimela
Senior Administration Clerk

Example of consultation letter sent to DWS and Department of Agriculture during the Scoping Phase

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

2021-08-27

Department of Water and Sanitation
Private Bag X5912
Upington
8800
Attention: Mr. Byron Fortuin

Byron Fortuin

ENVIRONMENTAL IMPACT APPLICATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, FOR THE CLEARING OF VEGETATION ON THE REMAINDER OF FARM NAAUWTESFONTEIN NO. 78, HOPETOWN. APPLICANT: MR. G.F. STEYTLER. Scoping Public Participation Phase.

Mr. Steytler 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 Mr. Steytler to clear vegetation to the extent of 177Ha Ha to establish crops. 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 27 September 2021** 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. Below is the link to the Scoping Report for your attention.

Where we are in the process

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

- A Draft Scoping Report has been submitted for Public Participation to other Departments, the Municipality (Local and District), ward councilor, 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. On 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.

Due to the **Covid pandemic** and in an attempt to lower the risk of infection, the Draft Scoping Report will not be forwarded as a hard copy. Instead, 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 Steytler link. To access the loaded documents use the password: SteY@gf78. Alternatively, you may request that the document be sent via 'We Transfer' app, in such a case, please provide the email address.

Yours sincerely

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

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

2021-08-27

Department of Agriculture
Directorate Land Use and Soil Management
P O Box 2303
Kimberley
8300
Attention: Mr. Roux

ENVIRONMENTAL IMPACT APPLICATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, FOR THE CLEARING OF VEGETATION ON THE REMAINDER OF FARM NAAUWTESFONTEIN NO. 78, HOPETOWN. APPLICANT: MR. G.F. STEYTLER. Scoping Public Participation Phase.

Mr. Steytler 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 Mr. Steytler to clear vegetation to the extent of 177Ha Ha to establish crops. 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 27 September 2021** at 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.

Where we are in the process

- A Draft Scoping Report has been submitted for Public Participation to other Departments, the Municipality (Local and District), ward councilor, and I&AP's (general public).

1 Kemsley Street
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natalie@dsafrica.co.za
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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. On 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 the EIA public participation phase 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.

Due to the **Covid pandemic** and in an attempt to lower the risk of infection, the Draft Scoping Report will not be forwarded as a hard copy. Instead, 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 Steytler link. To access the loaded documents use the password: SteY@gf78. Alternatively, you may request that the document be sent via 'We Transfer' app, in such a case.

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.

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

2021-08-27

Dear Interested and Affected Party

ENVIRONMENTAL IMPACT APPLICATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, FOR THE CLEARING OF VEGETATION ON THE REMAINDER OF FARM NAAUWTESFONTAIN NO. 78, HOPETOWN. APPLICANT: MR. G.F. STEYTLER. Scoping Public Participation Phase.

Mr. Steytler 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.

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 attached Background Information Document.

Public Participation Process

The purpose of the Background Information Document is to provide you with *basic information* regarding the proposed project and does not replace the Scoping Report or EIA. You are provided the opportunity to register as interested and affected parties and grant you the opportunity to raise any comments you might have on the proposed project.

If you would like to participate in the process, please register as an interested and affected party (I&AP), in writing. Comments/registration must be received **on or before 27 September 2021** before 5pm. If no comments are received from you, it will then be regarded that you do not have any comments.

Way Forward

- 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.
- On completion of the Scoping process, the EIA process will commence.
- The Draft EIA & EMP document 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) as part of the EIA Public Participation Phase.

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

- The outcome of the EIA Phase consultation process will be submitted to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform as part of the final EIA& EMP.
- Please note that due to the **Covid pandemic** and in an attempt to lower the risk of infection, the Draft Scoping Report will not be placed in a public place as a hard copy. Instead, 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 Steytler link. To access the loaded document use the password: SteY@gf78.
- All required documents will be submitted to the relevant department for decision-making.
- If the application is accepted, the relevant department will either issue or reject the Environmental Authorisation.
- As an I&AP's, you will be notified of the final decision of the relevant departments.

Yours sincerely

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

BACKGROUND INFORMATION REGARDING CLEARING OF VEGETATION ON THE REMAINDER OF FARM NAAUWTESFONTEIN NO. 78, HOPETOWN

MR. G.F. STEYTLER

AUGUST 2021

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 Mr. Steytler to apply for 269 Ha but clear about 177 Ha of vegetation on this area to establish pivot areas for crop production on the Remainder of farm Naauwtesfontein No. 78, Hopetown 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 27th of August 2021 and 27th of September 2021.

BRIEF PROJECT DESCRIPTION

The site is situated north-west from Hopetown in the Northern Cape (**Site A:** 29° 30' 38.85"S; 23° 56' 40.97"E and **Site B:** 29° 31' 10.72"S; 23° 58 '19.99"E) on the Remainder of Farm Naauwtesfontain No. 78, within the Thembelihle Local Municipal area. The farm can be reached by traveling along the R3112 (old Douglas road) north-west from Hopetown for about 16km until the farm road of Site A is reached.

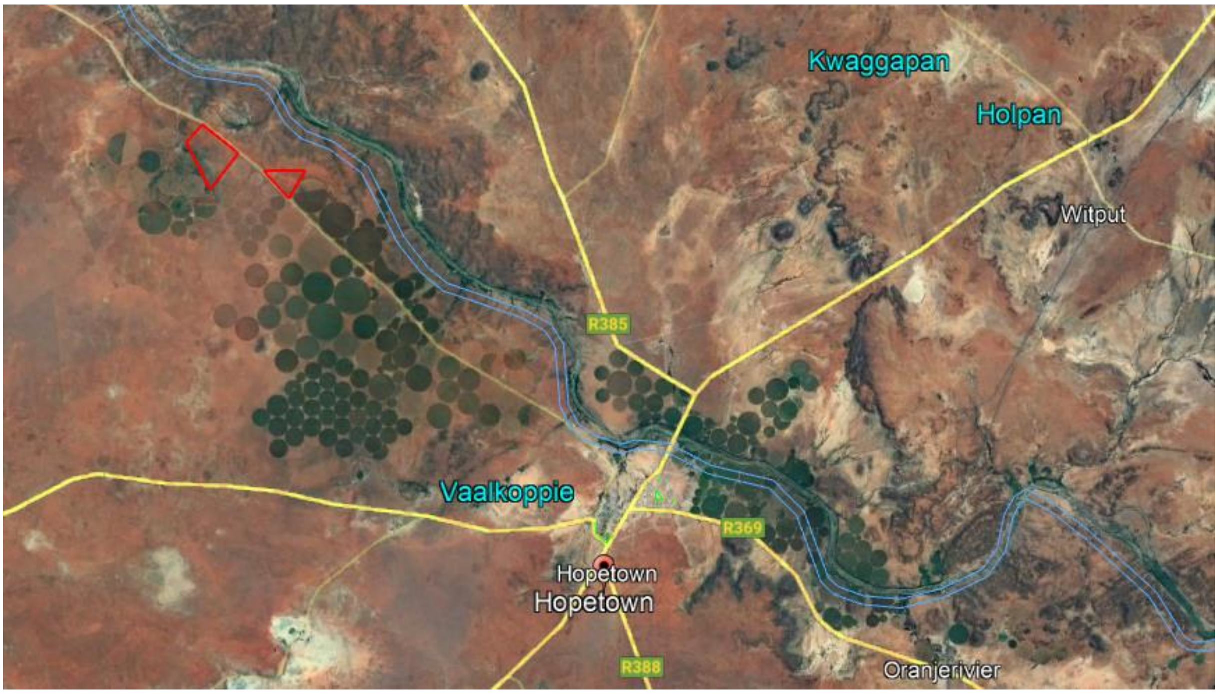

Figure 1: Site location is indicated as the red polygons along the R3112 (old Douglas road). The site further north is Site A and the site further south is Site B.

The property involves, belongs to Mr. Jennings who has a lease agreement with the Applicant (Mr. Steytler). Digital Soils Africa (Pty) Ltd. (DSA) was tasked by Mr. Steytler to conduct environmental investigations and complete the environmental application for the clearing of natural veld used for grazing purposes and to apply for the cultivating of virgin soil (known as ploughing certificate), to establish crops.

1 Kemsley Street
Richmond Hill
6001

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

Environmental Assessment

DSA was appointed by Mr. Steytler 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) – Clearing of vegetation of 20 Ha or more of indigenous vegetation.	*The site is 269 Ha in size, but only the pivot areas will be cleared from vegetation to establish crops, which amounts to about 177Ha in total pivot areas. Therefore the transformation of grazing land to cropland will be applicable.*

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 is not limited to:

Soil Suitability:

A soil survey was conducted on the farm to determine whether the land would be suitable for cultivation and irrigation. 269 ha of land was investigated and soil forms included:

- Coega (covering about 21Ha of the study area),
- Glenrosa (covering about 36Ha of the study area),
- Kimberley (covering about 57Ha of the study area),
- Olienhout (covering about 9Ha of the study area),
- Nkonkoni (covering about 97Ha of the study area), and
- Plooysburg (covering about 65Ha of the study area).

The Nkonkoni, Glenrosa, Olienhout, and Kimberley soil forms were generally considered suitable for irrigation, while portions of the Nkonkoni, Glenrosa, and Plooysburg soil forms were only moderately suitable due to the depth of limiting material. The Coega soil form and portion of the Olienhout soil forms were considered not suitable for irrigation.

Ultimately the soil report concluded that most of the surveyed area is suitable for irrigation, due to the free-draining soils and cracked rock underlying most profiles.

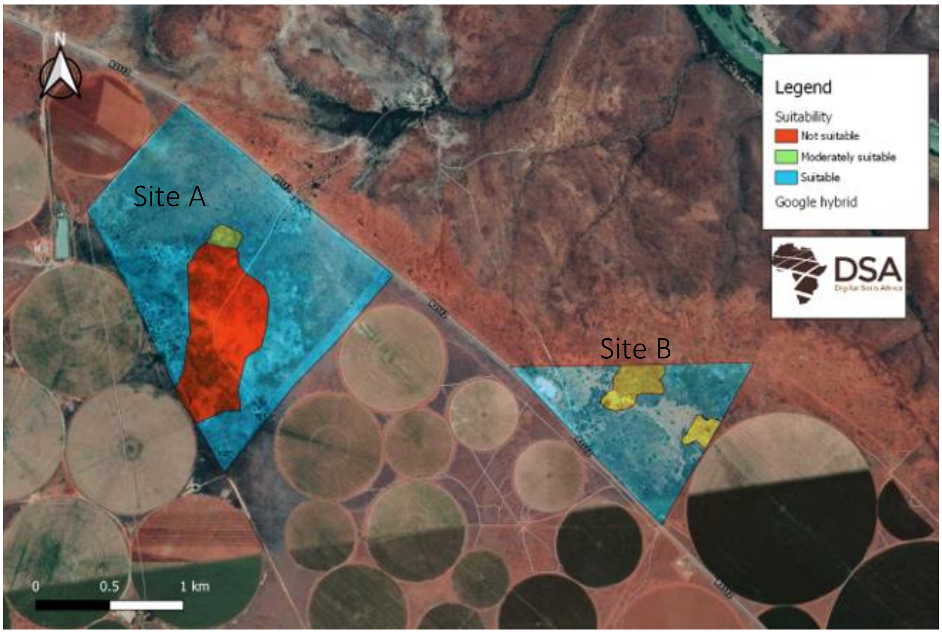

FIGURE 2: SUITABILITY AREAS FOR CROP PRODUCTION ACCORDING TO THE SOIL REPORT

The area not suitable for irrigation is limited by external drainage. The soil report recommended that in Site A, the pivot placement does not exceed more than 10% of unsuitable soil in a pivot. Since Site B has small areas of moderately suitable soils for irrigation, these can be incorporated into pivots, and thus the pivot placement is not affected by suitability.

Loss of on-site fauna and flora:

The site, according to Mucina and Rutherford (2006), hosts the Kimberley Thronveld (SVk4) vegetation type which has a Least Threatened conservation status. However, a vegetation survey will be conducted by a SACNASP registered botanist 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 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.

Sensitive Sites:

According to the Northern Cape Biodiversity Conservation Plan, the site falls does not fall within a Terrestrial Critically Biodiversity Area (CBA).
The Thembelihle Municipality does not have a Spatial Development Framework, but the Pixley Ka Seme District Municipality has a Spatial Development Framework. According to this SDF, the site falls within an area that is rated as a low sensitivity area.
To assess the sensitivity of the environment the onsite verification is therefore essential. The preliminary investigation indicates that the study area is not regarded as a site of ecological importance nor does the site have any high conservation value, thus the SDF rating and the CBA rating are applicable and aligns with onsite conditions.
The clearing of vegetation will be restricted to the pivot areas only and there are no water features on either Site A or B.
The site is also more than 1.7km from the Orange River, thus no surface water systems will be impacted.

Photo record of the study area:

Below are photos of Site A, representing Kimberley Thronveld that has been impacted through grazing.

1 Kemsley Street
Richmond Hill
6001

Below are photos of Site B, representing Kimberley Thronveld that appears to be more impacted through grazing.






 

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
2. EIA Phase.

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 of the area, e.g. the Municipality, Ward counsilor, 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** 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 **27 September 2021** till 5pm.

1 Kemsley Street
Richmond Hill
6001

Please note that due to the **Covid pandemic** and in an attempt to lower the risk of infection, the Draft Scoping Report will not be placed in a public place as a hard copy. Instead, 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 Steytler link. To access the loaded documents use the password:
SteY@gf78.

If you have any other questions or inquiries, please do not hesitate the contact the office at 067 622 5687 or 082 414 0472. If no comments are received from you, it will then be regarded that you do not have any comments.

Response from Mr Jennings

I.J. Jennings

88 Lizana Magagula Street

Belfast

1100

Tel nr: 082 773 7020

e-mail: ian.jennings5@gmail.com

Date: 02 August 2021

APPLICATION FOR THE CLEARING OF NATURAL VEGETATION ON THE REMAINDER OF NAAUWTESFONTEIN NO. 78, HOPETOWN FOR ESTABLISHING A MAIZE CROP AND PASTURE LAND

I, I.J. Jennings, ID nr: 6909125227088, are the owner of the abovementioned property and are aware of the application to clear vegetation for the establishing of a maize crop production and pasture land.

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

Kind regards,

....

I.J. Jennings

Date: 02 August 2021

1 Kemsley Street
Gqeberha
6001

<u>Proof of consultation sent via register post and email during the Scoping Phase:</u>

Register post:

Please take note, that:

- The Northern Cape Department of Roads and Public Works;
- The Office of the Regional Land Claims Commissioner Land Restitution Support: Northern Cape; and
- The Pixley Ka Seme District Municipality

were the only 3 departments that failed to provide a contact person after numerous attempts of contact. The contacts used during this public participation were obtained from the Department's websites and therefore these 3 Departments were sent and email and register post 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:

<u>Register of interested and affected parties</u>:

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 <u>must be submitted to the competent authority (CA).</u> 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 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.

1 Kemsley Street
Gqeberha
6001

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 giving to the Department in the submission of the final EIA report.

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

Emails:

Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler

Message 15 of 19

From Natalie Sharp
To cfo@thembelihlemunicipality.gov.za
Copy mmpa@thembelihlemunicipality.gov.za
Date Fri 12:38

Cover letter for BID.pdf (~178 KB)
Background Information Docum...
Download all attachments

Dear Mr. Shuping,

I trust you are well.

As per our ZOOM meeting on 10 August 2021, please find attached documents as part of the public participation for the project of Mr. Steytler who would like to clear vegetation on the Remainder of Farm Naauwtesfontein No. 78, Hopetown to establish crops.

Attached to this email please find the cover letter and background information document, should you wish to comment.

Kind regards

--

DSA Digital Soils Africa

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

RE: Public Participation for crop production project_farm Naauwtesfontein78, Hopetown_Applicant: Mr. Steytler

Message 4 of 19

From Radiile Shuping
To Natalie Sharp
Date Fri 15:30
Priority Normal

6343662E99444B31B5FF2DED6...

Good day Natalie

There dont seem to be any attachments to the mail. Copy me to my private mail account just to be safe, its radiile.shuping@gmail.com

Thanks

Radiile Shuping

Chief Financial Officer

Re: Public Participation for crop production project_farm Naauwtesfontein78, Hopetown_Applicant: Mr. Steytler

Message 5 of 1678

From Natalie Sharp
To Radiile Shuping
Copy radiile.shuping@gmail.com
Date Today 08:10

6343662E99444B31B5FF2DED6...
Cover letter for BID.pdf (~178 KB)
Background Information Docum...
Download all attachments

Dear Mr Shuping,

Please see if the attachments came through now.

Kind regards

DSA Digital Soils Africa

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

Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler Message 15 of 20

From Natalie Sharp
To CRobertson@ncpg.gov.za
Date Fri 12:41

Dear Robertson,

Please find attached background information documents for a proposed farming project near Hopetown, should your department wish to comment.

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 (~178 KB)
Background Information Docum...
Download all attachments

Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler Message 14 of 20

From Natalie Sharp
To sinenhlanhla.xulu@dalrrd.gov.za
Date Fri 12:42

Good day,

Please find attached background information documents for a proposed farming project near Hopetown, should your department wish to comment.

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 (~178 KB)
Background Information Docum...
Download all attachments

Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler Message 13 of 20

From Natalie Sharp
To nngxabazi
Date Fri 12:45

Good day Me. Marosane,

Please find attached background information documents for a proposed farming project near Hopetown. Could you please forward the information to your Ward Cllr 2, Mr. Tallies, should he wish to comment.

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 (~178 KB)
Background Information Docum...
Download all attachments

Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler

Message 12 of 20

From Natalie Sharp
To pixley@telkomsa.net
Date Fri 12:46

Good day,

Please find attached background information documents for a proposed farming project near Hopetown, should your department wish to comment.

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 (~178 KB)
- Background Information Docum...

Download all attachments

Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler

Message 11 of 20

From Natalie Sharp
To FortuinB@dws.gov.za
Date Fri 12:47

Good day,

Please find attached background information documents for a proposed farming project near Hopetown, should your department wish to comment.

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 (~178 KB)
- Background Information Docum...

Download all attachments

Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler

Message 10 of 20

From Natalie Sharp
To leonferreira(
Date Fri 12:48

Good day Mr. Ferreira,

Please find attached background information documents for a proposed farming project near Hopetown, should you wish to comment.

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 (~178 KB)
- Background Information Docum...

Download all attachments

FW: Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler

Message 1 of 20

From Leon Ferreira
To natalie@dsafrica.co.za
Copy 'Okkie Gmail', 'Gerrie Scholtz'
Date Today 14:54

Cover letter for BID.PDF (~183 K...
Background Information Docum...
Download all attachments

Dear Natalie

Please copy Okkie in with all future correspondence regarding the application.

I am concerned with the natural slope and drainage of water towards the river and this should not be negatively influenced.

We will obviously not want to jeopardise our neighbour's plans but caution must be taken to prevent future issues.

Regards

Leon Ferreira
Managing Director
T: +27 53 203 8191 | F: +27 53 203 8191 | C: +27 82 807 9245

Re: FW: Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler

From Natalie Sharp
To Leon Ferreira
Copy 'Okkie Gmail', 'Gerrie Scholtz'
Date 2021-08-30 16:09

Dear Mr. Ferreira,

Thank you kindly for your prompt response.

We have taken note of your concerns and will investigate the impact during the Environmental Impact Assessment. We will also consult the Soil Scientist, Dr. D. Bouwer who conducted the soil studies and drainage issues for his recommendations.

Please take note that Mr. Roux from the Department of Agriculture has also been consulted, and I will bring this to his attention, as he is the authority for decision-making on the application for a ploughing certificate.

I take note that you do not wish to jeopardize your neighbour's development, however, you also have environmental rights and your concern will be investigated.

I have added Okkie to the list of Interested and Affected Parties.

May I ask for his surname and cell number?

Kind regards

Natalie Sharp

Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler Message 9 of 20

From Natalie Sharp
To gsbi m
Date Fri 12:49

Good day Mr. Scholtz,

Please find attached background information documents for a proposed farming project near Hopetown, should you wish to comment.

Kind regards

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

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Background Information Docum...
Download all attachments

Good day Mr. Jennings,

We have received your letter of support for the proposed development on your property on 2 August 2021, thank you.

We have progress into the public participation phase of this project and since you are the landowner, we have to consult you.

Please find attached background information documents for the proposed farming project on your property for your information. If you would like to raise any additional comments you are welcome to contact me.

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 (~178 KB)
Background Information Docum...
Download all attachments

Public Participation for crop production project_farm Naauwtesfontein 78, Hopetown_Applicant: Mr. Steytler Message 7 of 20

From Natalie Sharp
To Roux Hannes
Date Fri 13:07

Good day Mr. Roux,

Please find attached background information documents for a proposed farming project near Hopetown, should your department wish to comment.

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 (~178 KB)
Background Information Docum...
Download all attachments

DSA
Digital Soils Africa

1 Kemsley Street
Gqeberha
6001

Proof of registry post:

REGISTERED LETTER
GEREGISTREERDE BRIEF
Post Office
(with an insurance option/met 'n versekeringsopsie)

ORDINARY PARCEL
ShareCall 0860 111 502 www.sapo.co.za
PE 948 574 453 ZA
CUSTOMER COPY 301016

Postage paid R ____ c
Registration fee / Registrasiegeld R ____ c
Insurance / Versekering R ____ c
Total / Totaal R ____ c

Full tracking and tracing/Volledige volg en spoor

Addressed to/Geadresseer aan
PKSDM
Private Bag X 1012
7000 Postcode/Postkode

Insured value of contents
Versekerde waarde van inhoud R ____ c

Enquiries/Navrae
Toll-free number
Tolvry nommer
0800 111 502

Initial of accepting officer
Paraaf van aaneem-beampte

Date stamp / Datumstempel
PARK
2021-06-27
6008

Affix Track and Trace customer copy
Plate Volg-en-Spoor-kliëntafskrif

701281

The value of the contents of this letter is as indicated and compensation is not payable for a letter received unconditionally. Compensation is limited to R100.00. No compensation is payable without documentary proof. Optional insurance up to R2 000.00 is available and applies to domestic registered letters only.-

Die waarde van die inhoud van hierdie brief is soos aangedui en vergoeding sal nie betaal word vir 'n brief wat sonder voorbehoud ontvang word nie. Vergoeding is beperk tot R100.00. Geen vergoeding is sonder dokumentêre bewys betaalbaar nie. Opsionele versekering tot R2 000.00 is beskikbaar en is slegs op binnelandse geregistreerde briewe van toepassing.

REGISTERED LETTER
GEREGISTREERDE BRIEF
Post Office
(with an insurance option/met 'n versekeringsopsie)

ORDINARY PARCEL
ShareCall 0860 111 502 www.sapo.co.za
PE 948 574 467 ZA
CUSTOMER COPY 301016

Postage paid R ____ c
Registration fee / Registrasiegeld R ____ c
Insurance / Versekering R ____ c
Total / Totaal R ____ c

Full tracking and tracing/Volledige volg en spoor

Addressed to/Geadresseer aan
Northern CP R
Po Bo 3132
Kimberly
8300 Postcode/Postkode

Insured value of contents
Versekerde waarde van inhoud R ____ c

Enquiries/Navrae
Toll-free number
Tolvry nommer
0800 111 502

Initial of accepting officer
Paraaf van aaneem-beampte

Date stamp / Datumstempel

Affix Track and Trace customer copy
Plate Volg-en-Spoor-kliëntafskrif

701281

The value of the contents of this letter is as indicated and compensation is not payable for a letter received unconditionally. Compensation is limited to R100.00. No compensation is payable without documentary proof. Optional insurance up to R2 000.00 is available and applies to domestic registered letters only.-

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REGISTERED LETTER
GEREGISTREERDE BRIEF
Post Office
(with an insurance option/met 'n versekeringsopsie)

ORDINARY PARCEL
ShareCall 0860 111 502 www.sapo.co.za
PE 948 574 382 ZA
CUSTOMER COPY 301016

Postage paid R ____ c
Registration fee / Registrasiegeld R ____ c
Insurance / Versekering R ____ c
Total / Totaal R ____ c

Full tracking and tracing/Volledige volg en spoor

Addressed to/Geadresseer aan
FO RLC
PO Box 2458
Kimberly
8300 Postcode/Postkode

Insured value of contents
Versekerde waarde van inhoud R ____ c

Enquiries/Navrae
Toll-free number
Tolvry nommer
0800 111 502

Initial of accepting officer
Paraaf van aaneem-beampte

Date stamp / Datumstempel
PARK
2021-06-27
6008

Affix Track and Trace customer copy
Plate Volg-en-Spoor-kliëntafskrif

701281

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1 Kemsley Street
Gqeberha
6001

Response and Comments

	Interested and Affected Party Name	Date received comments	Concerns raised	Response
1	Thembelihle Local Municipality Att: Mr. Radiile Shuping (Acting Municipal Manager)	On 10 August 2021 a Zoom meeting was carried out.	During the Zoom meeting the Acting Municipal Manager and the Technical Manager (Mr. Steven Marufu) were present. They requested information regarding the proposed project and indicated that since this development falls on private property, they do not have any objections or concerns at this stage.	Background information was provided during the meeting and the Background Information Document (BID) was sent on 27 August 2021 and access to Draft Scoping Report for comment and for more information.
2	Ward Councilor Ward 2: Jacobus Tallies (Me. Nomsa Marosane handles the administration for all councilors in Hopetown). There are currently only 4 wards, after local elections (27 Oct 2021) there will be 6 wards of which this site will then fall within Ward 6.		No comment was received.	BID was sent on 27 August 2021 and access to Draft Scoping Report for comment.
3	Pixley Ka Seme District Municipality Attention: Municipal Manager		No comment was received.	BID was sent on 27 August 2021 and access to Draft Scoping Report for comment.
4	Department of Water and Sanitation (Bloemfontein) Attention: Byron Fortuin		No comment was received.	BID was sent on 27 August 2021 and access to Draft Scoping Report for comment.
5	Department of Agriculture:		No comment was received	Application for a ploughing certificate was submitted on 16 August 2021.

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

	Directorate Land Use & Soil Management Attention: Mr. H. Roux			BID was sent on 27 August 2021 and access to Draft Scoping Report for comment.
6	Department of Agriculture, Environmental Affairs, Rural Development and Land Reform For Att: Mr. I. Gwija Sub-Directorate Impact Management		No comment was received	Draft Scoping Report was couriered to the Department on 27 August 2021.
7	Northern Cape Department of Roads and Public Works Contact person: Crystal Robertson (Communication Officer)		No comment was received	BID was sent on 27 August 2021 and access to Draft Scoping Report for comment.
8	The Office of the Regional Land Claims Commissioner Land Restitution Support: Northern Cape		No comment was received	BID was sent on 27 August 2021 and access to Draft Scoping Report for comment.
9	SAHRIS Contact Person: Natasha Higgitt			The online SAHRIS application online will be submitted once the Heritage Report is completed.
10	Land Owner: Mr. Jennings	2 August 2021	Mr. Jennings indicated that he supports the project.	BID was sent on 27 August 2021 and access to Draft Scoping Report for comment.
11	Neighbour: Leon Ferreira	30 August 2021 Mr. Ferreira phoned and emailed.	Mr. Ferreira requested that Okkie should also be consulted, as his pivot area is also neighboring the application area. He raised a concern regarding the natural slope and drainage of water towards the river and this should not be negatively influenced. He did indicate that he would wish to jeopardise our neighbour's plans but	BID was sent on 27 August 2021 and access to Draft Scoping Report for comment. DSA responded and indicated that this will be investigated during the EIA phase. However, an application for cultivating virgin soil has been submitted to the Department of Agriculture and as such drainage will be investigated.

			caution must be taken to prevent future issues.	
12	Neighbour: Gerrie Scholtz		No comment was received	BID was sent on 27 August 2021 and access to Draft Scoping Report for comment.
13	Neighbour (not directly abutting) Okkie Vermeulen		No comment was received	BID was forwarded by Mr. Ferreira on 27 August 2021 and access to the Draft Scoping Report for comment. Mr. Vermeulen was contacted via whatsapp on 31 August 2021 to inform him that he has been listed on the IA&P, but to date, he has not directly contacted DSA or submitted any comments.

- No person registered or contacted the EAP during the pre-application consultation period as a result of the Notice Board. The Notice Board was removed from the site on 28 September 2021.
- 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 were consulted with a detailed letter and sent via email and an opportunity was given to object or raise concern to the proposed project. The letter was emailed on 11 November 2021 and the comment period will stop on 13 December 2021. The following people are abutting neighbours:
  - Leon Ferreira
  - Gerrie Scholtz
- During the Scoping Phase Mr. Ferreira requested that Mr. Vermeulen must also be consulted as he is renting pivot areas abutting the proposed application area. Thus, during the EIA phase of public participation a letter was emailed on 11 November 2021 and the comment period will stop on 13 December 2021
- The Thembelihle Municipal was consulted via email and register post and an opportunity was given to object or raise concern to the proposed project. The letter was emailed on 11 November 2021 and the comment period will stop on 13 December 2021.
- The Pixle Ka Seme District Municipal was consulted via email and register post and an opportunity was given to object or raise concern to the proposed project. The letter was emailed on 11 November 2021 and the comment period will stop on 13 December 2021.
- The Ward 2 Councilor was consulted via email and an opportunity was given to object or raise concerns about the proposed project. The letter was emailed on 11 November 2021 and the comment period will stop on 13 December 2021. It should be noted that there are currently only 4 wards, after local elections, there will be 6 wards, of which this site will then fall within Ward 6.
- The Department of Water and Sanitation was consulted via email and register post and an opportunity was given to object or raise concern to the proposed project. The letter was emailed on 11 November 2021 and the comment period will stop on 13 December 2021.
- The Department of Agriculture was consulted via email and an opportunity was given to object or raise concern to the proposed project. The letter was emailed on 11 November 2021 and the comment period will stop on 13 December 2021.
- The Department of Roads and Public Work Northern Cape was consulted via email and an opportunity was given to object or raise concern to the proposed project. The letter was emailed on 11 November 2021 and the comment period will stop on 13 December 2021.
- The Lands Claim Commissioner of the Northern Cape was consulted via email and an opportunity was given to object or raise concern to the proposed project. The letter was emailed on 11 November 2021 and the comment period will stop on 13 December 2021.
- 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 will also be 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.

Example of consultation letter sent to DWS and Department of Agriculture during the EIA Phase

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

2021-11-11

Department of Water and Sanitation
Private Bag X5912
Upington
8800
Attention: Mr. Byron Fortuin

Byron Fortuin

ENVIRONMENTAL IMPACT APPLICATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, FOR THE CLEARING OF VEGETATION ON THE REMAINDER OF FARM NAAUWTESFONTEIN NO. 78, HOPETOWN. APPLICANT: MR. G.F. STEYTLER. EIA Public Participation Phase.

Mr. Steytler 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 registered as an Interested and Affected Party and are invited to participate in the EIA Phase of the public participation. All written comments will be responded to and forwarded to the relevant departments, in the form of a Public Participation Report.

The purpose of this letter and attached document 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 Environmental Impact Assessment (EIA) Report to be submitted to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (hereinafter referred to as the Department) 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 13 December 2021** at 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
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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.

Due to the **Covid pandemic** and in an attempt to lower the risk of infection, the Draft EIA Report will not be forwarded as a hard copy. Instead, 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 Steytler link. To access the loaded documents use the password: SteY@gf78. Alternatively, you may request that the document be sent via 'We Transfer' app, in such a case.

Yours sincerely

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

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2021-11-11

Department of Agriculture
Directorate Land Use and Soil Management
P O Box 2303
Kimberley
8300
Attention: Mr. Roux

ENVIRONMENTAL IMPACT APPLICATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, FOR THE CLEARING OF VEGETATION ON THE REMAINDER OF FARM NAAUWTESFONTEIN NO. 78, HOPETOWN. APPLICANT: MR. G.F. STEYTLER. EIA Public Participation Phase.

Mr. Steytler 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 registered as an Interested and Affected Party and are invited to participate in the EIA Phase of the public participation. All written comments will be responded to and forwarded to the relevant departments, in the form of a Public Participation Report.

The purpose of this letter and attached document 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 Environmental Impact Assessment (EIA) Report to be submitted to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (hereinafter referred to as the Department) 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 13 December 2021** at 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.

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Where we are in the process

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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.

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2021-11-11

Dear Interested and Affected Party

ENVIRONMENTAL IMPACT APPLICATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998, FOR THE CLEARING OF VEGETATION ON THE REMAINDER OF FARM NAAUWTESFONTAIN NO. 78, HOPETOWN. APPLICANT: MR. G.F. STEYTLER. EIA Public Participation Phase.

Mr. Steytler 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 registered as an Interested and Affected Party and are invited to participate in the EIA Phase of the public participation. All written comments will be responded to and forwarded to the relevant departments, in the form of a Public Participation Report.

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 attached Background Information Document.

Public Participation Process

The purpose of the Background Information Document is to provide you with *basic information* regarding the proposed project and does not replace the Environmental Impact Assessment Report (EIA). You are provided the opportunity to raise any comments you might have on the proposed project.

If you would like to participate in the process, please respond in writing. Comments must be received **on or before 13 December 2021** before 5pm. If no comments are received from you, it will then be regarded that you do not have any comments.

Way Forward

- The outcome of this consultation process will be submitted to the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (hereinafter referred to as the Department) as part of the Final EIA Report.
- On completion of the EIA public participation process, the Final EIA will be finalised and submitted to the Department.

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- The Draft EIA & EMP document and required specialist reports is 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) as part of the EIA Public Participation Phase.
- Please note that due to the **Covid pandemic** and in an attempt to lower the risk of infection, the Draft EIA will not be placed in a public place as a hard copy. Instead, 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 Steytler link. To access the loaded document use the password: SteY@gf78.
- All required documents will be submitted to the relevant department for decision-making.
- If the application is accepted, the relevant department will either issue or reject the Environmental Authorisation.
- As an I&AP's, you will be notified of the final decision of the relevant departments.

Yours sincerely

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

EIA PHASE: PUBLIC PARTICIPATION

BACKGROUND INFORMATION REGARDING CLEARING OF VEGETATION ON THE REMAINDER OF FARM NAAUWTESFONTEIN NO. 78, HOPETOWN

MR. G.F. STEYTLER

NOVEMBER 2021

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1 Kemsley Street

Port Elizabeth

Directors:
Prof Pieter le Roux
Dr George van Zijl
Dr Darren Bouwer
Dr Johan van Tol

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PURPOSE OF THIS DOCUMENT

The purpose of this document is to provide all **registered** I&AP's with information about the intent of Mr. Steytler to apply for 269 Ha but clear about 177 Ha of vegetation on this area to establish pivot areas for crop production on the Remainder of farm Naauwtesfontein No. 78, Hopetown 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 the 11th of November 2021 and 13th of December 2021.

BRIEF PROJECT DESCRIPTION

The site is situated north-west from Hopetown in the Northern Cape (**Site A:** 29° 30' 38.85"S; 23° 56' 40.97"E and **Site B:** 29° 31' 10.72"S; 23° 58 '19.99"E) on the Remainder of Farm Naauwtesfontain No. 78, within the Thembelihle Local Municipal area. The farm can be reached by traveling along the R3112 (old Douglas road) north-west from Hopetown for about 16km until the farm road of Site A is reached.

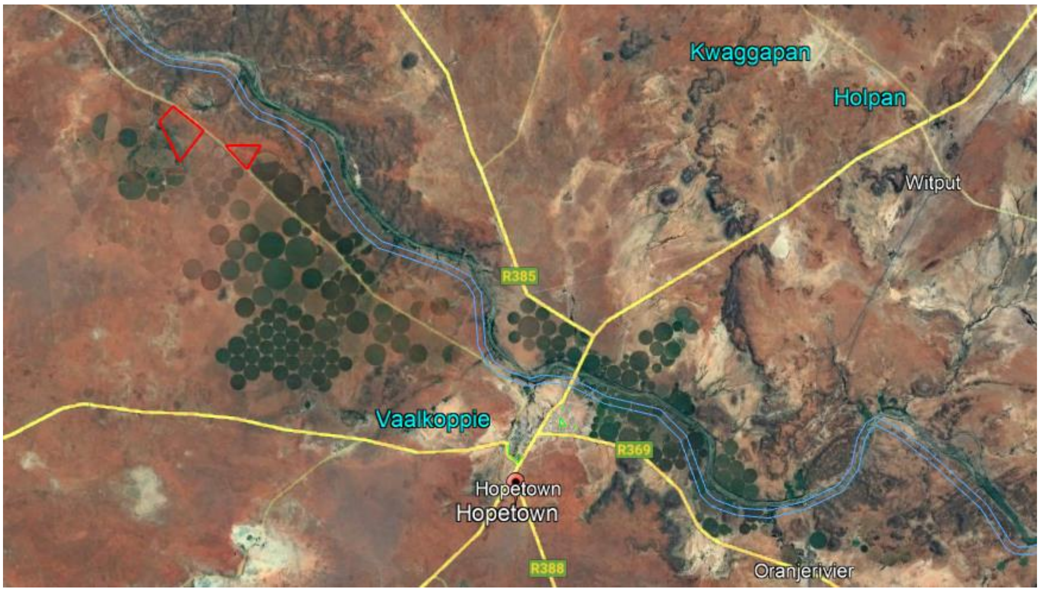

Figure 1: Site location is indicated as the red polygons along the R3112 (old Douglas road). The site further north is Site A and the site further south is Site B.

The property involves, belongs to Mr. Jennings who has a lease agreement with the Applicant (Mr. Steytler). Digital Soils Africa (Pty) Ltd. (DSA) was tasked by Mr. Steytler to conduct environmental investigations and complete the environmental application for the clearing of natural veld used for grazing purposes and to apply for the cultivating of virgin soil (known as ploughing certificate), to establish crops.

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

Environmental Assessment

DSA was appointed by Mr. Steytler 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) – Clearing of vegetation of 20 Ha or more of indigenous vegetation.	*The site is 269 Ha in size, but only the pivot areas will be cleared from vegetation to establish crops, which amounts to about 177Ha in total pivot areas. Therefore the transformation of grazing land to cropland will be applicable.*

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 cultivation and irrigation. 269 ha of land was investigated and soil forms included:

- Coega (covering about 21Ha of the study area),
- Glenrosa (covering about 36Ha of the study area),
- Kimberley (covering about 57Ha of the study area),
- Olienhout (covering about 9Ha of the study area),
- Nkonkoni (covering about 97Ha of the study area), and
- Plooysburg (covering about 65Ha of the study area).

The Nkonkoni, Glenrosa, Olienhout, and Kimberley soil forms were generally considered suitable for irrigation, while portions of the Nkonkoni, Glenrosa, and Plooysburg soil forms were only moderately suitable due to the depth of limiting material. The Coega soil form and portion of the Olienhout soil forms were considered not suitable for irrigation.

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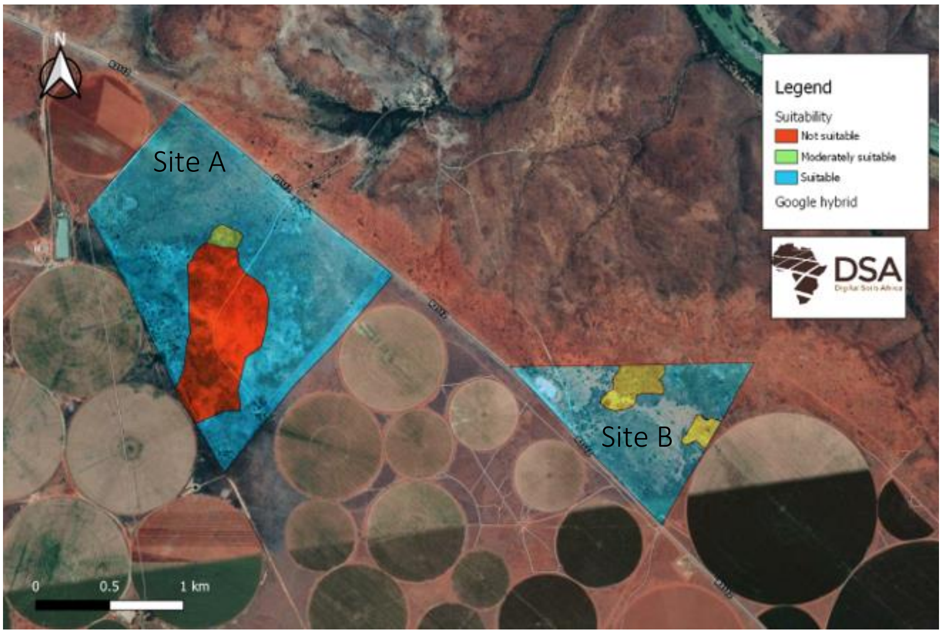

FIGURE 2: SUITABILITY AREAS FOR CROP PRODUCTION ACCORDING TO THE SOIL REPORT

Ultimately the soil report concluded that most of the surveyed area is suitable for irrigation, due to the free-draining soils and cracked rock underlying most profiles, however, some areas that are not suitable for irrigation (see Figure 2, the red polygon areas) are limited by external drainage. This area is underlain by a hardpan carbonate horizon, which is an indication of water accumulation in arid climates, and the other by hard rock.

Therefore, it was recommended in the soil report that the pivot placement in Site A does not exceed more than 10% of unsuitable soil. Site B only has small areas of moderately suitable soils for irrigation, which can be incorporated into pivot areas and thus the pivot placement is not affected by soil suitability. Therefore the environmental impacts on soil quality would be too high if pivot placement on Site A was to be placed over more than 10% of the unsuitable soils. For this reason, the pivot layout will be as suggested in Figure 3.

In terms of drainage, according to the soil report, drainage will take place on Site A towards the northeast, and thus it is not expected that irrigation and drainage will cumulatively contribute to water accumulating on the center section of Site A as a result of this project and therefore not contribute to the soil degradation risk. The same applies to Site B.

The Applicant will have to monitor the situation at the site and specifically, the 55Ha pivot areas on Site A. If waterlogging on the pivot areas is noted, this impact can be mitigated. Options might vary from shallow surface drains to more intensive drainage using wide-spaced furrows. The impact on soil properties is rated low with mitigation.

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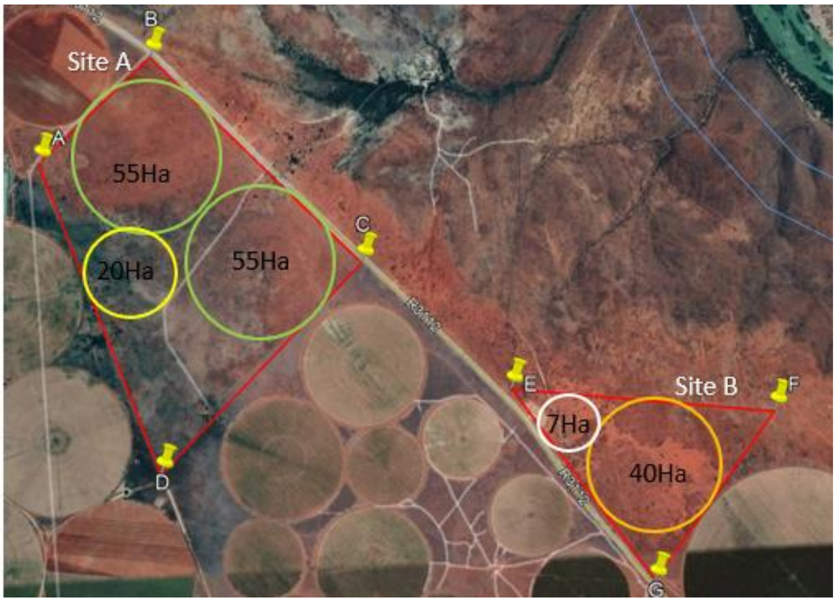

FIGURE 3: PIVOT LAYOUT

Loss of on-site flora:

A vegetation survey was completed by Dr. van Aardt. According to the vegetation report, four different vegetation units were identified at Site A, and two different vegetation types at Site B. According to the report completed by Dr. van Aardt, the species found in the abovementioned vegetation units is typical of species from the Kimberley Thronveld (SVk4) and karroid vegetation. The site is not listed as an endanged or protected ecosystem with only the wetland/drainage line as an important ecological feature with ecological function. The majority of this area will be excluded from the pivot layout as per Figure 3 and Figure 4. Another area of concern is the grass dominated shrubland in Site B, due to the presence of high numbers of the protected *Vachellia heamatoxylon.*

In terms of connectivity, Dr. van Aardt indicated that Site A has no to very limited connection to any natural vegetation due to the existing land-uses surrounding the site. Site B is however connected to the natural vegetation of SVk4 on the north-eastern and north-western boundaries but since the southern boundaries are bordered by agricultural land and the R3112 abuts the site, the connectivity is very limited.

The direct impact is the complete removal of natural vegetation and the replacement of pivot areas for crop production, thus the removal of natural vegetation will be permanent and to the extent of about 177Ha.

As a recommendation, Dr. van Aardt indicated that most of the areas surrounding the study area are already transformed and it is therefore recommended that most of the geophytes be transplanted in other natural areas. Several large trees of the protected *Vachellia heamatoxylon* and *V. erioloba* were found at the study site. Dr. van Aardt recommends that effort must be made to protect as many as possible of these species. Permits need to be obtained before any of the protected and specially protected species can be removed. No red data species were found to be present in the study area. All alien invasive species, especially the *Prosopis glandulosa* and *Tamarix ramosissima* should be removed and eradicated from the site as a high priority. The impact is rated low-moderate with mitigation.

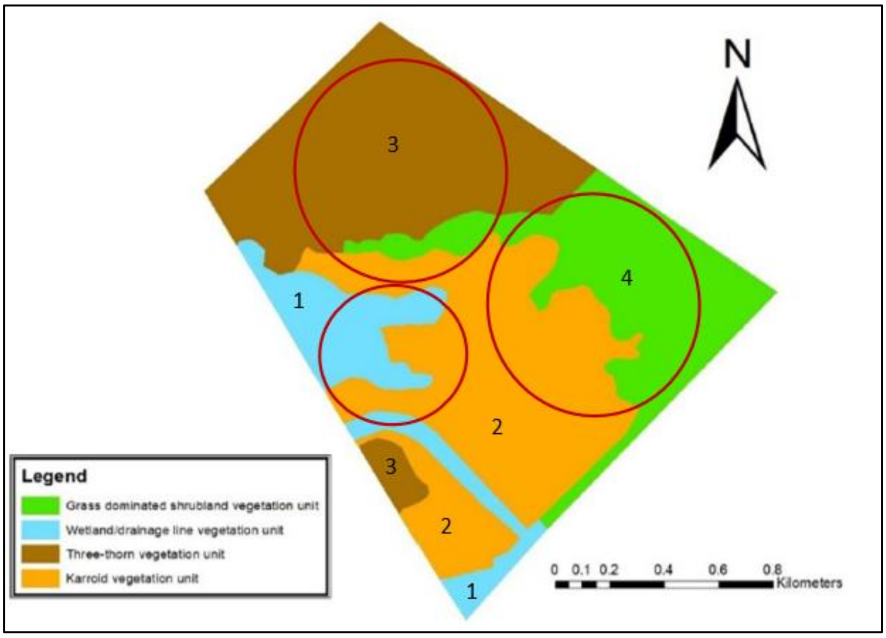

FIGURE 4: VEGETATION UNITS OF THE SITE A ACCORDING TO THE VEGETATION SURVEY REPORT. THE RED CIRCLES INDICATE THE PROPOSED PIVOT AREAS.

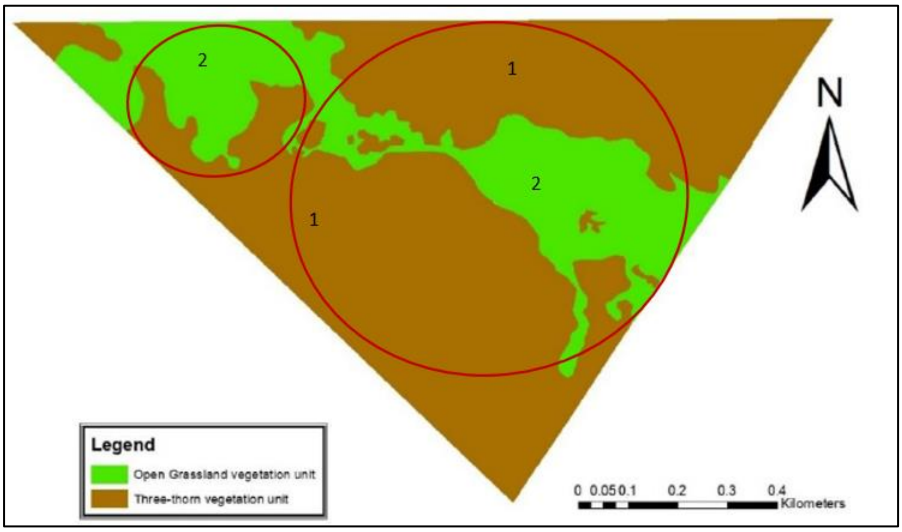

FIGURE 5: VEGETATION UNITS OF THE SITE B ACCORDING TO THE VEGETATION SURVEY REPORT. THE RED CIRCLES INDICATE THE PROPOSED PIVOT AREAS.

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Loss of on-site fauna:
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 will destroy habitat and put animals at risk of being killed, and nesting places being destroyed and 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.

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. 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. The impact is rated very low with mitigation.

Sensitive Sites:
According to the Northern Cape Biodiversity Conservation Plan, the site falls does not fall within a Terrestrial Critically Biodiversity Area (CBA). The Thembelihle Municipality does not have a Spatial Development Framework, but the Pixley Ka Seme District Municipality has a Spatial Development Framework. According to this SDF, the site falls within an area that is rated as a low sensitivity area.

According to the vegetation survey report, the onsite investigations confirmed that the plant species found at the site is typical of species from the Kimberley Thornveld (SVk4), which is classified as least threatened and karroid vegetation and is not listed as an endangered or protected ecosystem. Although the vegetation report indicated that the drainage line at Site A might serve as an important ecological feature with ecological functions, the author was not aware of the fact that neigboring farms created the drainage lines to drain runoff into Site A and thus artificially created the drainage line. Thus the broad-based, regional/national plans are applicable.

The clearing of vegetation will be restricted to the pivot areas only and the artificial drainage line is excluded from the pivot layout on Site A. The impact is rated moderate with mitigation.

Photo records of the study area can be viewed in the full EIA.

Water:
The proposed site falls within Lower Orange Water Management Area, in the sub-quaternary catchment, D33G. The site is located within a Fish Support Area of the *Barbus anoplus*. Both Sites A and B do not host any water feature (wetland, natural drainage line, stream, or river) and are situated more than 1.7km and 2.6km from the Orange River respectively. Site A is situated about 500 southwest of the nearest drainage line, but the R3112 separates the site from the drainage line and Site B is about 450m south of the nearest drainage line. Thus, there is no impact expected on the *Barbus anoplus* fish sanctuary.

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. 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. The natural drainage of both Sites A and B is northeast.

Site A is situated about 500m southwest of the nearest drainage line that eventually (2.6 km further) drains into the Orange River. In terms of surface runoff, the R3112 sever the site off and it is expected that any surface runoff that might contain silt will drain into the road reserve and away from the drainage lines. Surface runoff is, however, highly unlikely, considering the sandy soil with easy drainage and the low rainfall this area generally receives.

Site B is situated about 450m south of the nearest drainage line that eventually (1.6 Km further) drains into the Orange River. In terms of surface runoff, the path is not impeded but considering the sandy soil and low rainfall, it is unlikely that the impact of possible silt transport as a result of clearing vegetation will impact the Orange River. Furthermore, the 1.6km area and drainage lines are well established with natural vegetation, thus the limited 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. Due to the far distance (>1.6km) from the Orange River, it is highly unlikely that any TSS (Total Suspended Solids) and TDS (Total Dissolved Solids) increase will be experienced. 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.

The main concern was the Na that was high in relation to other cations, which could lead to sodicity and if not managed correctly, can lead to degradation of soil by reducing the flow of

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water through soil, which limits leaching and can cause salt to accumulate over time and develop of saline subsoils. It can also cause crusting and sealing on the soil surface, which impedes water infiltration, accelerating erosion and causing structureless soils.

However, the laboratory results indicate that the chemical parameters are manageable. The Cation Exchange Capacity (CEC) is extremely low (2.63-4.38 cmol(+)/kg), this, in turn, has a pronounced effect on the Exchangeable Sodium Percentage (ESP). The ESP is very high and especially high for a red apedal soil. Since ESP is a percentage of the Na to CEC, the low CEC can exaggerate the ESP. An exaggerated ESP is supported by the low Electrical Conductivity of the soils. The irrigation threshold of EC for water is 400 mS/m. These soils can be rectified with irrigation and fertilization on soils with adequate drainage, the Na should leach out if lime or Gipson is applied to the soil and be replaced with Ca, Ma and K, lowering the ESP.

An indirect impact could be ultimately the leaching of Na into the drainage lines and eventually into the Orange River. Dr. Bouwer who conducted the soil report indicated that the total amount of Na in the soils found in the study area is extremely low because of the relationship between Na and the cations, and the amount that would leach out will be very limited and will not have an indirect impact on the Orange River. Cumulatively, surrounding farms could however contribute to a larger impact.

In terms of reduction in the ecological reserve, abstraction of water is always a potential indirect impact if new croplands are established and more water is abstracted from a system that would sustain the ecology. 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.

With mitigation, the impact is rated low but can increase to low-moderate without mitigation.

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 Diamonds Field Advertiser on 27 August 2021, informing the public of the application. No person or entity registered as a result of the notice boards or advertisement.

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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 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 13 December 2021 till 5pm.

Please note that due to the **Covid pandemic** and in an attempt to lower the risk of infection, the Draft EIA will not be placed in a public place as a hard copy. Instead, a copy of the Draft EIA is also available on the DSA website at www.dsafrica.co.za. Please follow the link to Services, Environmental Services, Documents, and choose the Steytler link. To access the loaded documents use the password:
SteY@gf78.

If you have any other questions or inquiries, please do not hesitate the contact the EAP at 082 414 0472. If no comments are received from you, it will then be regarded that you do not have any comments.

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APPENDIX D

ENVIRONMENTAL MANAGEMENT PLAN

For the

Application for Environmental Authorisation for the claring of vegetation on the Remainder of Farm Naauwtesfontein No. 78, Hopetown

Prepared for

MR. G. F. STEYTLER

Reference: NC/EIA/12/PIX/THE/HOP1/2021

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TABLE OF CONTENTS

1. BACKGROUND

Digital Soils Africa (Pty) LTD (DSA) was tasked by Mr. George Frank Steytler to conduct environmental investigations and complete the Environmental Authorisation Application for the authorisation of clearing 269Ha of vegetation on the Remainder of the Farm Naauwtesfontein No. 78, Hopetown 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 Mr. Steytler (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.

Mr. Steytler would like to develop 269Ha of which about 177Ha of vegetation will be cleared to establish pivots for irrigating maize, wheat crops, and pasture. Two sites on the same farm were chosen for this development, which will be referred to henceforth as Site A (198Ha in total) and Site B (71Ha in total). The rest of the 92Ha that are located between the proposed pivot areas should be used as an offset area and preserve for conservation purposes and possible transplant of vegetation, depending on the outcome of the vegetation report.

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-west from Hopetown in the Northern Cape (**Site A:** 29° 30' 38.85"S; 23° 56' 40.97"E and **Site B:** 29° 31' 10.72"S; 23° 58 '19.99"E) on the Remainder of Farm Naauwtesfontein No. 78, within the Thembelihle Local Municipal area. The farm can be reached by traveling along the R3112 (old Douglas road) north-west from Hopetown for about 16km until the farm road of Site A is reached.

SGID of the properties under application:

C03300000000007800000

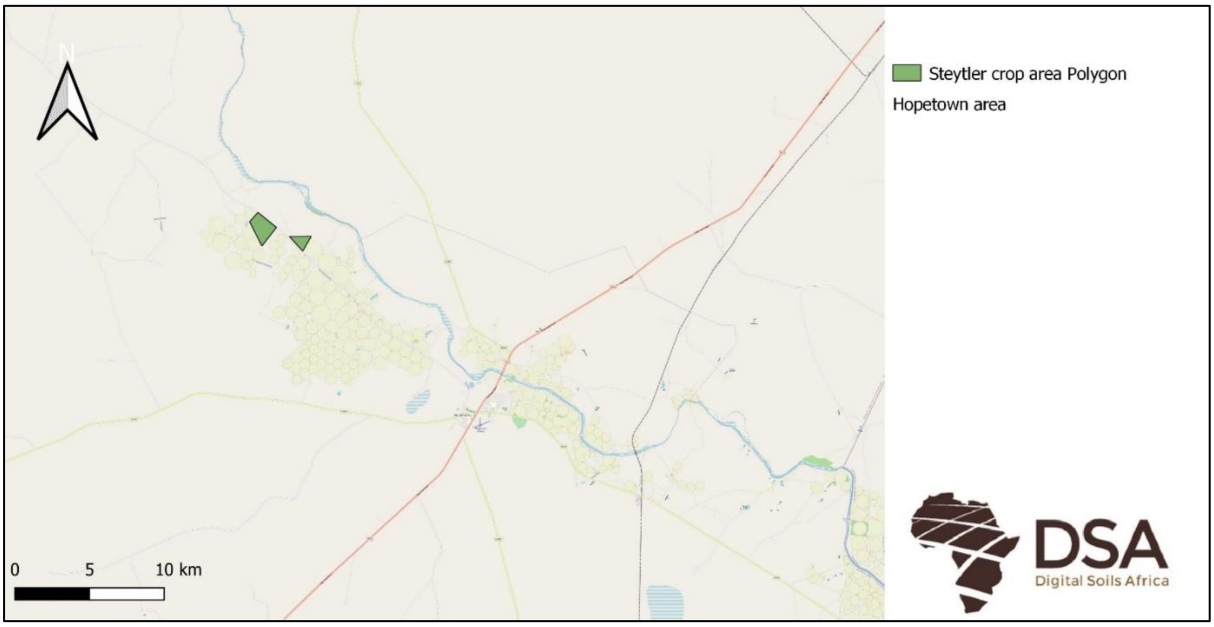

Figure 1: Site location

1 Kemsley Street
Gqeberha
6001

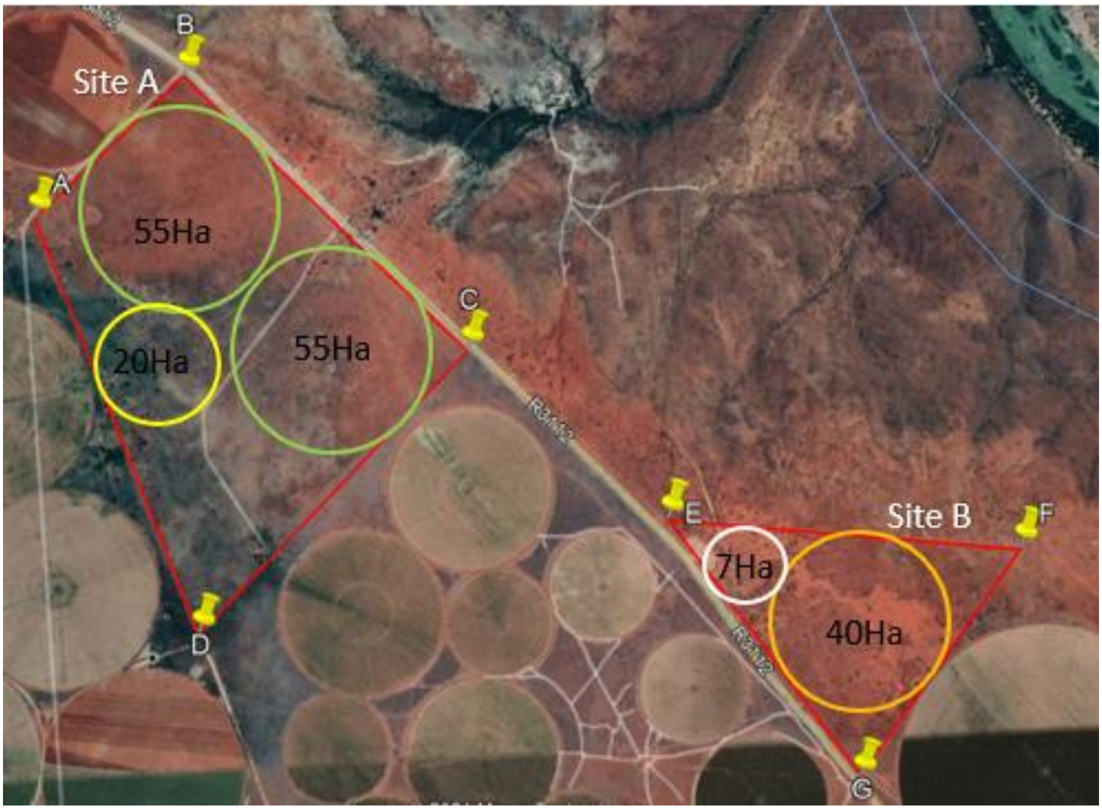

Figure 2: Proposed site layout of pivot areas

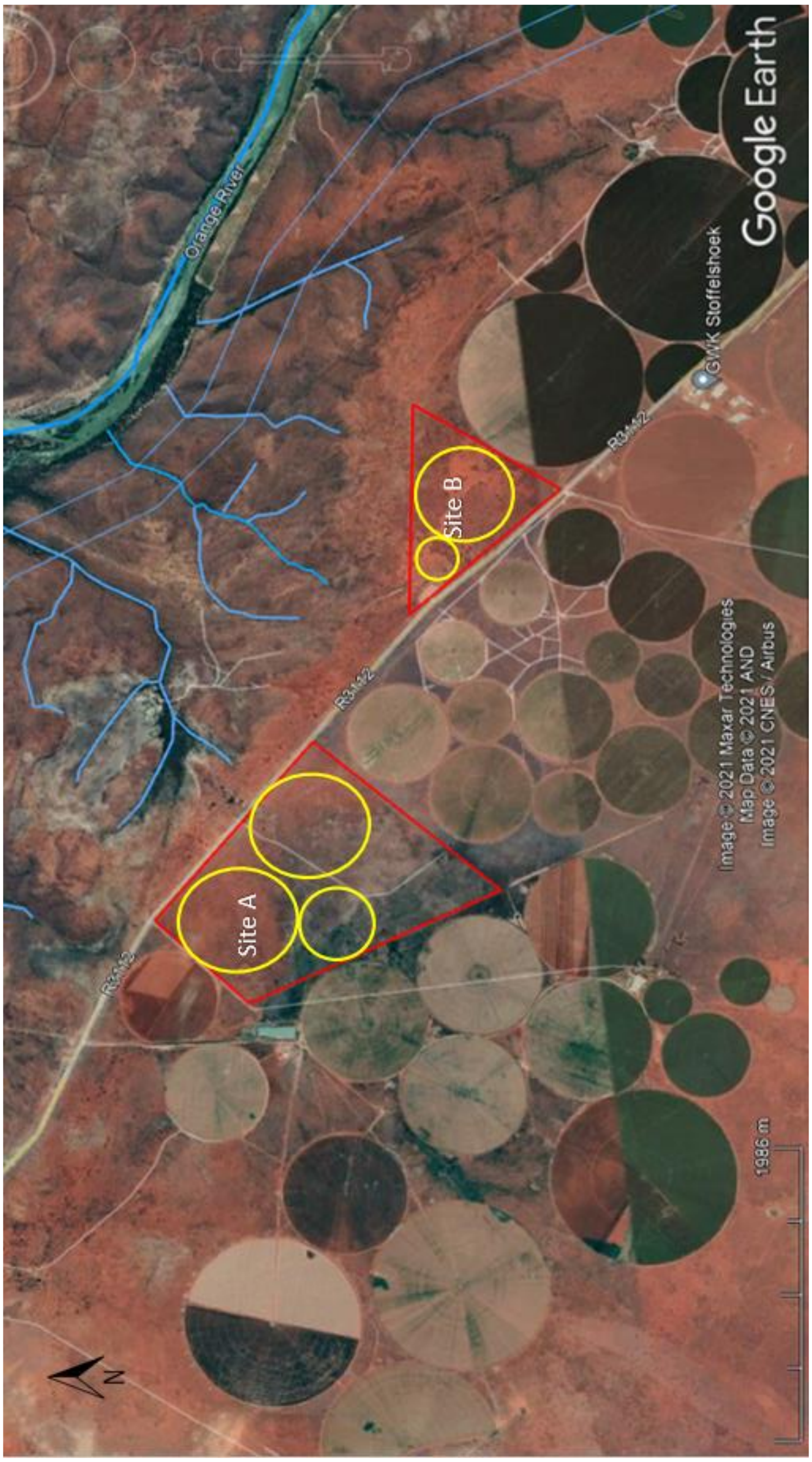

Figure 3: Sensitive areas indicated above. The blue line represents drainage lines and the Orange River, the red polygons the proposed site, and the yellow circles the proposed pivot areas.

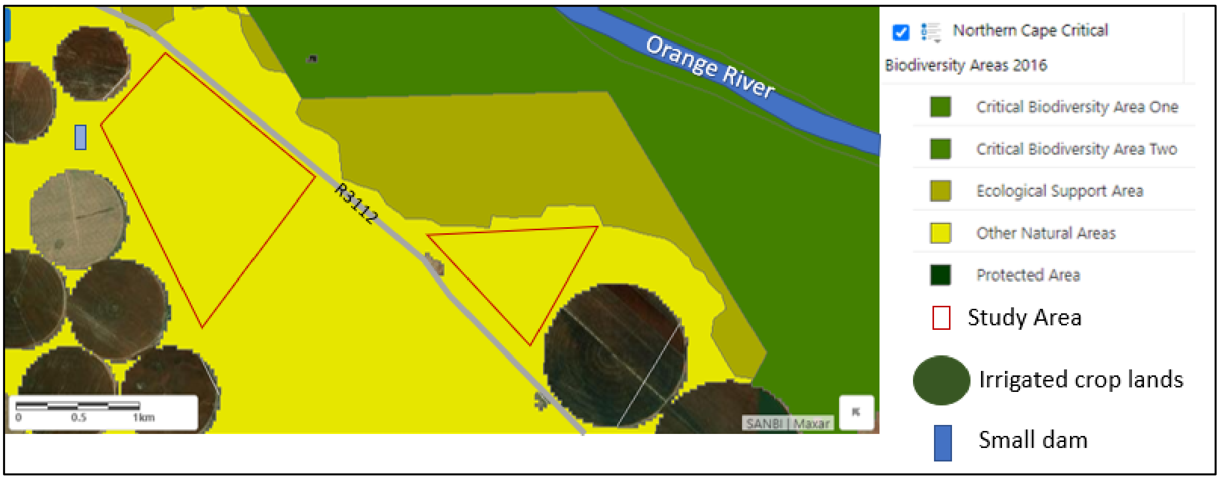

Figure 4: The site falls within 'Other Natural Areas' according to the BGIS of the Northern Cape Biodiversity Conservation Plan.

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 269 Ha in size, but only 177Ha of vegetation will be cleared for the establishment of pivots. Therefore the transformation of grazing land to crop land.	Site A: 29° 30' 38.85"S 23° 56' 40.97"E Site B: 29° 31' 10.72"S 23° 58 '19.99"E

The proposed development will transform 177 Ha of natural vegetation currently being used as a natural grazing area into maize, wheat and alternating every second year with lucerne on the Remainder of Farm Naauwtesfontein No. 78, Hopetown. The 92Ha area between the pivot areas will be used as a nursery to transplant vegetation rescued from the farm Naauwtesfontein No. 78.

The clearance of vegetation will take place simultaneously at Site A and Site B within 2-4 months.

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

Most of the surveyed area is suitable for irrigation, due to the free-draining soils and cracked rock underlying most profiles, however, the areas that are not suitable for irrigation are limited by external drainage. One area is underlain by a hardpan carbonate horizon, which is an indication of water accumulation in arid climates, and the other by hard rock.

Therefore, it was recommended in the soil report that the pivot placement in Site A does not exceed more than 10% of unsuitable soil. Site B only has small areas of moderately suitable soils for irrigation. Thus pivot areas were laid out in accordance with the recommendations of the soil report (see **Figure 2**).

The clearance of vegetation will take place simultaneously at Site A and Site B within 2-4 months. The construction phase will result in the clearing of natural veld on the allocated pivot areas according to the soil report and preparing the soil.

After about 4 months 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. It is also the intent of the Applicant to rest the crop fields annually through rotating crops. About 200Ha is currently approved and under crop production, the addition of the 269Ha will allow the Applicant to continue to produce 177Ha of crops per annum, but also allowing the alternating camps to rest. It is not the intent of the Applicant to increase crop production to 400Ha per annum. 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, such as deep ripping, removing access rocks, spreading of chicken manure or other organic fertilisers on the land, as well as Gipson or lime to leach out the Na.

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 is owned by Mr. I.J. Jennings. The Applicant is Mr. G.F. Steytler and has a lease agreement with the landowner for the proposed development. On 2 August 2021, Mr. Jennings indicated he supports the proposed development. Mr. Steytler will therefore manage and maintain the site during the construction and operational phases, and if need be the decommissioning phase.

Zoning

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The site is zoned Agriculture and the proposed development is not an application for 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

Site A is situated more than 2.6 km from the Orange River, and Site B is more than 1.7 km from the river. There is one artificial drainage line on Site A, which was constructed by abutting neighbours to drain water from their properties onto Site A. There are no other water features on the site. The closest natural drainage line to Site A is separated by the R3112 and is about 500 northeast of the site, and Site B is about 450m south from the closest natural drainage line. Therefore, authorization from the DWS is not a requirement, since the development is more than 100m from natural drainage lines.

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 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. However, the laboratory results indicate that the exchangeable sodium percentage (ESP) values are high. Na in relation to other cations is high, thus a possible indication of sodicity, and if not managed correctly, can lead to degradation of soil by reducing the flow of water through soil, which limits leaching and can cause salt to accumulate over time and develop of saline subsoils. It can also cause crusting and sealing on the soil surface, which impedes water infiltration, accelerating erosion and causing structureless soils.

The soil report indicated that this potential risk can be rectified with irrigation and fertilization on soils with adequate drainage, so that the Na can leach out and be replaced with Ca, Ma and K, lowering the ESP. Thus soil management will be the most important principle to apply to manage the chemical parameters and prevent soil degradation.

Once the vegetation is cleared, the soil will be deep ripped, which will further improve drainage, access rocks will be removed, spreading of chicken manure or other organic fertilisers, but also Gipson or lime should be applied to leach out the Na. Once the soil is prepared, the maize or wheat will be planted.

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. The Method Statements contain sufficient detail such that the Environmental Officer and Project 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 Manager to formalize the approved Method Statement. Method Statements and/or Management Plans must be submitted by the Contractor to the Project 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.

The Environmental Officer and/or Applicant must monitor the implementation of the Method Statements and activity-specific management plans during the operation phase of the project.

PLANNING AND DESIGN PHASE MANAGEMENT

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 A and B, excluding a center section of Site A due to unsuitable soil properties.

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 269ha was presented as a potential development area, which was divided into Site A and Site B. Initially, 145 Ha on Site A was considered for clearing vegetation and establishing pivots. However, specialist studies conducted during the EIA phase, have indicated that an alternative layout plan or site development plan, should be considered to minimize the impacts on the physical, biological, and socio-economic aspects of the proposed development. The revised site layout reduced the 145 Ha to 130 Ha on Site A.

The soil report and findings were the leading factors in deciding to allocate the pivot areas. Deep soil depths, favoured soil types, and drainage led to the best soil suitability areas. At Site A there is a central section that was identified as not being suitable for irrigation due to potential drainage issues, thus the pivot placement of Site A should not exceed more than 10% of unsuitable soil in a pivot. To achieve this objective, two 55Ha pivots should be placed as close as possible to the boundary of the north-eastern section of the property, as the soils along this portion are the most suited. A 20Ha pivot can be placed directly south of the most northern 55Ha pivot, west from the haul road (see **Figure 2**). In the soil report, another 20Ha pivot area was identified most south of Site A, however, it is the opinion of the author that this pivot should not be developed as more than 80% of this pivot area will have unsuitable soil.

In addition, Site A is flanked by pivot areas of neighbouring farms, except to the northeast of the site. During the Scoping Phase public participation, a neighbor raised a concern regarding the natural slope of their site and drainage of water towards Site A and ultimately towards the river. This might potentially be a problem for the Applicant if water from abutting farms drains into the applied site.

What was interesting to find from the two specialist studies completed (soil and vegetation) for this site and more specifically Site A, was that the soil report did not find any soil indicating the presence of a wetland, however, at Site A a wetland/drainage line vegetation unit was classified. If the soil is considered, the areas where the vegetation report identified the wetland/drainage line vegetation have a limiting factor of hard carbonate layer at about 0.5-1m deep. Considering the feedback from the abutting neighbour during the Scoping Phase public participation, that they have constructed drainage lines on their property to drain into this particular site, it is not surprising that wetland/drainage line vegetation has succeeded in establishing. If sufficient water from abutting croplands accumulates for enough time in this area the hard carbonate layer will limit drainage and the soil will become saturated for longer periods, resulting in vegetation preferring saturated soils.

Considering the above, if the pivots are placed according to the layout plan, then cumulative drainage can be directed towards the center area of Site A that is excluded from being developed.

Site B had small areas of moderately suitable soils for irrigation, while the majority of this site was favourable, thus the pivot placements would not be affected by suitability at Site B. One large pivot area of 40Ha will be placed in the center of Site B, with a smaller 7Ha pivot area north-west from the 40Ha pivot area.

The next step is to demarcate the pivot areas before the clearing of vegetation to avoid unnecessary disturbance. The development perimeter must be demarcated using beacons.

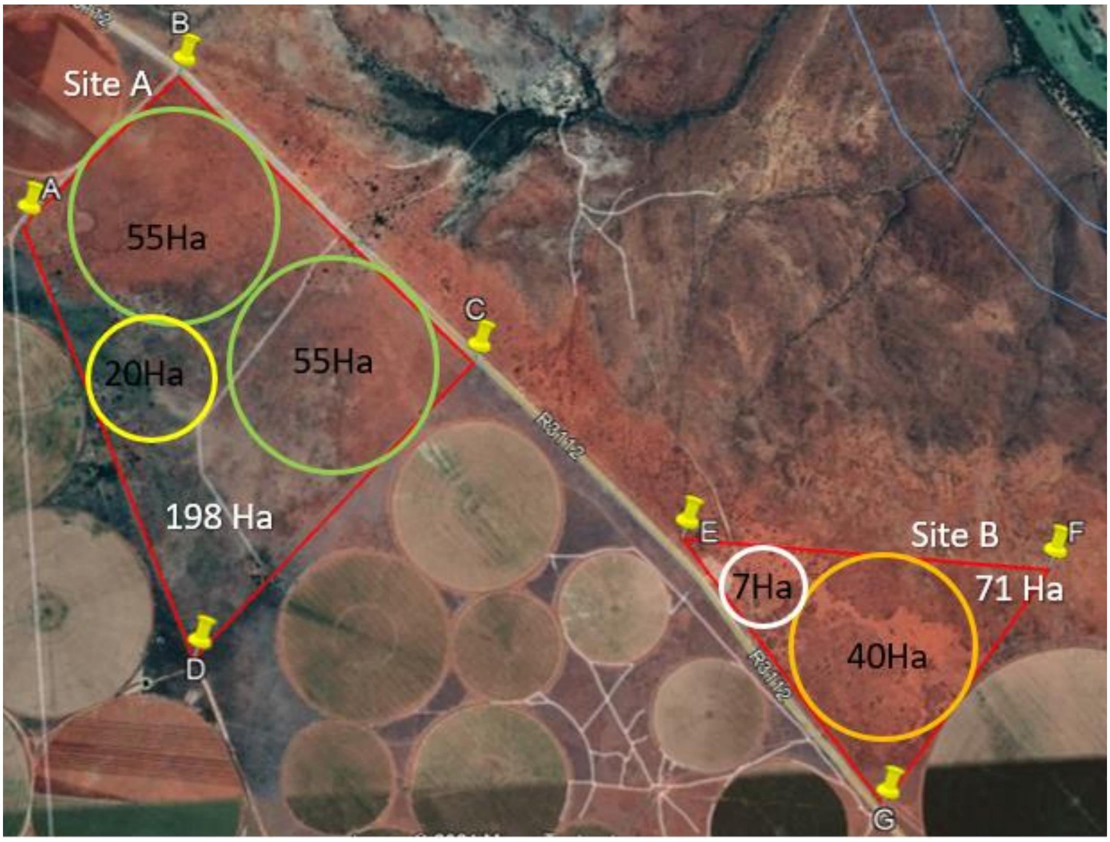

Figure 5: Site plan with coordinates in below Table.

Coordinates of the site

	Site A
A	29° 30’ 28.13”S 23° 56’ 9.65”E
B	29° 30’ 7.73”S 23° 56’ 30.13”E
C	29° 30’ 40.38”S 23° 57’ 16.54”E
D	29° 31’ 20.77”S 23° 56’ 39.93”E
	Site B
E	29° 31’ 0.18”S 23° 57’ 48.92”E
F	29° 31’ 59.66”S 23° 58’ 42.51”E
G	29° 31’ 31.84”S 23° 58’ 21.44”E

Site A: 198 Ha
Site B: 71 Ha

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, of environmental change due to monitoring;
- The activity complies with all relevant legislation, permits, and authorizations.

The Applicant, Mr. Steytler, is responsible for 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 of 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,
    - Monitoring efficiency of crop rotation, and
    - Fertilization.
- Management of alien vegetation is sufficient to prevent spreading or cause fire hazards;
- Managing crop health;
- The activity complies with all relevant legislation, permits, and authorizations.

The Applicant, Mr. Steytler, is responsible for ongoing management of the site, until the farm is sold or 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/lisences/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 Mr. G.F. Steytler 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/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.

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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 to 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

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6001

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.

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
Geology & Palaeonology	None	None	None	None
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	Low	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 is 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 pivot layout is followed.

GEOLOGY, SOIL MANAGEMENT & EROSION

Objective:

- Prevent erosion and sedimentation in the riparian areas.
- Prevent soil pollution and degradation.

Actions / Management Measures:

Geology and Palaeonology

Construction Phase:

- **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 the South African Heritage Resources Agency (SAHRA).
- The decision regarding the Environmental Auhtorisation Application must eb 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 paleontologist.

Soil Management

- To reduce the potential risk of soil degradation, soils must be irrigated and fertilised so that Na can leach out and be replaced with Ca, Ma and K, lowering the ESP.
- Crop rotation should be applied, alternating every year between crops or lucerne.
- 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, such as deep ripping, removing access rocks, spreading of chicken manure or other organic fertilisers on the land, as well as Gipson or lime to leach out the Na.
- No additional land should be cleared.
- The 92 Ha area between pivots 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 layout plan.
- Monitor and maintain the drainage.
- Keep record of the irrigation and adjust the scheduling if required.

Erosion control:

- Increase soil cohesion by applying organic matter to improve soil structure.
- If there is enough water, irrigate the soil before tillage/ploughing.
- 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 269 Ha 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 westerlies 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 or ECO (monthly) and or the responsible Farm Manager to detect signs of erosion.
- It must be ensured that the erosion minimization measures installed, are effective.
- The Applicant, or ECO, 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 pivot 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 ECO, or the responsible Farm Manager to detect any source of 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 2**).
- The 92 Ha area between pivots 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.
- Crop rotation should be implemented and pivot areas should be rested every alternating year.

Monitoring Responsibility:

- Site inspections should be conducted by the Applicant and Contractor, or ECO, 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:

Protected Species:

- Effort should be made to transplant the species listed in the table below to the 92 Ha area surrounding the pivot areas:

Species	Northern Cape Nature Conservation Act	
	Schedule 1 Specially protected	Schedule 2 Protected
Anacampseros filamentosa		X
Babiana hypogaea		X
Boophone disticha		X
Brunsvigia sp		X
Harpagophytum procumbens subsp. *procumbens*	X	
Jamesbrittenia pinnatifida		X
Pelargonium nanum	X	
Plinthus karooicus		X
Ruschia spinosa		X
Vachellia erioloba		X
Vachellia haematoxylon		X

- Permit for the legally protected plants must be obtained before removing them.

Due to the nature of the development, 177Ha of Kimberley Thronveld (SVk4) vegetation will be permanently removed to establish the pivot areas and crops. The only possible mitigation to some degree would be to establish transplant identified species to the remaining 92 Ha and to follow an alien eradication programme. The following can be done to mitigate the impacts on the floral species:

- The development would be restricted to the demarcated area as provided by the site layout plan (**Figure 2**) and no vegetation outside the demarcated boundaries will be removed.
- As a recommendation, Dr. van Aardt every effort should be made to transplant the geophytes into abutting natural areas.
  - Several large trees of the protected *Vachellia heamatoxylon* and *V. erioloba* were found at the study site. Dr. van Aardt recommends that effort must be made to protect as many as possible of these species.
  - Permits need to be obtained before any of the protected and specially protected species can be removed.
- All alien invasive species, especially the *Prosopis glandulosa* and *Tamarix ramosissima* should be removed and eradicated from the site as a high priority.
- Only the existing farm roads will be used and vehicles will not traverse virgin land.
- The soil must be protected as described under the heading ‘Soil’.

- Veld fires should be controlled.

Alien control (with specific reference to the Botanical Report):

To control *Prosopis glandulosa*

- Fire can be used to prevent the re-establishment of young *P. glandulosa*.
- For larger trees, mechanical, chemical and biological control would be better:
  - Mechanical control methods:
    Root ploughing – large trees must first be felled by hand and stumps removed with a tractor to ensure roots are severed below ground level. The soil should neither be too wet or too dry for effective root ploughing.
    Chaining – a mouldboard plough is pulled behind a caterpillar tractor, or a heavy chain pulled between two machines to remove trees. The ideal moisture is for soil to be dry on the surface but moist below.
    For smaller, unbroken trees or smaller portions of invaded land, hand clearance by sending work teams into the invaded pasture to fell all trees and seedlings and uproot stumps can be applied.
  - Chemical control treatments:
    The most effective chemical for high tree kill is clopyralid which is used in the USA, but dicamba, plicloram, and triclopyr have also been successfully used.
  - Biological control:
    Replace free-ranging cattle with sheep and in conjunction with other control methods could drastically reduce the spread.
    Introduce the bruchid beetles (*Algarobius prosopis* and *A. bottimeri*); or other seed-feeding insects such as the *Mimosetes protractus* and *Neltumius arizonensis;* or the seed-feeding weevil (*Coelcephalapion gandolfoi*)
- Ultimately integrated control is the best method. Mixed mechanical, chemical and fire methods have proved more effective than alone, but are costly and required a high-level of management. Thereafter the correct management of soil coverage should be implemented with regular monitoring and removal of young *P. glandulosa.*

To control *Tamarix ramosissima*

- Mechanical (pulling, cutting, disking): include mowing, burning, chopping, chaining, and disking. However, these methods usually only suppress this species temporarily and

Tamarisk will resprout vigorously from the root crown following mechanical control methods.

  - Hand pulling can be an effective way to control Tamarisk in situations where plants are small, where access is difficult, or where herbicides cannot be used.
  - Mowing is occasionally useful to reduce the volume of Tamarisk before treatment with herbicide, especially in sites where prescribed burning is not feasible. However, a single cutting of tamarisk is ineffective, because Tamarisks resprout vigorously. By comparison, cutting combined with herbicide treatment can be a very effective integrated approach.
  - Heavy equipment can be used to remove entire plants. However, any fragments that move into the water column may resprout and form new populations. This technique also causes considerable soil disturbance and ecosystem disruption.
  - A root plough pulled by a bulldozer has become a standard method for Tamarisk control, providing good to excellent control. Root ploughing is most effective when the soil is relatively dry and when combined with follow-up treatments such as hand grubbing resprouts or applying herbicides. Root ploughing may affect desirable vegetation and could lead to wind erosion.

- <u>Cultural:</u> Cattle, goats, and sheep will graze Tamarisk plants if desirable vegetation is lacking, however, it has little nutritional value and cattle will only graze young seedlings early in the year. Goats might be able to control dense stands of tamarisk where little native vegetation is present, particularly if the stands are cut or burned first, with goats eating the regrowth.
- As a stand-alone strategy, burning has not been successful and is not recommended.
- <u>Biological:</u> The release of the tamarisk leaf beetle (*Diorhabda carinulata*) from China has made significant impacts on many populations of tamarisk. This insect feeds on the leaves of tamarisk and slowly reduces plant vigor. Tamarisk does not usually die from single defoliation from tamarisk beetles, and it can resprout within several weeks of defoliation. Repeated defoliation of individual tamarisk trees can lead to severe dieback the next season and death of the tree within several years. Data indicate that 4 years of defoliation can result in about 60% mortality.
  - Biological control will not eradicate tamarisk but it has the potential to suppress tamarisk populations by 75 to 85%. The insect spreads rapidly but is poorly adapted.
- <u>Chemical control:</u> There are various products, such as Triclopyr Garlon 3A, Garlon 4 Ultra, Pathfinder II of which cut stump treatments can be very effective. Cut stems horizontally at or near ground level, and immediately apply herbicide solution to cover

the outer 20% of the stump face. Follow-up treatment of resprouts with this mixture will be necessary. This mixture is selective and will not injure desirable grasses.

- Glyphosate Rodeo, Aquamaster which provides only partial control of Tamarix species, because the herbicide precipitates out when in contact with divalent and trivalent salts, the salty excretions on the foliar glands will reduce the effectiveness of glyphosate. Foliar treatment with glyphosate will probably be most effective if applied shortly after a rainfall event
- Imazapyr Arsenal AC, Habitat, Stalker, Chopper, Polaris is the most widely used herbicide to control Tamarix. Both conventional and low volume applications can give good control.
- Glyphosate is nonselective. Spot treatments can be made using a drizzle gun. Plants should not be removed for at least 2 years to ensure good control.
- As with all chemicals, it is important to read the manufacturers' labels and material safety data sheets before using it.

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.

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Monitoring Responsibility:

- A list of plants that are relocated must be kept by the Applicant, the Contractor, or ECO, or the Farm Manager.
- The Applicant, the Contractor, or ECO, or representative Farm Manager must check for alien invasive vegetation and removal thereof as the development progress.
- The Applicant or ECO is responsible to identify/allocate appropriate areas in the surrounding 92 Ha outside of the pivot 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 92 Ha area surrounding the pivot 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.
- 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 2**) 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 pivot 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.

Monitoring Responsibility:

- A list of animals that are relocated must be kept by the Applicant, the Contractor, or ECO, or the Farm Manager.
- The Applicant, the Contractor, or ECO or representative Farm Manager must check for snaring devices, and traces of poison, and removal thereof on a weekly basis.
- The Applicant or ECO 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 behavior of his staff with specific reference to environmental management for the duration of construction.
- The Contractor, or ECO, 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, Farm Manager or ECO.

BIODIVERSITY MANAGEMENT

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 92 Ha between the pivot 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 for the invasive *Prosopis glandulosa* and *Tamarix ramosissima.*

Monitoring Responsibility:

- A list of animals that are relocated must be kept by the Applicant, the Contractor, or ECO, or the Farm Manager.
- The Applicant, the Contractor, or ECO or representative Farm Manager must check for snaring devices, and traces of poison, and removal thereof on a weekly basis.
- The Applicant or ECO 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 behavior of his staff with specific reference to environmental management for the duration of construction.
- The Contractor, or ECO, 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, Farm Manager or ECO.

WATER

Objective:

- Prevent silt transport into the drainage lines.
- Prevent pollution into the Orange River system.

Actions / Management Measures:

- If water from neigboring farms accumulates on sections of Site A, it could potentially become problematic for the crops and Applicant. Drainage channels might be constructed to divert water away from pivots areas, but the general drainage will remain towards the drainage lines. If required, a channel to divert the cumulative drained water from Site A can be constructed to divert water into the R3112 road reserve. This will reduce any possible impact on the Orange River.
- 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 (**Figure 2**).
- 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 artificial drainage line.
- 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 or ECO 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 Department of Agriculture.
- It must be ensured that the abutting crop lands on the neighbours farm are not affected and remain effective.

- The Contractor, Applicant or ECO 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 on a monthly basis.
- Visual inspection must be conducted by the Contractor, Applicant or ECO 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 neighboring crops due to this development.

AIR QUALITY

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 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 traveling along the farm road.
- This potential impact should be addressed in an environmental awareness programme.

Monitoring Responsibility:

- The Contractor (daily), Applicant or ECO (monthly), or representative Farm Manager must monitor and manage the dust generation during the construction phase or harvest seasons.
- The Farm Manager or ECO 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 ECO or representative Farm Manager to detect any source of dust pollution regularly.
- The Applicant and Farm Manager must research correct pesticides to be used, and consult with Soil Scientists with 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, or ECO, and Farm Manager must log and record complaints received from abutting residents or workers when pesticides are applied.
- The Farm Manager or ECO 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 neighboring farm or 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.
- Traveling 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.
- 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 ECO, or representative Farm Manager must monitor and manage the noise generated during the construction phase.
- The Applicant, or ECO, or Farm Manager must log and record complaints received from abutting residents due to noise.
- The Farm Manager or ECO 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:

- The 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 use to level small excavations on the property if there are any.
- Vegetation that will not be transplanted can be ploughed into the topsoil to increase the humus content of the soil. Likewise with crop residue.
- 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 at allocated areas. 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 onsite) will be maintained according to Municipal specification and as discussed under the heading "Water". If it produces foul odors, 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 offense.
- 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 ECO, 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 ECO, 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 ECO, 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:

- The ensure that appropriate management strategies are adhered to minimize the visual impact.
- To receive no complaints regarding impacts to visual quality.

Actions / Management Measures

- No vegetation clearing should take place outside the proposed study area in accordance with the site layout plan (**Figure 2**) and the visual impact will be reduced through the establishment of crops and alien control programme.
- To reduce 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 surrounds 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.

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- 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 or ECO (monthly), or representative Farm Manager must monitor and manage the personal onsite and maintain ongoing housekeeping to keep the construction site tidy.
- The Applicant or ECO and Farm Manager must keep a complaint register and log any complaints received regarding visual impacts.
- The ECO and 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 should be erected on both sides of Site A and Site B entrances 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 the R3112, or 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 of flagman for situations where harvest trucks may impede normal traffic flows along the R3112 at the entrances to the two Sites.
- 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.
- The appropriate signage (W107 & W108 –1,2m size) should be erected on both sides of Site A and Site B entrances.
- If poor visibility or slow access of vehicles onto the R3112 could result in any accidents, a flagman will be used at the access during harvest time.

Monitoring Responsibility:

- The Contractor, Applicant or ECO, 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 or ECO and Farm Manager must keep a complaint register and log any complaints received regarding trucks and earthmoving machinery.
- The ECO or 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.

SOCIO-ECONOMIC IMPACT

Objective:

- To ensure that abutting neighbours and farm owner 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 neighbors.
- Farmworkers may not wander on 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 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.

HERITAGE AND ARCHAEOLOGICAL IMPACT

Objective:

- The ensure that any archaeological and historical material of interest that might be found, is reported to SAHRA.
- The ensure that if any human remains are found, is reported to the local police, and SAHRA.
- To ensure that contractors and personal on site is 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

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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 ECO, or representative Farm Manager must report any new findings if anything is unearthed during construction immediately.
- The Contractor, Applicant or ECO, 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 ECO, 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 on compliance with the training programme can be recorded and evaluated to nominate and elect the best candidate who has improved personal performance with regards 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 of 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 stability and erosion after heavy rains.
- Unauthorized clearing of natural vegetation.
- Sodicity.
- 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.

SODICITY

- Assess the soil and ensure salt does not accumulate over time and develop saline subsoils. Inspect for crusting and sealing on the soil surface, which impedes water infiltration, accelerating erosion and causing structureless soils.
- Assess the vegetation, whether there is dieback of vegetation in low-lying areas, or whether non-salt tolerant plants are being replaced by salt-tolerant plants.
- Assess low-lying neighbouring crops if there is dieback of the crops.
- Assess pivot floor, if there is a failure of plants to germinate or grow.
- If any of these signs are noticed, the Applicant must consult the Department of Agriculture or Soil Scientist to ensure that the soil is not left to deteriorate but mitigation measures are implemented to reverse the impact.

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 to be 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 to be 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 expose 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 professions 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 farm workers are managed and informed of consequences if trespassing occurs.
- Ensure suitable management of the labor 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 potential of Naauwtesfontein 78, Hopetown, Northern Cape Province

June 2021

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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.

JAN-DIRK MARX

EDUCATION

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.

Jmarx

Jan-Dirk Marx

- SACNASP- 132344

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EXECUTIVE SUMMARY

A soil survey was conducted at Naauwtesfontein 78 Farm on approximately 288 ha of land near Hopetown in the Northern Cape to determine whether the land would be suitable for irrigation. The soil forms observed included the Coega, Glenrosa, Kimberley, Olienhout, Nkonkoni, and Plooysburg. The Nkonkoni, Glenrosa, Olienhout, and Kimberley soil forms were generally considered suitable for irrigation, while portions of the Nkonkoni, Glenrosa, and Plooysburg soil forms were only moderately suitable due to the depth of limiting material. The Coega soil form and portion of the Olienhout soil forms were considered not suitable for irrigation.

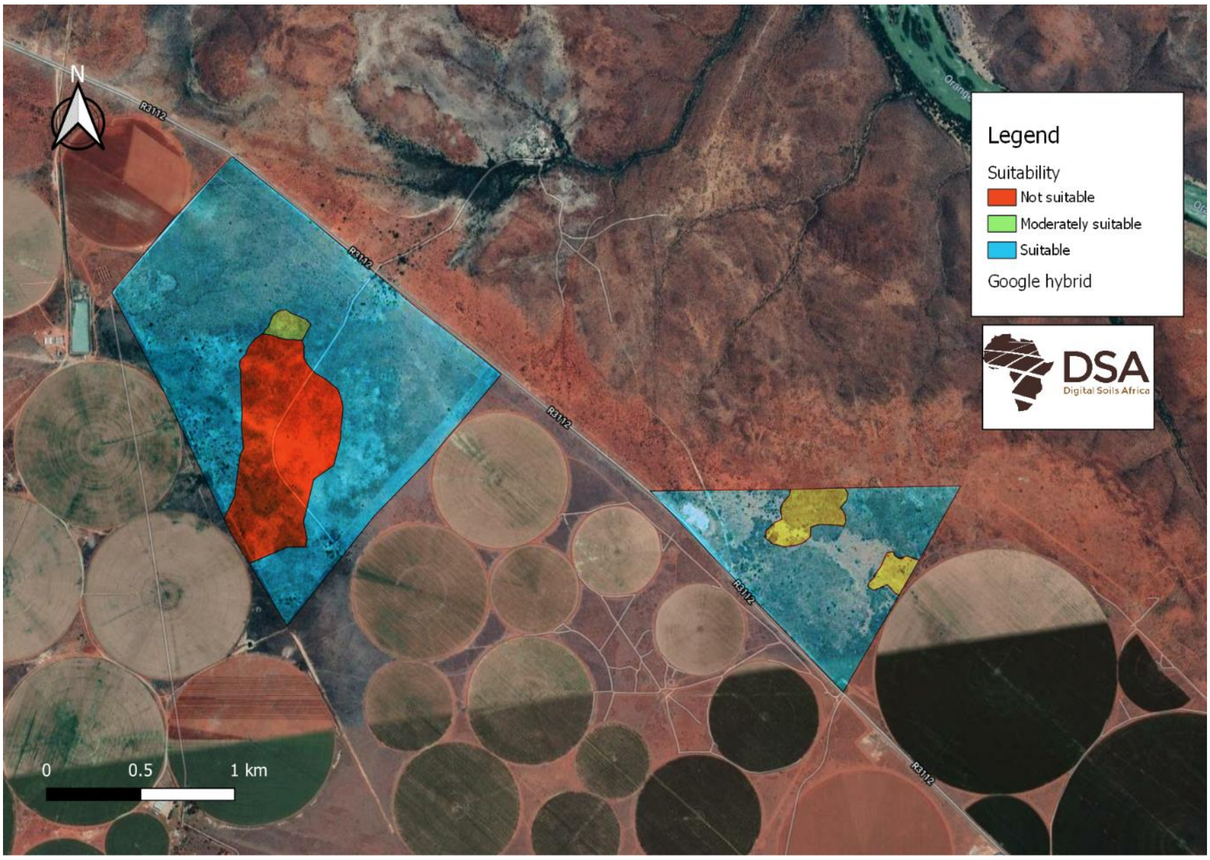

FIGURE 15: SUITABILITY OF THE STUDY AREA.

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INTRODUCTION

Digital Soils Africa conducted a soil Survey on approximately 288 ha on the farm Naauwtesfontein 78 near Hopetown in the Northern Cape Province. The survey aimed to determine which areas would be suitable for irrigation. When land is irrigated it is necessary to understand the risks of waterlogging and salinization for it to be sustainable. Salinization is defined as the process where salts are accumulated within the soil, causing a white salt crust at the soil surface. This occurs due to insufficient rainfall not being able to flush out the salts from the crop root zone. Irrigated lands are more prone to salinization because of added salts brought in by irrigation water. 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. It is for this reason that 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).

LOCATION

The farm Naauwtesfontein 78 is situated approximately 21 km outside of Hopetown. The area is southeast of Douglas on the R3112. The coordinates of the study area are presented in Table 1.

TABLE 1: COORDINATES OF SELECTED POINTS ON THE PERIMETER OF THE STUDIED AREA

Name	X	Y
1	23.9416904222	-29.5019396933
	23.9356086947	-29.5079316023
	23.9553100656	-29.5115377591
	23.9444743116	-29.5226163365
	23.9356086947	-29.5079316023

TABLE 2: COORDINATES OF SELECTED POINTS ON THE PERIMETER OF THE STUDIED AREA

Name	X	Y
2	23.9628265670	-29.5166718848
	23.9785448347	-29.5164482623
	23.9725915943	-29.5255232140

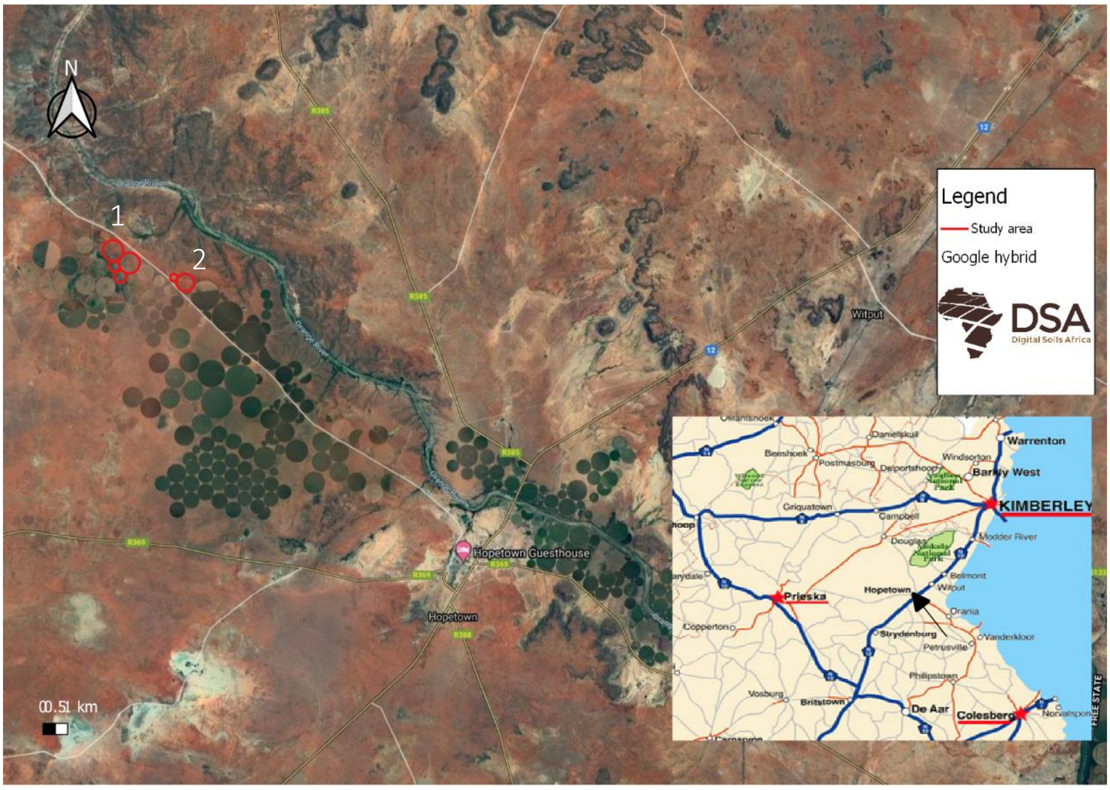

FIGURE 1: The farm Naauwtesfontein 78 near Hopetown.

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METHODOLOGICAL APPROACH

DESKTOP SURVEY

A field visit was conducted on the 5th and 6th of May 2021. A total of 73 profiles were opened by the client using a TLB, the profiles were opened to 2 m or until a restricted layer was reached. 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 due to the soil being homogenous. The profiles sampled were 8, 48, 58, and 71. A total of 8 samples were analyzed which included 4 topsoil horizons (0-300 mm) and 4 subsoil horizons (300-700 mm). 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.

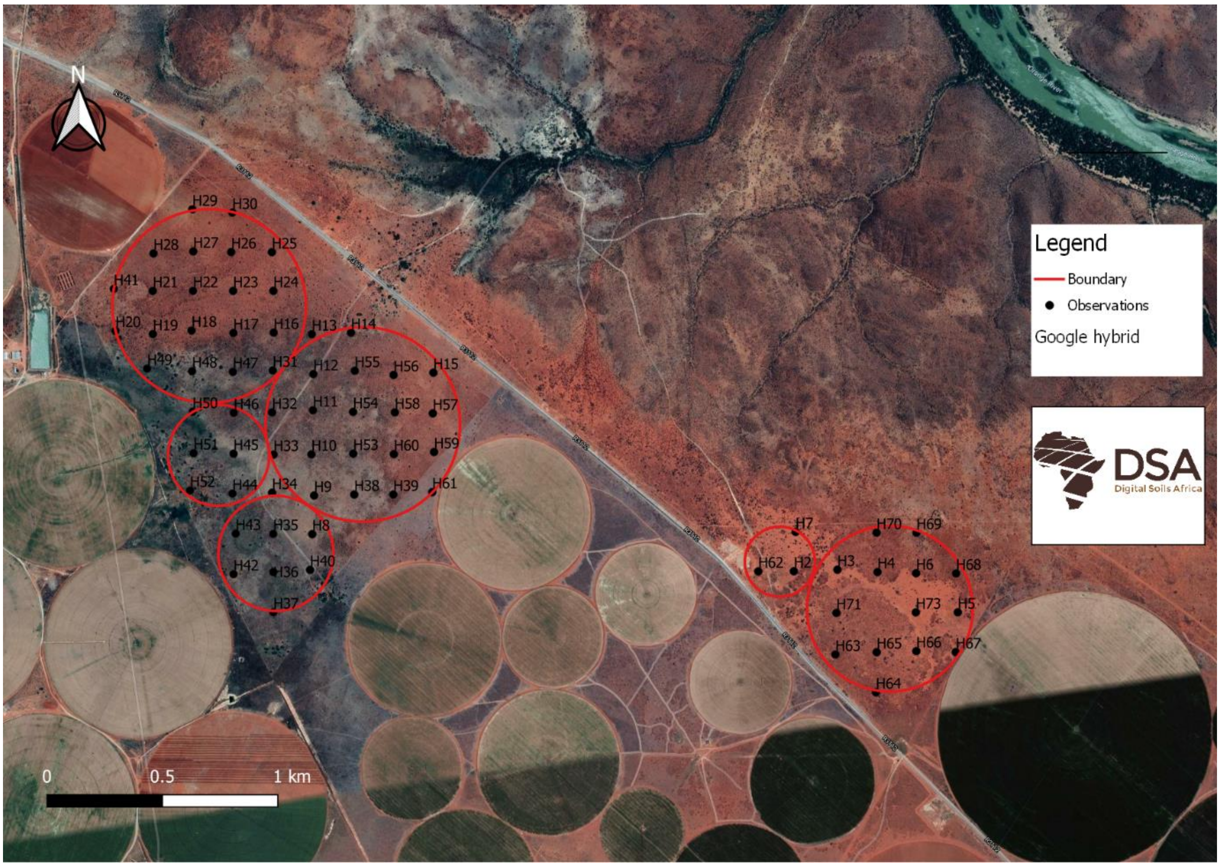

FIGURE 2: THE LOCATION OF THE OBSERVATIONS.

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RESULTS

SOIL FORMS

The Nkonkoni (97 ha) and the Plooysburg (65 ha) soil forms are the dominant soil forms in the study area (Figure 3). The Kimberley soil form was found in the northern and southern sides of the study areas and covered approximately 57 ha. The Glenrosa soil form (36 ha) was observed in the northern and eastern sides. The Coega and Olienhout soil forms occurred the least in the study area with the Coega covering 21 ha and the Olienhout 9 ha.

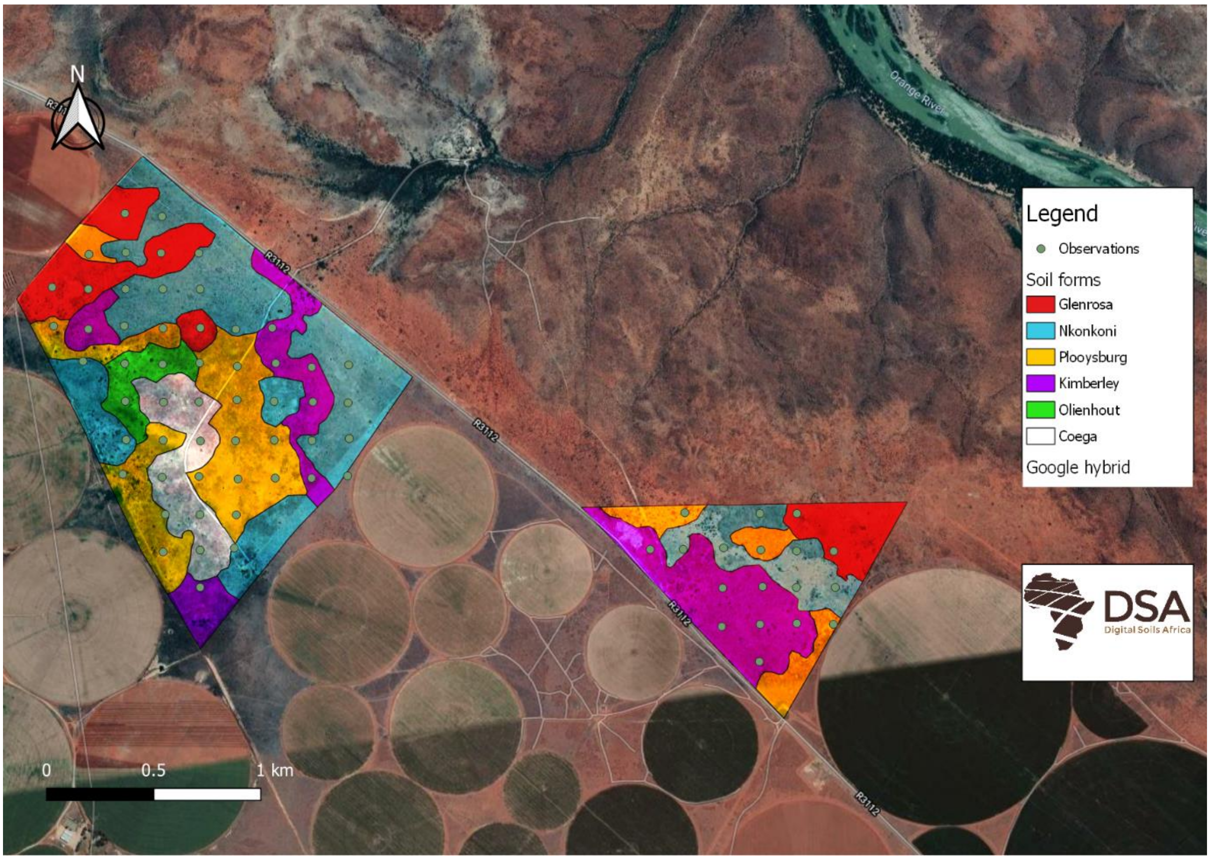

FIGURE 3: SOIL FORMS IN THE STUDY SITE.

NKONKONI 2111

The Nkonkoni soil form consists of an Orthic A (200 mm for the study area) overlying a Red Apedal horizon on a Lithic horizon. The thickness of the Red Apedal varied between 500-1800 mm. The Lithic horizon varied between 700 and 2000 mm. The 2311 soil family has a Chromic topsoil horizon and a Dystrophicphic, aluvic subsoil horizon on a saprolithic horizon. The depths of the Nkonkoni soil form were the main indicator used for the suitability of irrigation. The Nkonkoni soil forms were the most dominant soil in the study area, and only 13 % of the Nkonkoni soil forms weren't suitable for irrigation practices due to depth.

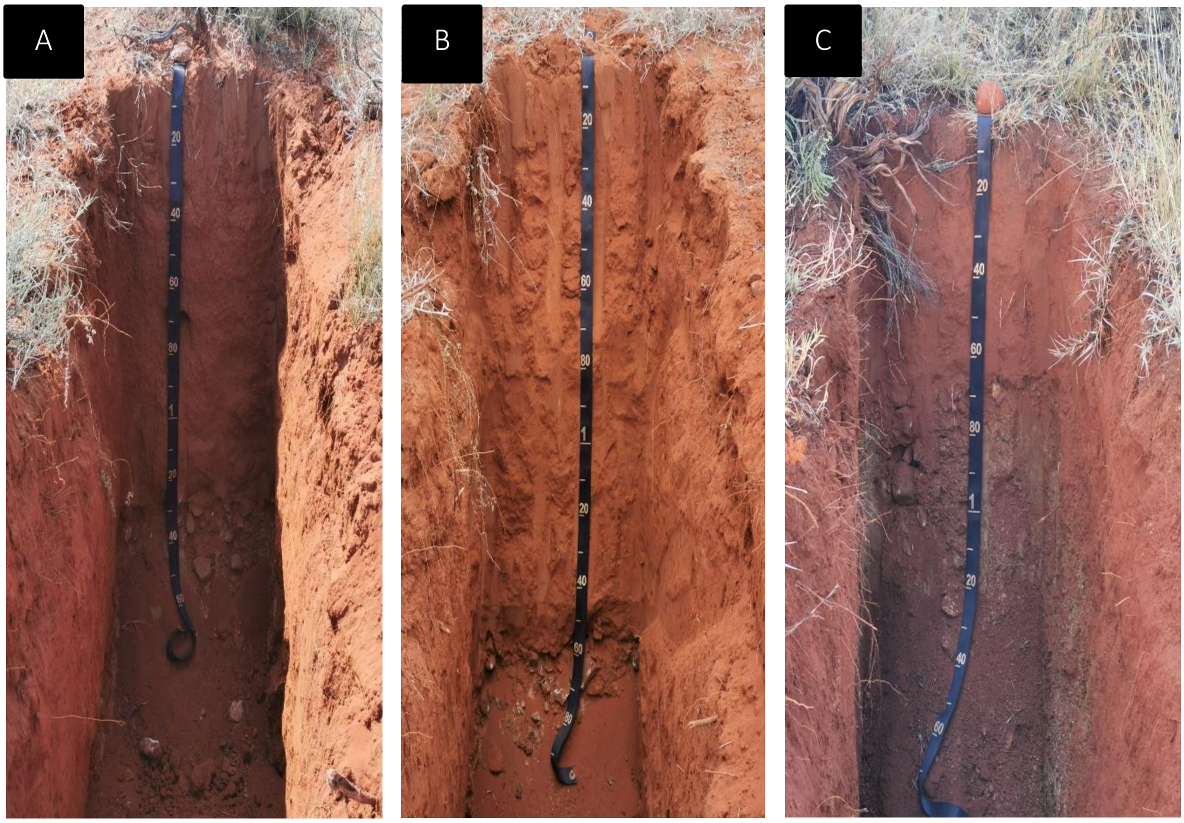

FIGURE 4: NKONKONI SOIL FORMS.

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 400-2000 mm. The 2100 family consists of a Chromic topsoil horizon overlaying Dystrophic, aluvic Red Apedal horizon on Hard Carbonate. About 36 % of the Plooysburg soil forms were too shallow for irrigation with depths of 600-700 mm.

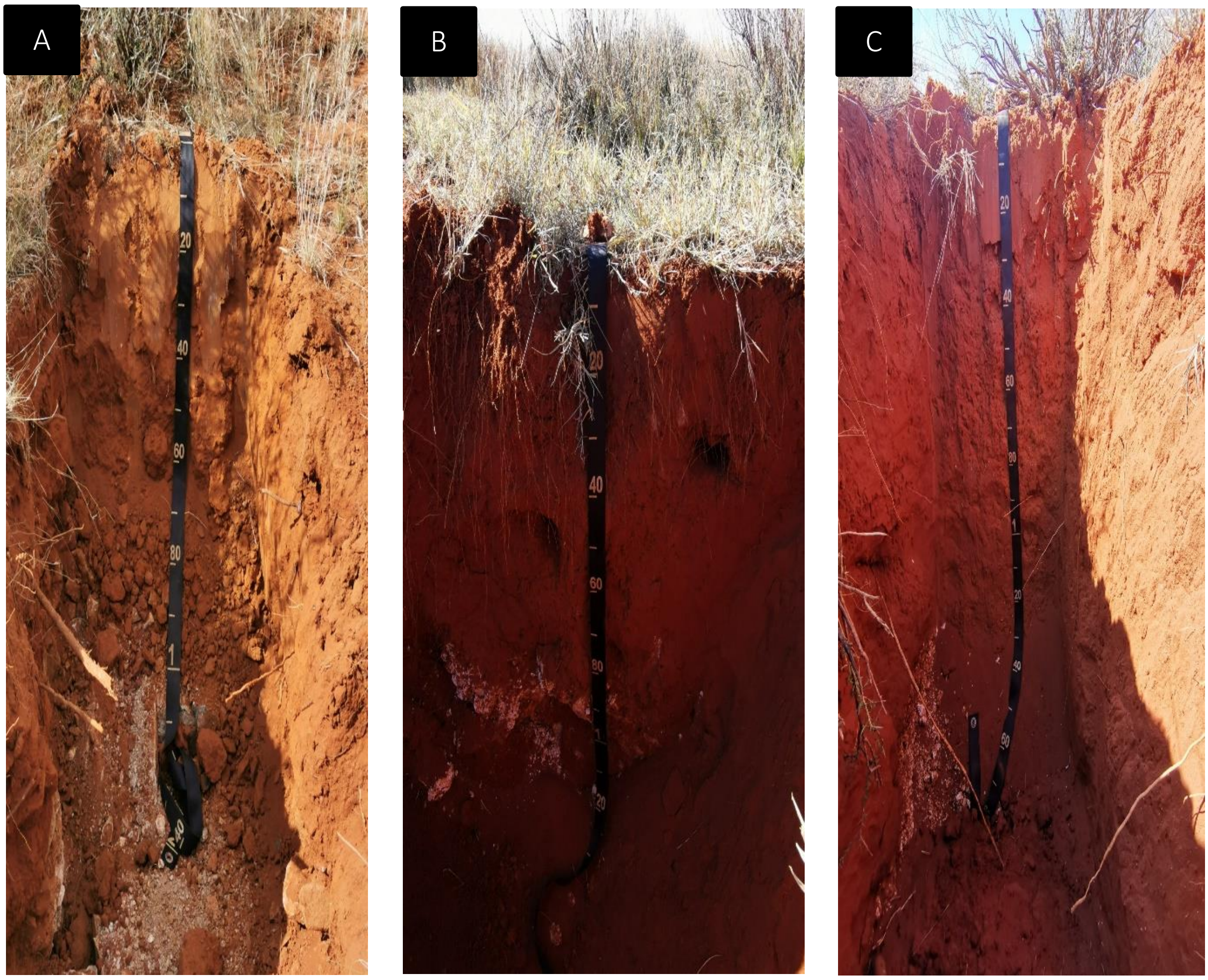

FIGURE 5: PLOOYSBURG SOIL FORMS.

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COEGA 2100

The Coega soil form consists of an Orthic A with Hard Carbonate underlying it. The Coega soils found on site had a maximum depth of 400 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 the majority of hard carbonate of the Coega's could not be broken to such an extent that irrigation would be suitable thus giving the reason that the hard carbonate would not be able to be mechanically ripped.

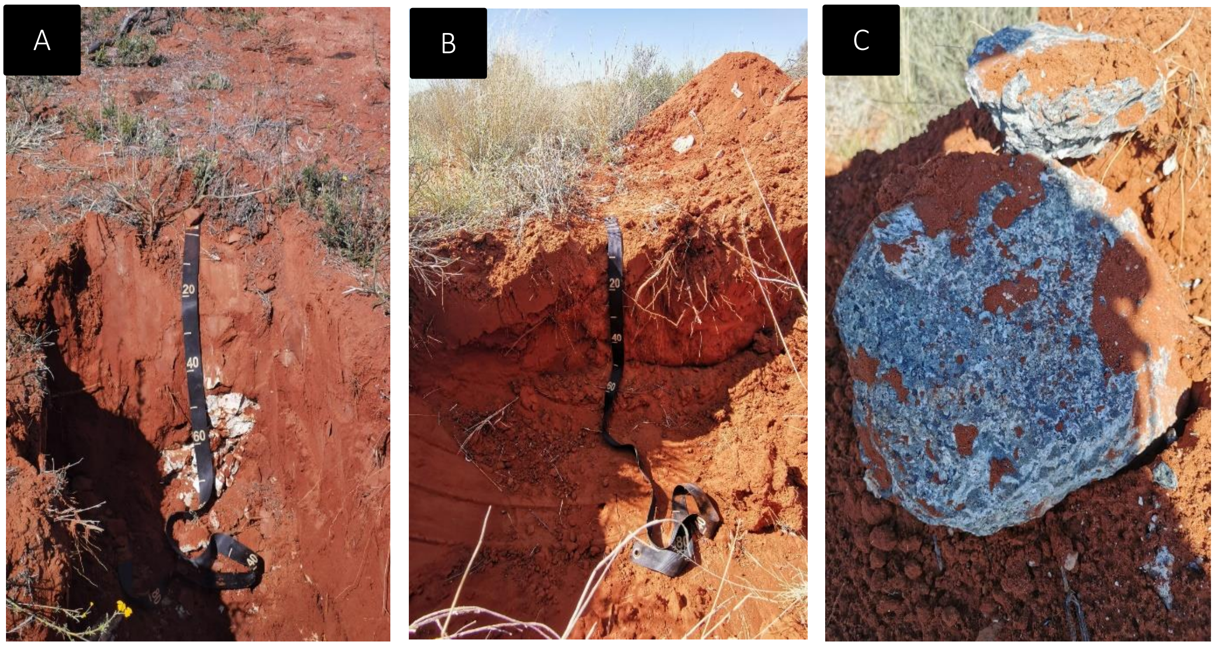

FIGURE 6: COEGA SOIL FORMS.

GLENROSA 2210

The Glenrosa soil consists of an Orthic A horizon on a Lithic horizon. The Lithic horizon was classified as calcareous, 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 1200 mm. Calcareous concretions were present within the Lithic horizon. Glenrosa soils are characterized by weathering shale parent material. If the material is soft, weathered, and/or layering is vertically positioned, it will favor root penetration to greater depths. The Glenrosa soils were classified as suitable and moderately suitable for irrigation if the depths were more than 1 m. Where depths didn't exceed 1 m it was observed that the lithic horizon was of such extent that although the profile did not exceed 1 m, infiltration would still be possible to such depths.

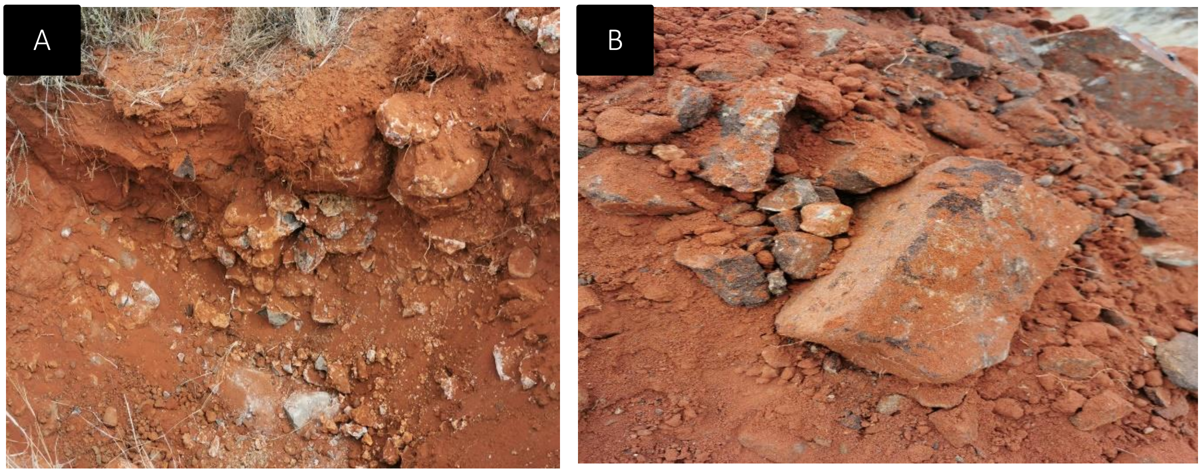

FIGURE 7: GLENROSA SOIL FORMS.

KIMBERLEY 2100

The Kimberley soil form consists of an Orthic A overlaying a Red apedal on Soft Carbonate. The 2100 family has a Chromic A horizon overlying an Aluvic Red Apedal. The Kimberley soil form was only found on a small part of the focus area and had depths of 1200-2000. The Kimberley soils were considered suitable for irrigation.

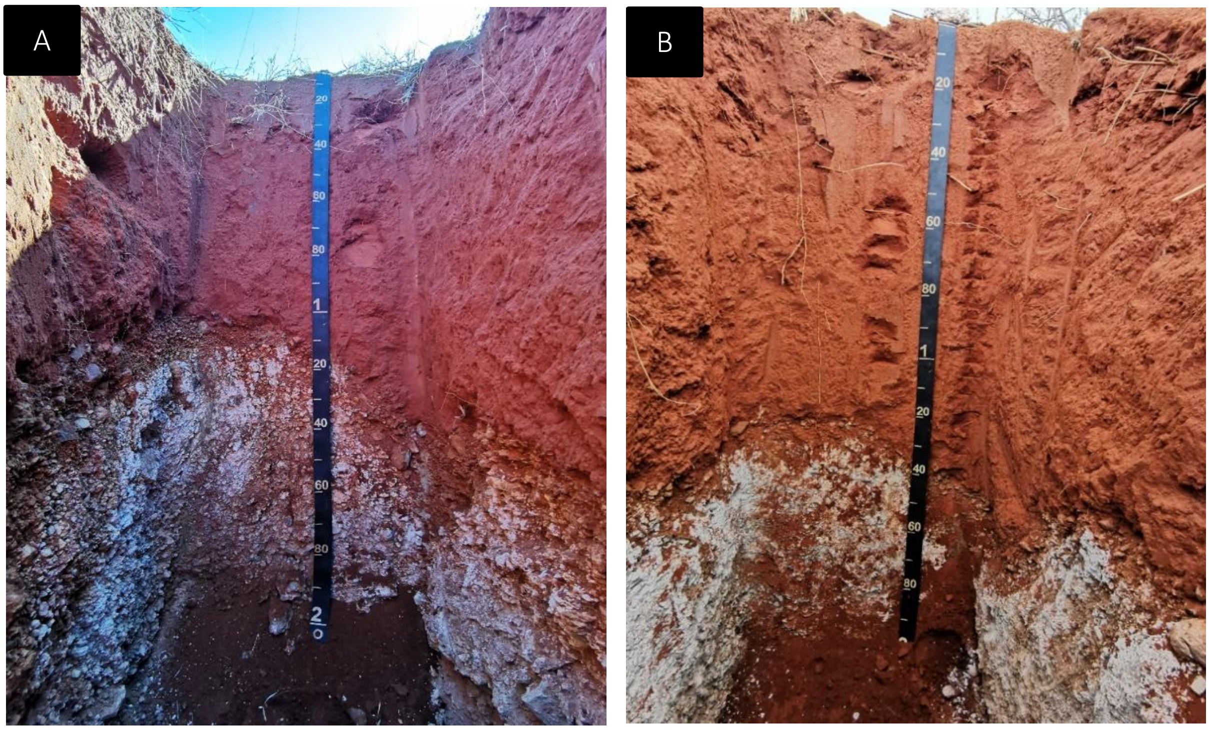

FIGURE 8: KIMBERLEY SOIL FORMS.

OLIENHOUT 2200

The Olienhout soil form consists of an Orthic A on Soft Carbonate on Hard Carbonate. The topsoil also contained carbonate. The depths of the Olienhout ranged between 800-1200 mm. The Hard Carbonate for the Olienhout soil form started at 800- 1200 mm thus only leaving the Soft Carbonate which is easily ripped. 40 % of the Olienhout soil form was not suitable for irrigation due to the soil not meeting the required depths.

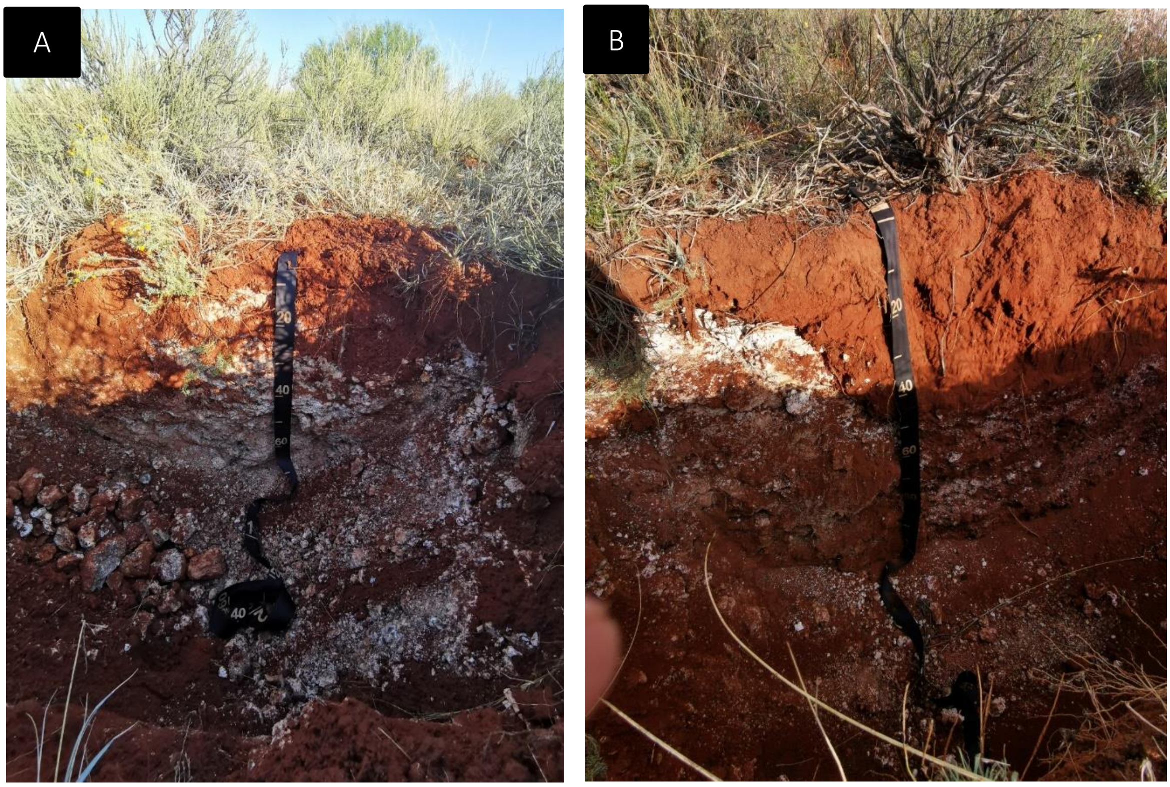

FIGURE 9: OLIENHOUT SOIL FORMS.

SOIL DEPTHS

The soils of the study area are quite deep with most of the soils ranging from 1.01-2 m in depth. A small portion of the area had depths below 0.5 m (Figure 10). The Coega soils were associated with the 0-0.5 m soil depths. The only restricting layers were hard carbonate and the lithic horizons. The hard carbonate was found within the Coega, Plooysburg, and Olienhout soil forms, while the lithic was found within the Nkonkoni and Glenrosa soil forms. The Lithic horizon had a restricting layer at 800 mm depths at certain profiles where the TLB did not go further. Upon further inspection of the profiles, it was found that the lithic horizon could be ripped and thus giving way to depths more suitable for irrigation (Figure 11).

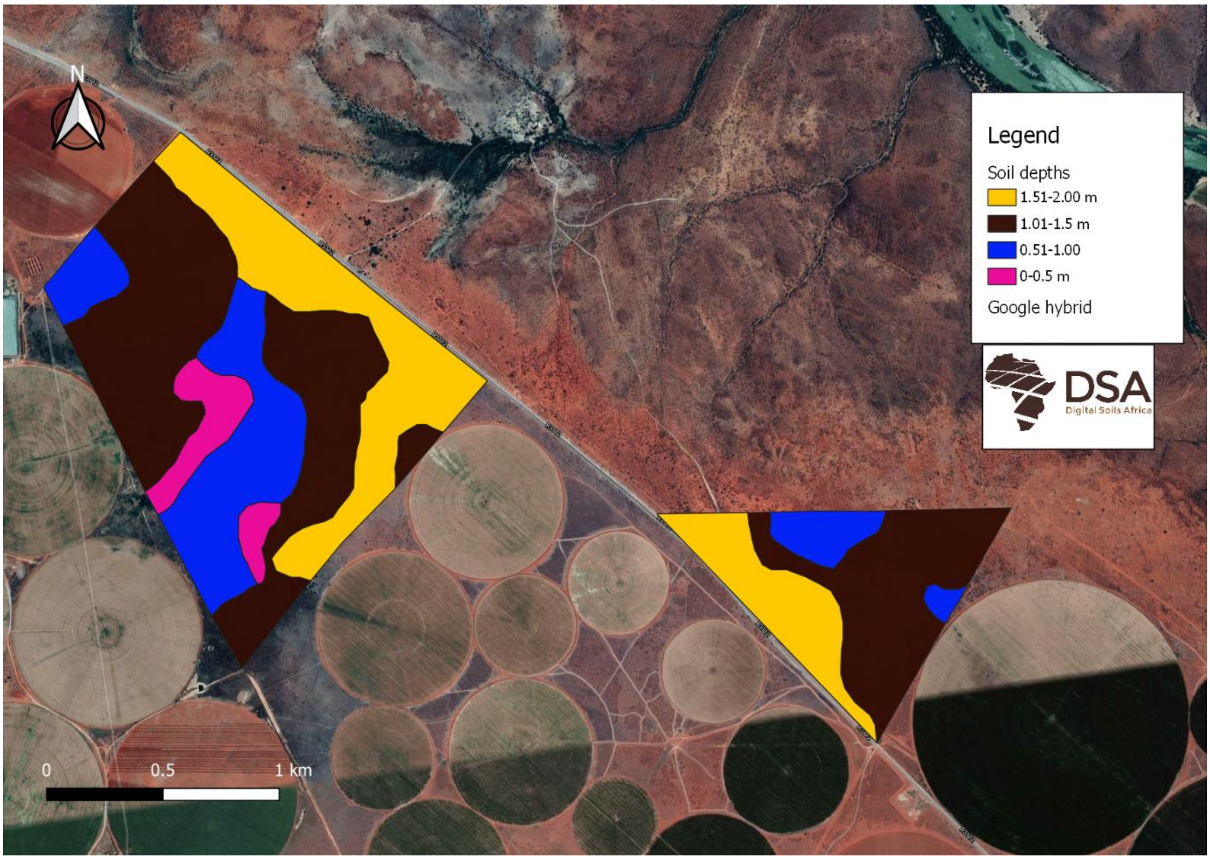

FIGURE 10: TOTAL SOIL DEPTHS.

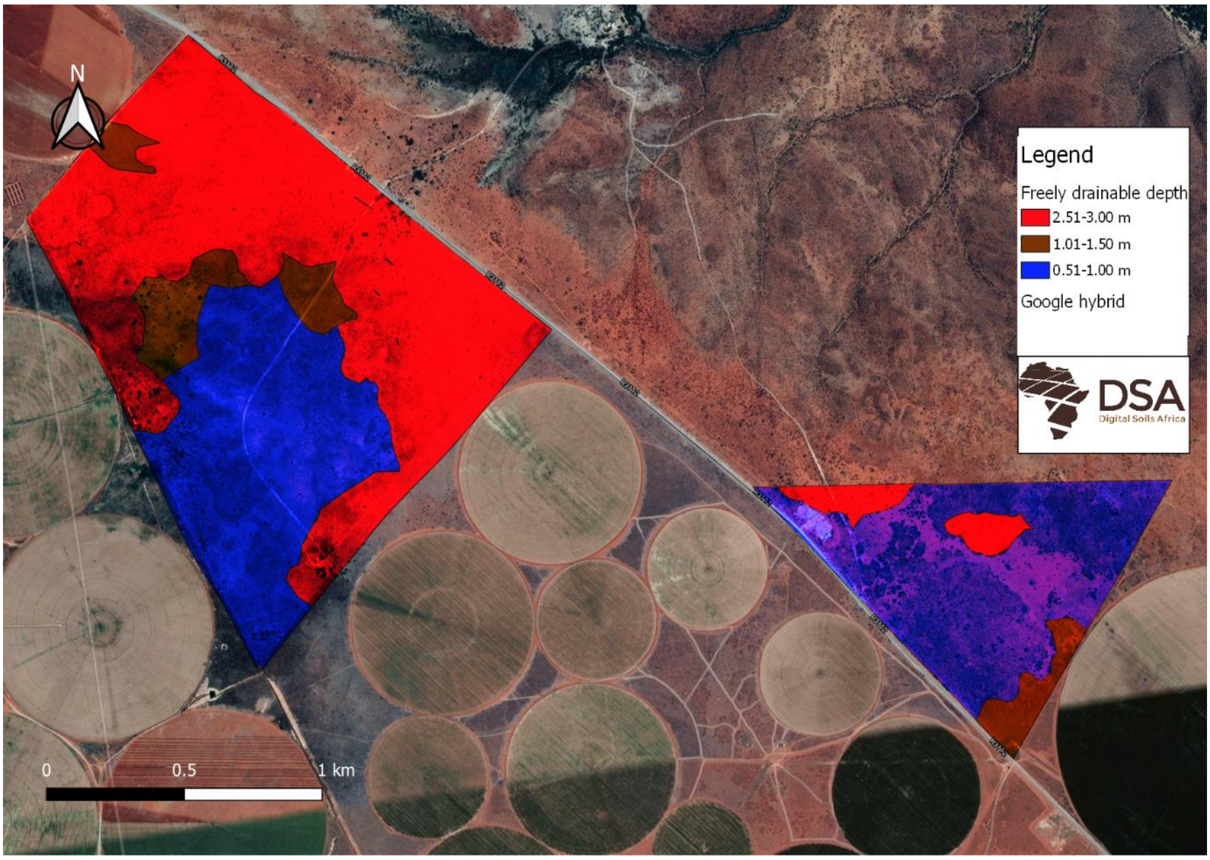

FIGURE 11: FREELY DRAINED DEPTH FOR STUDY AREA.

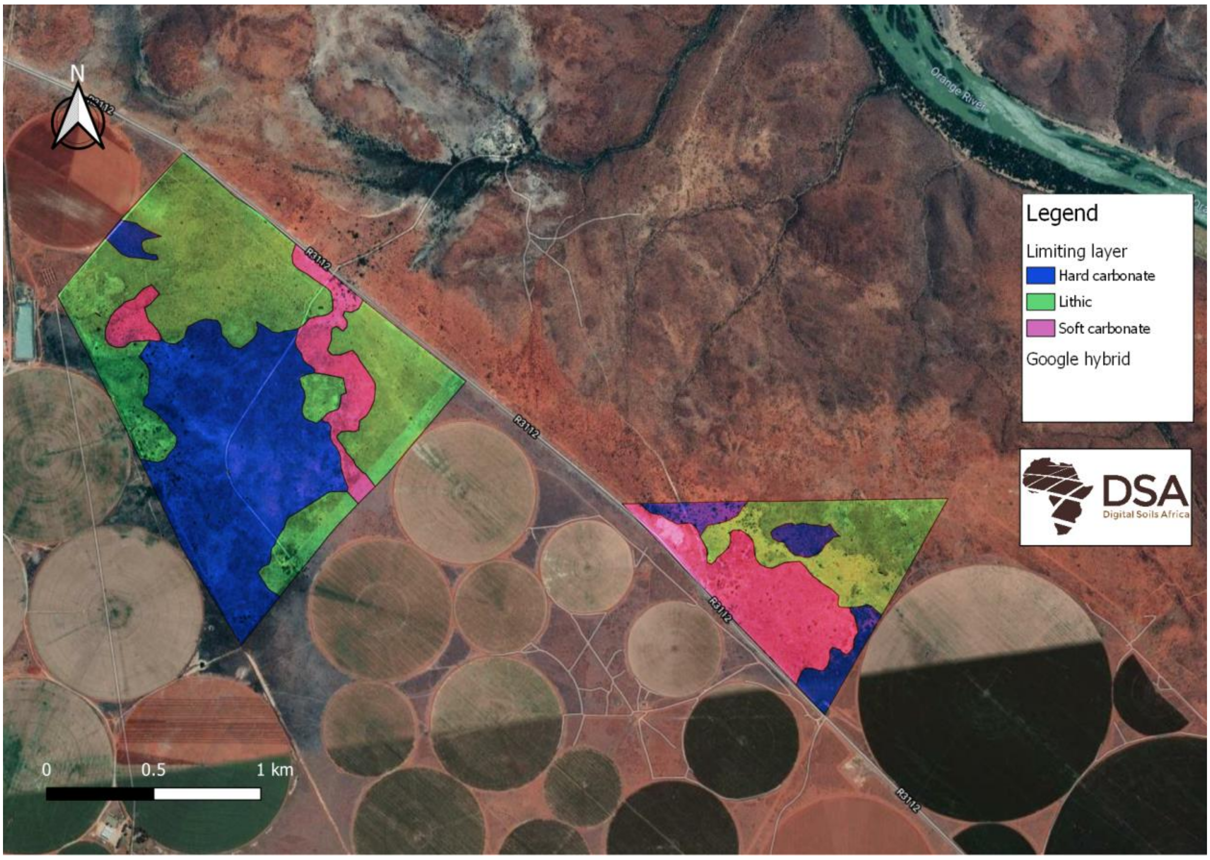

FIGURE 12: LIMITING LAYERS.

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SLOPE

The topography of the area was relatively flat with the majority of the area having an elevation of between 1114 and 1082 m. The only area where a decrease in elevation can be seen is on the North-eastern side closer to the river (Figure 13). The slope was northeast and drainage would occur in the north-eastern direction. Although a slope was present, it was insignificant due to the slope being too level. It can thus be concluded that farms close to the study area would possibly not be affected by drainage. Small areas situated in the middle of site 1 had a southern slope. As seen in Figure 13, the drainage would be to the riverside (northeast). Site 1 and 2 both showed a downward movement of the slope.

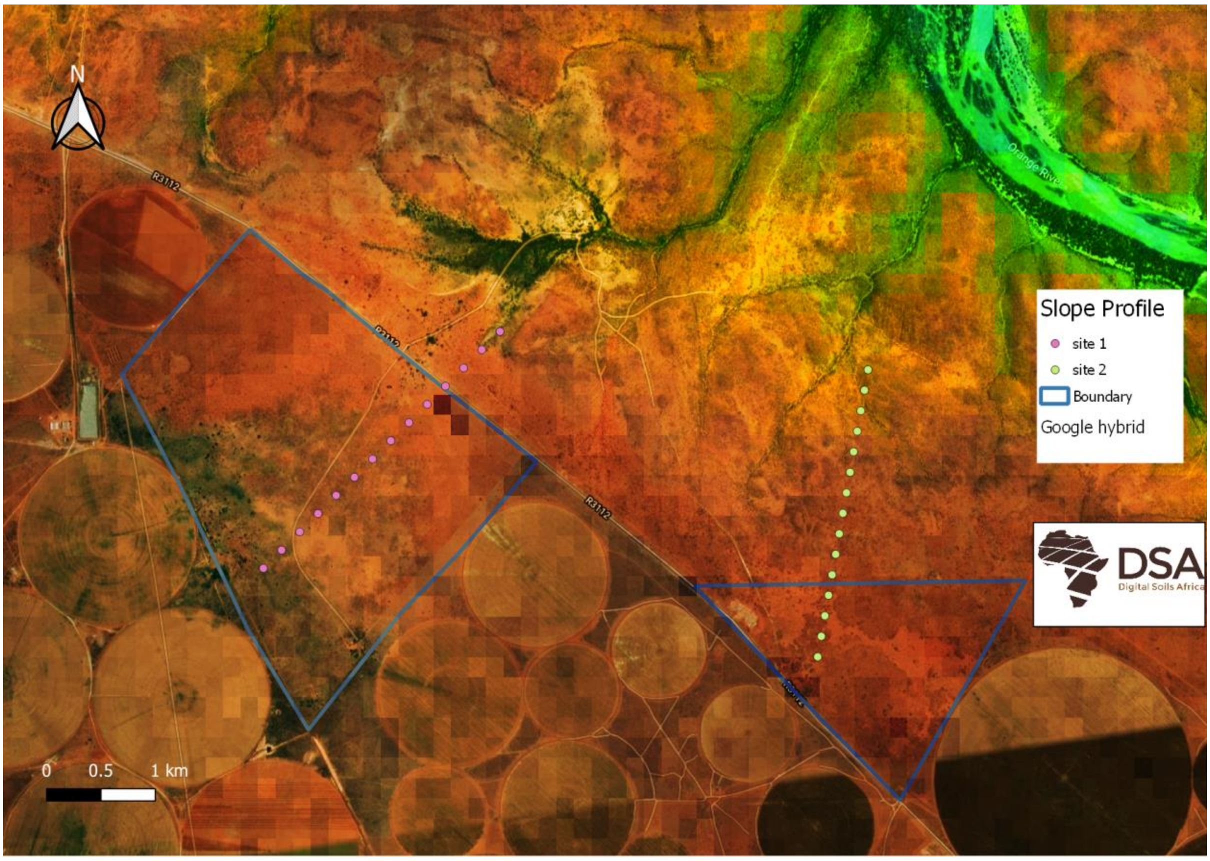

FIGURE 13: DIGITAL ELEVATION MODEL.

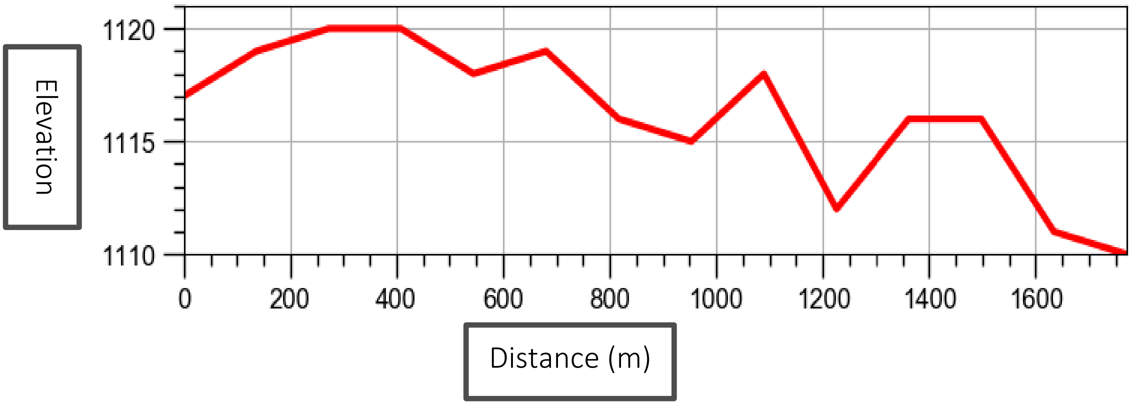

FIGURE 14 A: SLOPE FOR SITE 1.

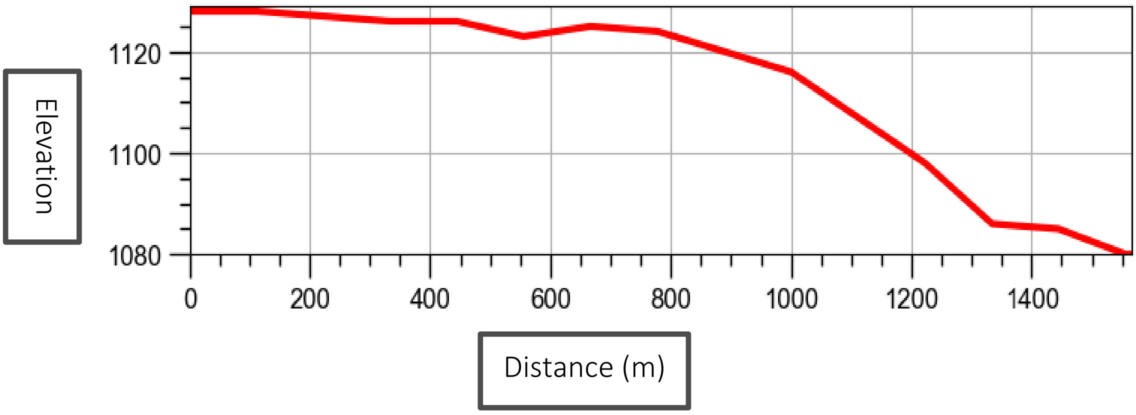

FIGURE 14 B: SLOPE FOR SITE 2.

CHEMICAL AND TEXTURAL ANALYSIS

The chemical properties of the soils are similar with small variations. The A and B horizons are chemically very similar. The pH is slightly acidic and ranges from 5.56 to 5.94, indicating that there is no salinity evident from the pH values. The pH values can be altered from a fertility perspective.

The Cation Exchange Capacity (CEC) is extremely low (2.63-4.38 **cmol(+)/kg**), this, in turn, has a pronounced effect on the Exchangeable Sodium Percentage (ESP). The ESP is very high and especially high for a red apedal soil. Since ESP is a percentage of the Na to CEC, the low CEC can exaggerate the ESP. An exaggerated ESP is supported by the low Electrical Conductivity of the soils. The irrigation threshold of EC for water is 400 mS/m. These soils can be rectified with irrigation and fertilization on soils with adequate drainage, the Na should leach out and be replaced with Ca, Ma and K, lowering the ESP.

TABLE 3: SELECTED CHEMICAL PROPERTIES FOR MODAL SOIL PROFILES

Sample	Soil Form	Diagnostic Horizon	pH KCl	CEC cmol (+)/kg	ESP %	ECe mS/m
H8	Plooysburg	Orthic A	5.56	3.00	28.60	31.5
		Red apedal B	5.72	2.63	26.94	82.2
H48	Plooysburg	Orthic A	5.69	3.37	25.05	38.7
		Red Apedal B	5.68	3.47	28.88	35.9
H58	Kimberley	Orthic A	5.65	2.79	24.07	24.45
		Red Apedal B	5.82	2.85	25.77	20.59
H71	Kimberley	Orthic A	5.69	2.80	25.51	19.37
		Red Apedal B	5.94	4.38	21.60	25.15

Clay percentages are generally low and very sandy. Most soils will have good drainage, but soil water holding capacity and fertility will be low and will 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, provided there is sufficient physical drainage. The texture results show that in general, the soils do have sufficient drainage.

TABLE 4: PARTICLE SIZE DISTRIBUTION OF MODAL SOIL PROFILES

Sample	Soil Form	Diagnostic Horizon	Texture % Clay	% Silt	% Sand
H8	Plooysburg	Orthic A	8.6	2.4	89.9
		Red apedal B	7.2	2.8	91.3
H48	Plooysburg	Orthic A	6.4	3.4	91.8
		Red Apedal B	6.6	3.2	91.6
H58	Kimberley	Orthic A	6.8	3.0	92.0
		Red Apedal B	6.8	2.4	91.6
H71	Kimberley	Orthic A	9.6	2.4	88.5
		Red Apedal B	9.2	4.0	87.7

SUITABILITY

Most of the surveyed area is suitable for irrigation, due to the free-draining soils and cracked rock underlying most profiles. Both areas not suitable for irrigation are limited by external drainage. One area is underlain by a hardpan carbonate horizon, which is an indication of water accumulation in arid climates, and the other by hard rock. The area suitable for irrigation's perimeter points is given in Table 5.

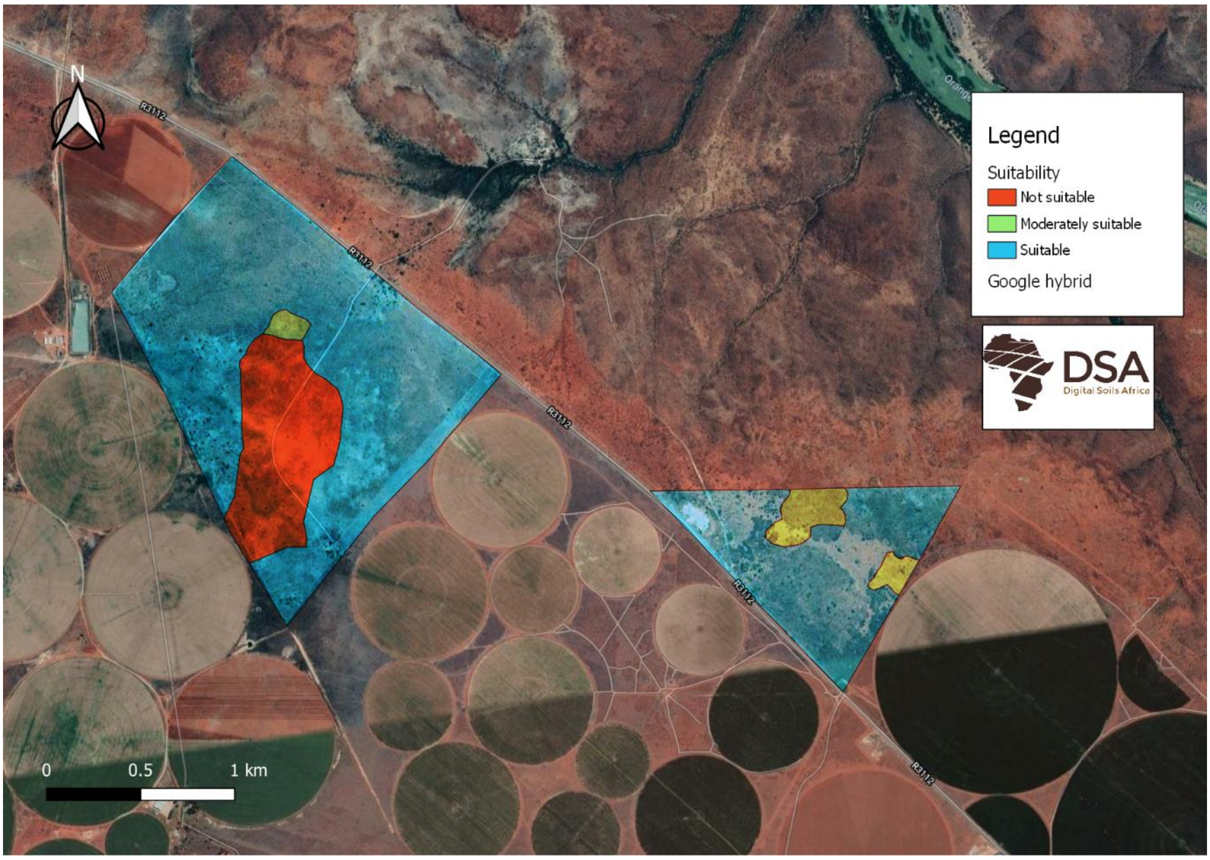

FIGURE 15: SUITABILITY OF THE STUDY AREA.

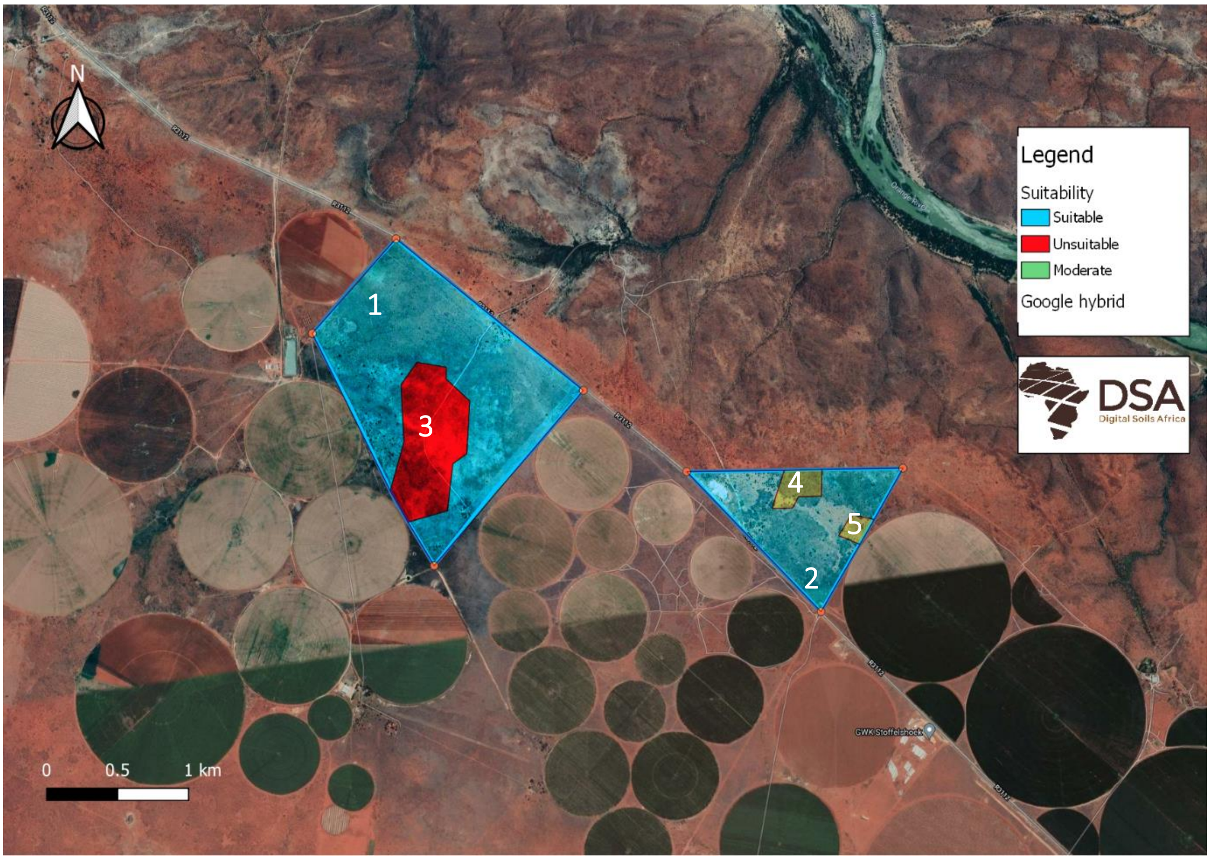

FIGURE 16: SUITABILITY WITH COORDINATE POINTS.

TABLE 5: THE COORDINATES OF THE CORNERS OF THE PERIMETER OF SUITABLE AREA

Area	Suitability	X	Y
1	Suitable	23.9356086946617	-29.5079316022946
		23.9416904222249	-29.5019396933396
		23.9553100656412	-29.5115377591355
		23.9444743116025	-29.5226163365083
		23.942564687835	-29.519864542138
		23.9454292038002	-29.5191380063374
		23.9458229050467	-29.5161628961117
		23.9468354412982	-29.5155431525144
		23.947052655779	-29.5122036586304
		23.9453330411395	-29.5108174212612
		23.9453511423462	-29.5100770367071
		23.9432163312773	-29.5097595164061
		23.9420578540465	-29.5111772737663
		23.9422750685273	-29.5148003412485
		23.9412795021571	-29.51788772249
		23.9356086946617	-29.5079316022946
2	Suitable	23.9785448346769	-29.5164482622502
		23.9764501468361	-29.5197070280442
		23.9748210382303	-29.519376247649
		23.9738797754802	-29.5207151140077
		23.9754183780524	-29.521266406771
		23.9725915943157	-29.5255232139541
		23.9628265669606	-29.5166718848036
		23.9699291871111	-29.5166000124269
		23.9690286520762	-29.5189982115877
		23.9705310522349	-29.5189667085188
		23.9709473799898	-29.5182578868766
		23.9726262669141	-29.5182224456641
		23.9726624693276	-29.5165370047862
		23.9785448346769	-29.5164482622502

RECOMMENDATION

It is recommended that in Area 1, the pivot placement does not exceed more than 10% of unsuitable soil in a pivot. Since Area 2 has small areas of moderately suitable soils for irrigation, these can be incorporated into pivots, and thus the pivot placement is not affected by suitability.

CONCLUSIONS

The A and B horizons are characteristically sandy and therefore will facilitate good drainage. Most of the soils are very high-potential irrigation soils.

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 high. Thus, it indicates that although sodicity is not a general threat to irrigation on this site, Na in relation to other cations is high. On these soils this can be rectified with irrigation and fertilization on soils with adequate drainage, the Na should leach out and be replaced with Ca, Ma and K, lowering the ESP. This is confirmed by the very low ECe values.

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White R E, 2006. Principles and Practice of Soil Science: The Soil as a Natural Resource. 4th ed. Blackwell Science, Oxford, UK.

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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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APPENDICES

General Information

Site:	NAAUWTESFONTEIN 78					Soil form:	Nkonkoni
Map/Photo example: GPS	Figure 4					Soil family:	2111
Position:	23.944476	-29.509143				Colour	Red/Brown
Surface stones:	0%					Occurrence of flooding:	Low
Altitude:	1117 m					Wind erosion potential:	Medium
Terrain unit:	Upper slope					Water erosion potential:	High
Slope:	1%					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/mudstone					Date described:	2021-07-09
Geological group:	Kalahari group					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 600	Lithic	Brown	Moderate, weak, SANBL	None	Present	Clear

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General Information

Site:	NAAUWTESFONTEIN 78				Soil form:	Plooysburg
Map/Photo example:	Figure 5				Soil family:	2100
GPS Position:	23.939103 -29.506064				Colour	Red/Brown
Surface stones:	0%				Occurrence of flooding:	Low
Altitude:	1115m				Wind erosion potential:	low
Terrain unit:	Upper slope				Water erosion potential:	moderate
Slope:	1%				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:	2021-07-09
Geological group:	Kalahari group				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 900	Hard Carbonate	White	Strong	None	Present	Clear

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General Information

Site:	NAAUWTESFONTEIN 78					Soil form:	Kimberley
Map/Photo example:	Figure 8					Soil family:	2100
GPS Position:	23.949895	-29.512249				Colour	Red
Surface stones:	0%					Occurrence of flooding:	Low
Altitude:	1110 m					Wind erosion potential:	Medium
Terrain unit:	Foot slope					Water erosion potential:	Medium
Slope:	1.5%					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:	2021-07-09
Geological group:	Kalahari group					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	None	Clear
B 1100	Red apedal	Red	Moderate, weak, SANBL	None	None	Clear
C 2000	Soft Carbonate	White	Moderate	None	Present	Clear

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Appendix 2: Soil forms

Observation	X	Y	Soil Form	Limiting layer	Freely depth	Drainable depth
H1	23.0350180000	-28.2785610000	Plooysburg	Hard Carbonate	1.01-1.50 m	1.51-2.00 m
H2	23.9677400000	-29.5184320000	Nkonkoni	Lithic	2.51-3.00 m	0.51-1.00 m
H3	23.9696860000	-29.5183730000	Nkonkoni	Lithic	2.51-3.00 m	0.51-1.00 m
H4	23.9714800000	-29.5184630000	Plooysburg	Hard Carbonate	0.51-1.00 m	1.00-1.51 m
H5	23.9750700000	-29.5200300000	Nkonkoni	Lithic	0.51-1.00 m	0.51-1.00 m
H6	23.9732070000	-29.5185090000	Nkonkoni	Lithic	2.51-3.00 m	1.51-2.00 m
H7	23.9678189395	-29.5169012728	Plooysburg	Hard Carbonate	1.00-1.51 m	1.00-1.51 m
H8	23.9462030000	-29.5169880000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H9	23.9462860000	-29.5154870000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H10	23.9461670000	-29.5138840000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H11	23.9462330000	-29.5121660000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H12	23.9462520000	-29.5107570000	Plooysburg	Hard Carbonate	1.01-1.50 m	1.01-1.50 m
H13	23.9461830000	-29.5092060000	Nkonkoni	Lithic	2.51-3.00 m	1.01-1.50 m
H14	23.9479350000	-29.5091480000	Kimberley	Soft Carbonate	2.51-3.00 m	1.01-1.50 m
H15	23.9516200000	-29.5107030000	Nkonkoni	Lithic	2.51-3.00 m	1.51-2.00 m
H16	23.9444760000	-29.5091430000	Glenrosa	Lithic	2.51-3.00 m	0.51-1.00 m
H17	23.9426760000	-29.5091590000	Plooysburg	Hard Carbonate	1.01-1.50 m	1.01-1.50 m
H18	23.9408060000	-29.5090630000	Nkonkoni	Lithic	2.51-3.00 m	1.01-1.50 m
H19	23.9390750000	-29.5091970000	Kimberley	Soft Carbonate	2.51-3.00 m	1.51-2.00 m
H20	23.9374050290	-29.5090708849	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H21	23.9390728504	-29.5075201584	Glenrosa	Soft Carbonate	2.51-3.00 m	0.51-1.00 m
H22	23.9408694809	-29.5075201584	Nkonkoni	Lithic	2.51-3.00 m	1.01-1.50 m
H23	23.9426661115	-29.5075201584	Nkonkoni	Lithic	2.51-3.00 m	1.01-1.50 m
H24	23.9444627421	-29.5075201584	Nkonkoni	Lithic	2.51-3.00 m	1.51-2.00 m

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H25	23.9443970000	-29.5060130000	Nkonkoni	Lithic	2.51-3.00 m	1.51-2.00 m
H26	23.9425760000	-29.5060090000	Glenrosa	Lithic	2.51-3.00 m	0-0.50 m
H27	23.9408810000	-29.5059830000	Olienhout	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H28	23.9391030000	-29.5060640000	Plooysburg	Hard Carbonate	1.01-1.50 m	1.01-1.50 m
H29	23.9408400000	-29.5043460000	Glenrosa	Lithic	2.51-3.00 m	0-0.50 m
H30	23.9426290000	-29.5044710000	Nkonkoni	Lithic	2.51-3.00 m	1.51-2.00 m
H31	23.9444360000	-29.5106150000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H32	23.9444050000	-29.5122490000	Coega	Hard Carbonate	0.51-1.00 m	0-0.50 m
H33	23.9444720000	-29.5138910000	Plooysburg	Hard Carbonate	0.51-1.00 m	0-0.50 m
H34	23.9444070000	-29.5153770000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H35	23.9444560000	-29.5169770000	Coega	Hard Carbonate	0.51-1.00 m	0-0.50 m
H36	23.9401974277	-29.5210609597	Coega	Hard Carbonate	0.51-1.00 m	0-0.50 m
H37	23.9444627421	-29.5200281177	Plooysburg	Hard Carbonate	0.51-1.00 m	1.01-1.50 m
H38	23.9480820000	-29.5154460000	Kimberley	Soft Carbonate	2.51-3.00 m	1.51-2.00 m
H39	23.9498290000	-29.5154470000	Nkonkoni	Lithic	2.51-3.00 m	1.51-2.00 m
H40	23.9461051622	-29.5183799022	Glenrosa	Soft Carbonate	2.51-3.00 m	0.51-1.00 m
H41	23.9373290644	-29.5074405347	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H42	23.9426810000	-29.5185450000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H43	23.9427810000	-29.5169680000	Coega	Hard Carbonate	0.51-1.00 m	0-0.50 m
H44	23.9426360000	-29.5154100000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H45	23.9426810000	-29.5138570000	Coega	Hard Carbonate	0.51-1.00 m	0-0.50 m
H46	23.9426930000	-29.5122680000	Olienhout	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H47	23.9426540000	-29.5106720000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H48	23.9408280000	-29.5106460000	Nkonkoni	Lithic	1.01-1.50 m	1.01-1.50 m
H49	23.9388190000	-29.5105460000	Olienhout	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H50	23.9408540000	-29.5122240000	Nkonkoni	Lithic	1.01-1.50 m	1.01-1.50 m
H51	23.9408950000	-29.5138380000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m

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H52	23.9407360000	-29.5152900000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H53	23.9480350000	-29.5138540000	Nkonkoni	Lithic	1.01-1.50 m	1.01-1.50 m
H54	23.9480280000	-29.5122290000	Kimberley	Soft Carbonate	0.51-1.00 m	0.51-1.00 m
H55	23.9481040000	-29.5106280000	Nkonkoni	Lithic	2.51-3.00 m	1.01-1.50 m
H56	23.9498390000	-29.5107940000	Nkonkoni	Lithic	2.51-3.00 m	1.51-2.00 m
H57	23.9515930000	-29.5122880000	Kimberley	Soft Carbonate	2.51-3.00 m	1.51-2.00 m
H58	23.9498950000	-29.5122490000	Nkonkoni	Lithic	2.51-3.00 m	1.01-1.50 m
H59	23.9516490000	-29.5137910000	Nkonkoni	Lithic	2.51-3.00 m	1.51-2.00 m
H60	23.9498530000	-29.5138740000	Nkonkoni	Lithic	2.51-3.00 m	1.01-1.50 m
H61	23.9515710000	-29.5153530000	Kimberley	Soft Carbonate	2.51-3.00 m	1.51-2.00 m
H62	23.9661490000	-29.5184370000	Kimberley	Soft Carbonate	2.51-3.00 m	1.51-2.00 m
H63	23.9695980000	-29.5216730000	Kimberley	Soft Carbonate	2.51-3.00 m	1.01-1.50 m
H64	23.9714110000	-29.5231440000	Kimberley	Soft Carbonate	2.51-3.00 m	1.01-1.50 m
H65	23.9714440000	-29.5215830000	Kimberley	Soft Carbonate	2.51-3.00 m	1.51-2.00 m
H66	23.9732150000	-29.5215390000	Plooysburg	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H67	23.9749780000	-29.5215790000	Glenrosa	Lithic	1.01-1.50 m	1.01-1.50 m
H68	23.9749930000	-29.5185170000	Glenrosa	Lithic	2.51-3.00 m	1.01-1.50 m
H69	23.9732220000	-29.5169340000	Nkonkoni	Lithic	2.51-3.00 m	0.51-1.00 m
H70	23.9714380000	-29.5169320000	Kimberley	Soft Carbonate	2.51-3.00 m	1.51-2.00 m
H71	23.9696430000	-29.5200560000	Olienhout	Hard Carbonate	0.51-1.00 m	0.51-1.00 m
H73	23.9731950000	-29.5200330000	Nkonkoni	Lithic	2.51-3.00 m	1.01-1.50 m

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October 2021

AN ECOLOGICAL REPORT ON THE FLORA:
REMAINDER OF FARM NAAUWTESFONTEIN No.78
HOPETOWN

A report commissioned by Digital Soils Africa

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CONDITIONS RELATING TO THIS REPORT

Declaration of interest

Sparaxis Environmental PTY (Ltd) and its members/co-workers:

- Have no vested interest in the property studied nor is it affiliated with any other person/body involved with the property and/or proposed development.

- Is not a subsidiary, legally or financially of the proponent.

- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA).

- Declare that remuneration for services provided by Sparaxis Environmental PTY (Ltd) and its members/co-workers is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorizing this proposed project.

- 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 NEMA.

- Reserve the right to modify aspects pertaining to the present investigation should additional information become available through ongoing research and/or further work in this field.

- Is committed to biodiversity conservation but concomitantly recognize the need for economic development. We reserve the right to form and hold our own opinions within the constraints of our specialties and experience, and therefore will not submit willingly to the interests of other parties or change our statements to appease them

The study was undertaken by Dr AC van Aardt (PhD UFS) that is registered as a Professional Natural Scientist (Reg. No. 131584 (Ecological Sciences and Botanical Sciences), Mr JCL de Jager (MSc UFS) and Mr M Müller (BSc Hons UFS)

They have the following qualifications

SPECIALIST	QUALIFICATION
Dr A.C. van Aardt	PhD – Botany MSc – Botany BSc Hons (Botany) BSc (Botany & Zoology)
JCL de Jager	MSc – Botany BSc Hons – Botany BSc (Botany, Zoology & Entomology)
M Müller	BSc Hons – Environmental Sciences BSc (Geography and Environmental Sciences)

Indemnity

Although Sparaxis Environmental Pty (Ltd) exercises due care and diligence in rendering services and preparing documents, the client takes full responsibility for this report and its implementation in terms of the National Environmental Management Act of 1998, and exempt Sparaxis Environmental Pty (Ltd) and its associates and their sub-contractors from any legal responsibility based on the timing of the assessment, the result and the duration thereof, which has an influence on the credibility and accuracy of this report. Sparaxis Environmental Pty (Ltd) accepts no liability, and the client, by receiving this document indemnifies Sparaxis Environmental Pty (Ltd) and its directors, managers, agents and employees all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by Sparaxis Environmental Pty (Ltd) and by the use of the information contained in this report

Factors limiting the quality of this report

The formal site visit was undertaken on 11 September 2021. This was just after the winter season and most of the plants did not have any flowers, inflorescences or seeds that could aid in the identification of grasses, forbs, herbs, shrubs and geophytes. Plants that had flowers or had remnants of flowers at the time of the visit could be identified. Some of the more rare and cryptic species may have been overlooked due to their inconspicuous growth forms. Many of the rare and endangered succulent species can only be distinguished (in the veld) from their very similar relatives on the basis of their reproductive parts. These plants flower during different times of the year. Multiple visits to any site during the different seasons of the year could, therefore, increase the chances to record a larger portion of the total species complex associated with the area. The survey of the study site is, however, considered as successful with a correct identification of the different vegetation units and their ecological sensitivity.

Copyright

Approach

Conclusions reached, and recommendations made are based not only on occurrence of individual species, but more appropriately on habitats and ecosystem processes. Planning must therefore allow for the maintenance of species, habitats and ecosystem processes, even if Red Data or endemic plant or animal species are absent.

Dr A.C. van Aardt
Sparaxis Environmental Pty (Ltd)

INTRODUCTION

The savanna environment is known for its seasonal aridity resulting in long periods of drought. The vegetation components of the savanna have developed since the early Tertiary resulting in a unique combination of indigenous plants and animals that were selected over hundreds of thousands of years. Knowledge of this ecosystem will enable better management and decision making about sustainable development. Vegetation is the most obvious external feature that ecosystems are classified and defined on. Natural live on earth is threatened by uncontrolled and ill-planned development. Past and present development on a World scale is responsible for the destruction of various plant and animal species as well as the habitats in which they occur. A balance needs to be developed between the needs of humans and conservation of natural habitats or resources. This balance is one of the biggest challenges faced by decision-makers in the country.

Preventing the destruction of any ecosystem requires a need for systematic planning and co-ordination of human activities and development should be prioritised. Studies of the natural environment which include soil, water, vegetation, animals and cultural as well as historical aspects should be included in these developmental activities.

Plant communities can be seen as an important unit in any ecosystem and therefore, forms the basis for environmental planning and the compiling of environmental management plans. Plant species assemblages is an indication of the habitat, ecosystem health, and rarity of the ecosystem, and are an important part of an Environmental Impact Assessment.

AIMS OF THE STUDY

This report aims to present ecological information on the flora of the section proposed for clearing of vegetation for the establishment of crop farming on the Remainder of

Farm Naauwtesfontein No. 78 in the Hopetown district, Northern Cape, South Africa (hereafter referred to as the study area).

The objectives of this study were to:

- Identify, describe, and delineate the different vegetation units present on the property;
- Compile a vegetation unit map of the area;
- Indicate the presence of protected plant species or suitable habitat;
- Identify alien invasive plant species;
- To provide a sensitivity map of the study area (where applicable).

STUDY AREA

<u>Location</u>

The study areas are located along the northern and southern parts of the R3112 between Hopetown and Douglas. The area can be divided into two sites namely Study site A and B (Figure 1). Study site A is situated southwest of the R3112 while Study site B is located between the R3112 and the Orange River (on the northern side). The study area is located approximately 16 km, north west of Hopetown (Figure 1). Agricultural fields where pivots are used for irrigation of crops surround the study area.

The study areas fall in the Savanna biome described by Mucina and Rutherford (2006) and more specifically the Kimberley Thornveld (SVk4) which is a least threatened vegetation type. The sizes of the study area are 197 ha for Study site A and 69.2 ha for Study site B.

Figure 1: Locality of the study area (Yellow lines) (Source: Google Maps)

Existing impacts on the study sites include:

- Study site A
  - The north-eastern boundary is the R3112 between Hopetown and Douglas
  - The north-western, south-western and south-eastern boundaries are existing agricultural land under irrigation where crops are being planted
- Study site B
  - The north-eastern and north-western boundaries are bordered by natural vegetation from the SVk4 vegetation type.
  - On the north-eastern boundary there is an access road for the ESKOM power line.
  - The south-eastern boundary is an agricultural land under irrigation where crops are being planted
  - The south-western boundary is the R3112 between Hopetown and Douglas

METHODS

VEGETATION

Principles of the Braun-Blanquet survey technique were used to do the survey and describe plant communities as ecological units. Relevant literature was used to obtain an overview of the vegetation of the site. Ecological sensitivity of the plant communities was assessed and categorised according to the habitat and plant species assemblages. Aerial photographs were used to study the site and preliminary delineation of the different vegetation units was done. These vegetation units were verified on foot at the site and vegetation sample plots placed in each.

Data recorded included:

Data gathered included the physiognomy and floristic composition (species richness and canopy cover of each species) of each species. A list of plant species present, including, trees, shrubs, grasses, forbs, geophytes and succulents were compiled. All identifiable plant species were listed. Additional notes were made of any features that might be of ecological significance.

Red data and protected species

An investigation was carried out on rare and protected plant that might possibly occur in the region. The National Red List of Threatened Plants of South Africa, Lesotho and Swaziland, compiled by the Threatened Species Programme, South African National Biodiversity Institute (SANBI) were used. The Northern Cape Nature Conservation Act (No. 9 of 2009) was also consulted as well as The Red List of South African Plants compiled by SANBI (2020). The New Plants of South Africa (SANBI 2016) was also used.

The presence of rare and protected species or suitable habitat thereof was recorded during the field visit.

Data processing

Vegetation data was classified to identify, describe, and map vegetation types. Description of the vegetation units includes tree, shrub, and herbaceous layers. Conservation priority for each vegetation unit was assessed by evaluating plant species composition in terms of the present knowledge of the vegetation of the Savanna Biome of South Africa. Four conservation priority categories were used for the different vegetation units:

High	Ecologically sensitive and valuable land with high species richness that should be conserved, and no development allowed.
Medium	Land that should be conserved but which low impact development could be considered under exceptional circumstances.
Medium-low	Land that has some conservation value but on which development could be considered with limited impact on the vegetation/ecosystem. It is recommended that certain sections of the vegetation be maintained.
Low	Land that has little conservation value and that could be considered for development with little to no impact on the vegetation/ecosystem.

RESULTS OF THE VEGETATION SURVEY

Vegetation units

The study area was divided into two sections namely: Study site A (Figure 2) and Study site B (Figure 3).

Study site A

1. Wetland/drainage line vegetation unit
2. Karroid vegetation unit
3. Three-thorn vegetation unit
4. Grass dominated shrubland vegetation unit

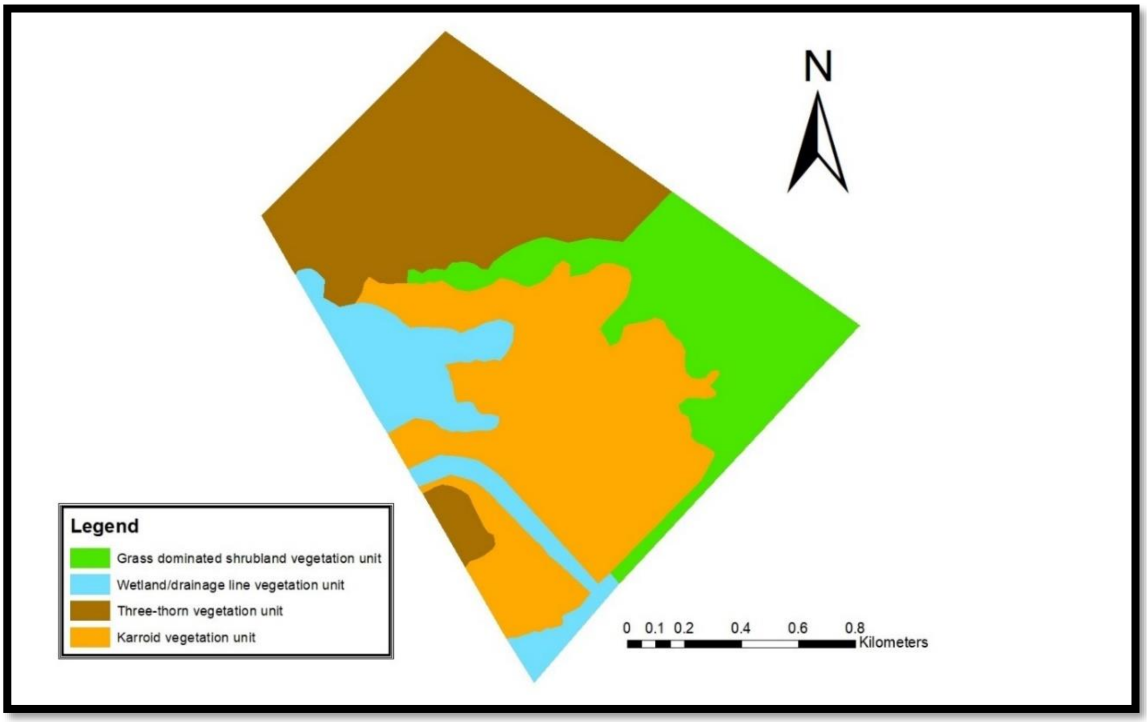

Figure 2: Different vegetation units identified in study site A

Study site B

1. Three-thorn vegetation unit
2. Open Grassland vegetation unit

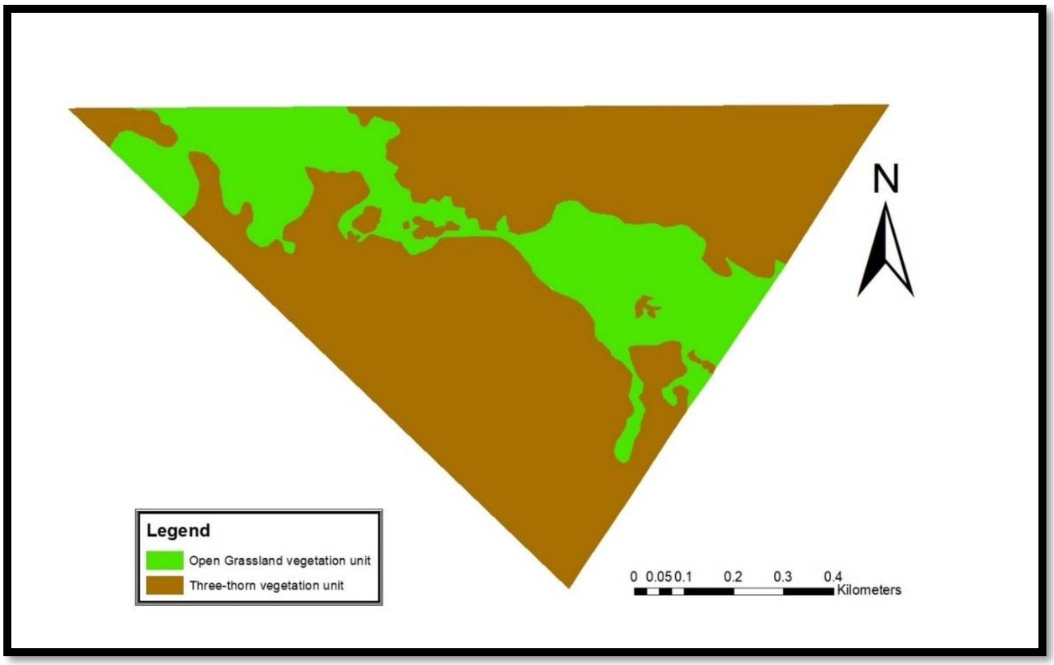

Figure 3: Different vegetation units identified in Study site B

Study site A

1. **Wetland/drainage line vegetation unit**

Status	Invaded
Vegetation structure	Natural vegetation with bare soil patches dominated by sedges and woody plants. This area also has some alien invasive species present
Topography	Flat (1.2%) with a north-western aspect
Rock cover	No rocky cover
Conservation priority	Medium

This unit occur in the middle section of the south-western border of the study site and cover approximately 23.51 ha of Study site A. The topography is flat topography with a north-western aspect. The drainage channel contains individuals of the declared alien invader tree species *Prosopis glandulosa* and *Tamarix ramosissima* that have displaced many native species. From an ecological perspective the area has a medium conservation value due to the invasion, however, due to it being a wetland/drainage line the area has an important ecosystem functioning. This unit is thus regarded as having a high ecological sensitivity.

The vegetation of this area is dominated by alien invasive trees: *Prosopis glandulosa* and *Tamarix ramosissima,* sedges Afro*scirpoides dioecus* and *Pseudoschoenus inanis* and the alien invasive forb *Cirsium vulgare.*

Protected species:

Plant Family	Species	Protected
Iridaceae	*Babiana hypogaea*	X

Alien invasive and problem plant species:

Plant Family	Species	Growth form
Amaranthaceae	*Atriplex *semibaccata*	Herb
Asteraceae	**Cirsium vulgare*	Herb
Asteraceae	*Erigeron *bonariensis*	Herb
Asteraceae	*Sonchus *oleraceus*	Herb
Brassicaceae	*Lepidium *didymum*	Herb
Caryophyllaceae	*Spergularia *media*	Herb
Fabaceae	**Prosopis glandulosa*	Tree
Onagraceae	**Oenothera stricta*	Herb
Papaveraceae	**Argemone ochroleuca*	Herb
Poaceae	*Paspalum *dilatatum*	Grass
Poaceae	*Poa *annua*	Grass
Polygonaceae	*Polygonum *aviculare*	Herb
Tamaricaceae	*Tamarix *ramosissima*	Tree
Urticaceae	*Urtica *urens*	Herb
Verbenaceae	**Phyla nodiflora*	Herb
Verbenaceae	**Verbena bonariensis*	Herb

List of species found during the study:

The following is a list of plant species identified during the survey, where * indicates alien species and plants regarded as problem plants by Bromilow (2018):

Plant Family	Species	Growth form
Amaranthaceae	*Atriplex *semibaccata*	Herb
Amaranthaceae	*Salsola aphylla*	Shrub
Apocynaceae	*Gomphocarpus fruticosus*	Shrub
Asteraceae	**Cirsium vulgare*	Herb
Asteraceae	*Chrysocoma ciliata*	Shrub
Asteraceae	*Erigeron *bonariensis*	Herb
Asteraceae	*Eriocephalus ericoides*	Shrub
Asteraceae	*Felicia filifolia*	Shrub
Asteraceae	*Gazania krebsiana*	Herb
Asteraceae	*Helichrysum leontonyx*	Herb
Asteraceae	*Helichrysum luteoalbum*	Herb
Asteraceae	*Hertia pallens*	Shrub
Asteraceae	*Nidorella resedifolia*	Herb
Asteraceae	*Pentzia incana*	Shrub
Asteraceae	*Senecio cf. abruptus*	Herb
Asteraceae	*Sonchus *oleraceus*	Herb
Brassicaceae	*Lepidium *didymum*	Herb
Caryophyllaceae	*Spergularia *media*	Herb

Plant Family	Species	Growth form
Cyperaceae	*Afroscirpoides dioeca*	Sedge
Cyperaceae	*Pseudoschoenus inanis*	Sedge
Fabaceae	**Prosopis glandulosa*	Tree
Fabaceae	*Melolobium microphyllum*	Shrub
Fabaceae	*Vachellia karroo*	Tree
Iridaceae	*Babiana hypogaea*	Geophyte
Onagraceae	**Oenothera stricta*	Herb
Papaveraceae	**Argemone ochroleuca*	Herb
Poaceae	*Aristida congesta*	Grass
Poaceae	*Cynodon dactylon*	Grass
Poaceae	*Eragrostis lehmanniana*	Grass
Poaceae	*Panicum schinzii*	Grass
Poaceae	*Paspalum *dilatatum*	Grass
Poaceae	*Pennisetum sphacelatum*	Grass
Poaceae	*Phragmites australis*	Grass
Poaceae	*Poa *annua*	Grass
Polygonaceae	*Polygonum *aviculare*	Herb
Ranunculaceae	*Ranunculus multifidus*	Herb
Solanaceae	*Lycium cinereum*	Shrub
Tamaricaceae	*Tamarix *ramosissima*	Tree
Thymelaeaceae	*Lasiosiphon polycephalus*	Shrub
Typhaceae	*Typha capensis*	Herb/hydrophyte
Urticaceae	*Urtica *urens*	Herb
Verbenaceae	**Phyla nodiflora*	Herb
Verbenaceae	**Verbena bonariensis*	Herb

2. Karroid vegetation unit

Figure 4: Area in the karroid component indicating both *Eriocephalus ericoides* and *Lasiosiphon polycephalus.*

Status	Natural
Vegetation structure	Natural vegetation cover dominated by shrubs and grasses with herbs and forbs
Topography	Flat (1.1%) with north-western aspect
Rock cover	No rocky cover
Conservation priority	Medium

The unit is located in the central parts of Study site B and is comprised of natural vegetation. The topography is flat with a north-western aspect. This component is around 72.1 ha in size. Little to no disturbance occur in this unit, however there were areas were individuals of *Prosopis glandulosa* and some of the *Lycium* species were uprooted. Most of the vegetation found in the area is natural.

The vegetation is mostly dominated by karroid shrubs (Figure 4), with an alternating dominance between *Eriocephalus ericoides* and *Lagarosiphon polycephala* with some *Pentzia incana, Melolobium microphyllum, M. canescens* and various *Lycium species.* Grasses included various species from *Stipagrostis* namely: *S. uniplumis, S. cilliata, S. obtusa, S. namaquensis*. Limited forbs and herbs were found that could be positively identified because of the timing of the impact assessment.

In this Karroid component patches of *Rhigozum trichotomum* that is growing among *Eriocephalus ericoides, Lagarosiphon polycephala* and the various species of *Stipagrostis* can be found. These areas are, however, too small to map, but is worth mentioning.

Remnants of species (Figure 5 A and B) that raise concern were found during the study. Due to the lack of identification structures in the form of fruits or flowers and leaves these species are identified as possibly being Figure 5 A – *Boophone disticha* and B – *Brunsvigia* cf. *radulosa* both being protected species.

Figure 5: Remnants of species of concern. A – *Boophone disticha* and B – *Brunsvigia* sp.

Protected species:

Plant Family	Species	Protected	Specially protected
Aizoaceae	*Ruschia spinosa*	X	
Amaryllidaceae	*Boophone disticha*	X	
Amaryllidaceae	*Brunsvigia sp*	X	
Fabaceae	*Vachellia haematoxylon*	X	
Geraniaceae	*Pelargonium nanum*		X

Alien invasive and problem plant species:

Amaranthaceae	*Atriplex *semibaccata*	Herb
Asteraceae	**Cirsium vulgare*	Herb
Fabaceae	**Prosopis glandulosa*	Tree
Polygonaceae	*Polygonum *aviculare*	Herb

List of species found during the study:

The following is a list of plant species identified during the survey, where * indicates alien species and plants regarded as problem plants by Bromilow (2018):

Plant Family	Species	Growth form
Acanthaceae	*Justicia incana*	Shrub
Aizoaceae	*Ruschia spinosa*	Succulent
Amaranthaceae	*Atriplex *semibaccata*	Herb
Amaranthaceae	*Salsola aphylla*	Shrub
Amaryllidaceae	*Boophone disticha*	Geophyte
Amaryllidaceae	*Brunsvigia sp*	Geophyte
Asparagaceae	*Asparagus capensis*	Shrub
Asparagaceae	*Asparagus retrofractus*	Shrub
Asparagaceae	*Asparagus suaveolens*	Shrub

Plant Family	Species	Growth form
Asteraceae	**Cirsium vulgare*	Herb
Asteraceae	*Chrysocoma ciliata*	Shrub
Asteraceae	*Ericephalus ericoides*	Shrub
Asteraceae	*Erigeron *bonariensis*	Herb
Asteraceae	*Eriocephalus ericoides*	Shrub
Asteraceae	*Felicia muricata*	Shrub
Asteraceae	*Gazania jurineifolia*	Herb
Asteraceae	*Gazania krebsiana*	Herb
Asteraceae	*Hertia pallens*	Shrub
Asteraceae	*Nidorella resedifolia*	Herb
Asteraceae	*Pentzia incana*	Shrub
Asteraceae	*Pentzia quinquefida*	Shrub
Bignoniaceae	*Rhigozum trichotomum*	Shrub
Brassicaceae	*Heliophila cornuta*	Shrub
Cyperaceae	*Afroscirpoides dioeca*	Sedge
Fabaceae	**Prosopis glandulosa*	Tree
Fabaceae	*Dichilus lebeckioides*	Shrub
Fabaceae	*Lotononis pungens*	Herb
Fabaceae	*Melolobium canescens*	Shrub
Fabaceae	*Melolobium microphllum*	Shrub
Fabaceae	*Vachellia haematoxylon*	Tree
Fabaceae	*Vachellia tortilis*	Tree
Geraniaceae	*Pelargonium nanum*	Herb
Iridaceae	*Moraea pallida*	Geophyte
Lamiaceae	*Salvia verbenaca*	Herb
Poaceae	*Aristida congesta*	Grass
Poaceae	*Eragrostis lehmanniana*	Grass
Poaceae	*Pennisetum sphacelatum*	Grass
Poaceae	*Stipagrostis ciliata*	Grass
Poaceae	*Stipagrostis namaquensis*	Grass
Poaceae	*Stipagrostis obtusa*	Grass
Poaceae	*Stipagrostis uniplumis*	Grass
Polygonaceae	*Polygonum *aviculare*	Herb
Rhamnaceae	*Ziziphus mucronata*	Tree
Ruscaceae	*Eriospermum sp*	Geophyte
Santalaceae	*Thesium hystrix*	Shrub/parasite
Santalaceae	*Viscum rotundifolium*	Shrub/parasite
Solanaceae	*Lycium bosciifolium*	Shrub
Solanaceae	*Lycium cinereum*	Shrub
Thymelaeaceae	*Lasiosiphon polycephalus*	Shrub

3. Three-thorn vegetation unit

Figure 6: Vegetation dominated by the presence of the *Rhigozum trichotomum*

Status	Natural
Vegetation structure	Vegetation is dominated by a shrub layer with scattered trees. There is also a ground layer composed of grasses, herbs and forbs.
Topography	Moderate slope (2%) with a south-eastern aspect
Rock cover	Rock cover mostly absent, however in isolated patches of open vegetation large rocks are present
Conservation priority	Medium

This vegetation unit is located on the north and north-western boundary of the study site and covers approximately 64.1 ha. The topography has a moderate slope with a south-eastern aspect. No disturbance was visible in this area.

The vegetation is dominated by the shrub *Rhigozum trichotomum* (Figure 6) with shrub to tree size individuals of *Senegalia mellifera.* The tree layer is composed of scattered individuals of *Vachellia tortilis.* The grass layer contained species of *Aristida* and *Stipagrostis* as the dominant species.

Among the dense stands of *Rhigozum trichotomum,* there were more open (Figure 7) areas with larger rocks, that were mostly dominated by grasses, herbs and forbs. In these vegetation areas the shrub component were dominated by *Ruschia spinosa* and more herbs and forbs than in the *Rhigozum* dominated vegetation.

Figure 7: Open rocky areas found among the *Rhigozum trichotomum* stands

Protected species:

Family	Species name	Protected
Aizoaceae	*Ruschia spinosa*	X
Scrophulariaceae	*Jamesbrittenia pinnatifida*	X
Anacampserotaceae	*Anacampseros filamentosa*	X

Alien plant species

Family	Species name	Growth form
Fabaceae	**Prosopis glandulosa*	Tree

List of species found during the study:

The following is a list of plant species identified during the survey, where * indicates alien species and plants regarded as problem plants by Bromilow (2018):

Family	Species name	Growth form
Acanthaceae	*Blepharis capensis*	Shrub
Acanthaceae	*Justicia incana*	Shrub
Aizoaceae	*Ruschia spinosa*	Succulent
Amaranthaceae	*Cyphocarpa angustifolia*	Herb
Amaranthaceae	*Salsola aphylla*	Shrub
Anacampserotaceae	*Anacampseros filamentosa*	Succulent
Apocynaceae	*Gomphocarpus fruticosus*	Shrub
Asparagaceae	*Asparagus capensis*	Shrub
Asparagaceae	*Asparagus retrofractus*	Shrub
Asteraceae	*Chrysocoma ciliata*	Shrub
Asteraceae	*Dicoma schinzii*	Herb
Asteraceae	*Eriocephalus ericoides*	Shrub
Asteraceae	*Felicia filifolia*	Shrub
Asteraceae	*Felicia muricata*	Shrub
Asteraceae	*Gazania krebsiana*	Herb
Asteraceae	*Geigeria pectidea*	Herb
Asteraceae	*Pentzia incana*	Shrub
Bignoniaceae	*Rhigozum trichotomum*	Shrub
Fabaceae	**Prosopis glandulosa*	Tree
Fabaceae	*Dichilus lebeckioides*	Herb
Fabaceae	*Melolobium adenodes*	Shrub
Fabaceae	*Melolobium microphyllum*	Shrub
Fabaceae	*Searsia lancea*	Tree
Fabaceae	*Senegalia mellifera*	Tree
Fabaceae	*Vachellia tortilis*	Tree
Hyacinthaceae	*Ledebouria sp.*	Geophyte
Iridaceae	*Moraea pallida*	Geophyte
Lamiaceae	*Salvia verbenaca*	Herb
Malvaceae	*Hermannia spinosa*	Shrub
Pedaliaceae	*Sesamum triphyllum*	Herb
Poaceae	*Aristida congesta*	Grass
Poaceae	*Enneapogon scoparius*	Grass
Poaceae	*Eragrostis lehmanniana*	Grass
Poaceae	*Oropetium capense*	Grass
Poaceae	*Setaria sphacelata*	Grass
Poaceae	*Stipagrostis namaquensis*	Grass
Poaceae	*Stipagrostis uniplumis*	Grass
Rhamnaceae	*Ziziphus mucronata*	Tree
Santalaceae	*Thesium hystrix*	Shrub/parasite
Scrophulariaceae	*Jamesbrittenia pinnatifida*	Herb
Scrophulariaceae	*Peliostomum leucorrhizum*	Shrub

Plant Family	Species	Growth form
Solanaceae	*Lycium bosciifolium*	Shrub
Solanaceae	*Lycium cinereum*	Shrub
Thymelaeaeceae	*Lasiosiphon polycephalus*	Shrub

4. Grass dominated shrubland vegetation unit

Figure 8: Grasses, shrubs and trees present in the grassy vegetation unit.

Status	Natural vegetation
Vegetation structure	Various trees and shrubs with a dominant grass layer. Ground cover also contains forbs and herbs
Topography	Flat slope (1.5%) with north-eastern aspect
Rock cover	No rocks present
Conservation priority	High

This vegetation unit is located in the south-eastern corner of the study site and comprises 42.6 ha of the area. The topography is flat with a north-eastern aspect. No disturbance was visible in this vegetation unit.

The vegetation in this unit is dominated by grasses (Figure 8): *Aristida congesta, Eragrostis lehmanniana* and *Stipagrostis namaquensis*, although several species of shrubs (*Eriocephalus ericoides, Osteospermum leptolobum* and several species of *Asparagus* and *Lycium*) were also present. Tree species such as *Vachellia haematoxylon, Vachellia erioloba* (both protected species)*, Ziziphus mucronata, Searsia lancea* and *Vachelia tortilis* are also present in this vegetation unit*.*

Among the grasses the fruit of *Harpagophytum procumbens* subsp. *procumbens* (Figure 9) a specially protected species was found. This area also contained remnants of what could possibly be *Boophone disticha* (protected species), however, no leaves, flowers or fruits were available for identification.

Figure 9: Fruit of *Harpagophytum procumbens* subsp. *procumbens* found in the grassy area.

Protected species:

Plant Family	Species	Protected	Specially protected
Amaryllidaceae	*Boophone disticha*	X	
Fabaceae	*Vachellia erioloba*	X	
Fabaceae	*Vachellia haematoxylon*	X	
Pedaliaceae	*Harpagophytum procumbens* subsp. *procumbens*		X

Alien plant species:

Family	Species name	Growth form
Fabaceae	**Prosopis glandulosa*	Tree

List of species found during the study:

The following is a list of plant species identified during the survey, where * indicates alien species and plants regarded as problem plants by Bromilow (2018):

Plant Family	Species names	Growth form
Acanthaceae	*Justicia incana*	Shrub
Amaryllidaceae	*Boophone disticha*	Geophyte
Anacardiaceae	*Searsia lancea*	Shrub, Tree
Asparagaceae	*Asparagus capensis*	Shrub
Asparagaceae	*Asparagus suaveolens*	Shrub
Asteraceae	*Dicoma capensis*	Herb
Asteraceae	*Eriocephalus ericoides*	Shrub
Asteraceae	*Felicia filifolia*	Shrub
Asteraceae	*Felicia muricata*	Shrub
Asteraceae	*Gazania jurineifolia*	Herb
Asteraceae	*Gazania krebsiana*	Herb
Asteraceae	*Hertia pallens*	Succulent
Asteraceae	*Osteospermum leptolobum*	Shrub
Asteraceae	*Pteronia sp*	Shrub
Bignoniaceae	*Rhigozum trichotomum*	Shrub
Fabaceae	**Prosopis glanndulosa*	Tree
Fabaceae	*Melolobium microphyllum*	Shrub
Fabaceae	*Senegalia mellifera*	Tree
Fabaceae	*Senna italica*	Herb
Fabaceae	*Vachellia erioloba*	Tree
Fabaceae	*Vachellia haematoxylon*	Tree
Fabaceae	*Vachellia tortilis*	Tree
Malvaceae	*Hermannia bicolor*	Herb
Malvaceae	*Hermannia comosa*	Herb
Malvaceae	*Hermannia tomentosa*	Herb
Pedaliaceae	*Harpagophytum procumbens* subsp. *procumbens*	Herb
Poaceae	*Aristida congesta*	Grass
Poaceae	*Eragrostis lehmanniana*	Grass
Poaceae	*Stipagrostis namaquensis*	Grass
Poaceae	*Stipagrostis uniplumis*	Grass
Rhamnaceae	*Ziziphus mucronata*	Tree
Santalaceae	*Viscum rotundifolium*	Shrub/parasite
Solanaceae	*Lycium bosciifolium*	Shrub
Solanaceae	*Lycium cinereum*	Shrub
Thymelaeaeceae	*Lasiosiphon polycephalus*	Shrub

Study site B

1. Three-thorn vegetation unit

Figure 10: Three-thorn vegetation unit is dominated by *Rhigozum trichotomum*

Status	Natural vegetation
Vegetation structure	Vegetation dominated by shrubs with some grasses and scattered individual trees
Topography	Relative flat (0.9% and 1.3%) with a north-western slope
Rock cover	Coverage varies from no rocks to large rock in open patches where *Rhigozum trichotomum* is not present
Conservation priority	Medium

This vegetation unit is divided into two sections that occur on the borders of this vegetation unit. It is divided into two by the Open Grassland vegetation unit of the study site. The topography is relatively flat with a north-western slope and the area covers approximately 51.24 ha of the site. No disturbance was visible in this vegetation unit.

The tree layer was composed of *Vachelia tortilis, Ziziphus mucronata* and *Searsia lancea.* Shrubs such as *Rhigozum trichotomum* (Figure 10), *Senegalia mellifera* and different species of *Lycium* and *Asparagus* dominated the shrub layer. The spares grass layer was mostly dominated by species from the genus *Stipagrostis* and *Eragrostis.* Limited herbs and forbs were found. In this unit the fruits of the specially protected *Harpagophytum procumbens* subsp. *procumbens* (Figure 11) were again present as well as the remnants of the protected *Boophone disticha.*

Figure 11: Fruit of *Harpagophytum procumbens* subsp. *procumbens* found in this study site.

Some areas between the *Rhigozum trichotomum* stands were open with large rocks that was dominated by the shrub *Ruschia spinosa, Asparagus suaveolens, Lycium bosciifolium and Searsia burchellii* with dwarf shrubs and herbs such as *Barleria lichtensteiniana, Blepharis capensis* and *Dicoma capensis* and the herb *Cyphocarpa angustifolia.*

<u>Protected species:</u>

Plant Family	**Species**	**Protected**	**Specially protected**
Aizoaceae	*Plinthus karooicus*	X	
Aizoaceae	*Ruschia spinosa*	X	
Amaryllidaceae	*Boophone disticha*	X	
Pedaliaceae	*Harpagophytum procumbens* subsp. *procumbens*		X
Scrophulariaceae	*Jamesbrittinia pinnatifida*	X	

Alien plant species

No alien invasive plant species were found in this vegetation unit.

List of species found during the study:

The following is a list of plant species identified during the survey, where * indicates alien species and plants regarded as problem plants by Bromilow (2018):

Plant Family	Species	Growth form
Acanthaceae	*Barleria lichtensteiniana*	Herb
Acanthaceae	*Blepharis capensis*	Dwarf shrub, Shrub
Aizoaceae	*Plinthus karooicus*	Dwarf shrub
Aizoaceae	*Ruschia spinosa*	Succulent
Amaranthaceae	*Cyphocarpa angustifolia*	Herb
Amaryllidaceae	*Boophone disticha*	Succulent, Geophyte
Anacardiaceae	*Searsia burchellii*	Shrub, Tree
Anacardiaceae	*Searsia ciliata*	Shrub
Anacardiaceae	*Searsia lancea*	Shrub, Tree
Asparagaceae	*Asparagus capensis*	Shrub
Asparagaceae	*Asparagus retrofractus*	Scrambler, Shrub
Asparagaceae	*Asparagus suaveolens*	Shrub
Asphodelaceae	*Aloe claviflora*	Succulent, Herb
Asphodelaceae	*Bulbine sp.*	Geophyte
Asteraceae	*Dicoma capensis*	Herb
Asteraceae	*Eriocephalus ericoides*	Shrub
Asteraceae	*Felicia fascicularis*	Shrub
Asteraceae	*Felicia filifolia*	Shrub
Asteraceae	*Felicia muricata*	Shrub
Asteraceae	*Gazania krebsiana*	Herb
Asteraceae	*Geiegria pectidea*	Herb
Asteraceae	*Pentzia incana*	Shrub
Asteraceae	*Schkuhria pinnata*	Herb
Bigoniaceae	*Rhigozum trichotomum*	Shrub
Boraginaceae	*Ehretia alba*	Shrub
Fabaceae	*Melolobium canescens*	Dwarf shrub, Shrub
Fabaceae	*Senegalia mellifera*	Shrub, Tree
Fabaceae	*Vachellia tortilis*	Shrub, Tree
Hyacinthaceae	*Albuca tenifolia*	Geophyte
Hyacithaceae	*Ledebouria apertiflora*	Geophyte
Pedaliaceae	*Harpagophytum procumbens subsp procumbens*	Herb
Pedaliaceae	*Sesamum triphyllum*	Herb
Poaceae	*Aristida congesta*	Graminoid
Poaceae	*Ennepogon desvauxii*	Graminoid

Plant Family	Species	Growth form
Poaceae	*Eragrostis lehmanniana*	Graminoid
Poaceae	*Eragrostis obtusa*	Graminoid
Poaceae	*Eragrostis tef*	Graminoid
Poaceae	*Eragrostis trichophora*	Graminoid
Poaceae	*Setaria verticillata*	Graminoid
Poaceae	*Stipagrostis namaquensis*	Graminoid, Shrub
Poaceae	*Stipagrostis uniplumis*	Graminoid
Rhamnaceae	*Ziziphus mucronata*	Shrub, Tree
Ruscaceae	*Sansevieria aethiopica*	Succulent, Geophyte
Santalaceae	*Thesium hystrix*	Dwarf shrub, Parasite, Shrub
Santalaceae	*Viscum rotundifolium*	Succulent, Parasite, Shrub
Scrophulariaceae	*Aptosimum spinescens*	Dwarf shrub
Scrophulariaceae	*Jamesbrittinia pinnatifida*	Herb
Scrophulariaceae	*Peliostomum leucorrhizum*	Dwarf shrub
Solanaceae	*Lycium bosciifolium*	Shrub, Tree
Thymalaeaceae	*Lasiosiphon polycephalus*	Dwarf shrub

2. Open Grassland vegetation unit

Figure 12: Open Grassland vegetation unit found in Study site B.

Status	Natural vegetation
Vegetation structure	Mostly dominated by grasses with some shrubs and trees scattered throughout.
Topography	Relative flat (1.3%) with a North-western aspect
Rock cover	No rocky cover
Conservation priority	Medium

This vegetation unit occurs in the middle of Study Site B. The topography is relatively flat with a north-western aspect of 1.3% and the area covers approximately 17.99 ha. No disturbance was found in this vegetation unit.

Aristida congesta (Figure 12) dominates this vegetation unit. Other grasses present in this vegetation unit include *Eragrostis lehmanniana, Stipagrostis uniplumis* and *Setaria verticillata*. The scattered trees in this vegetation unit included: *Vachelia tortilis, Senegalia mellifera, Searsia lancea, Searsia burchellii* and *Ziziphus mucronata*. Shrubs were also present here but not dominating the vegetation, including: *Lasiosiphon polycephalus, Lycium bosciifolium, Lycium cinerieum, Asparagus sauveolens, A. capensis, Chrysocoma cilliata*, and *Eriocephalus ericoides* that was prominent. Other herbs and forbs were also found, but to a minimum.

In this vegetation unit open patches (Figure 13) were found where the grasses were limited. These areas were mostly dominated by the shrub *Lasiosiphon polycephala* and *Chrysocoma cilliata*. Although grasses were present, they were not dominant. These areas are too small to map, however, are worth mentioning.

Figure 13: *Lasiosiphon polycephala* and *Chrysocoma cilliata* dominated open areas found in the Open Grassland areas.

Protected and specially protected species:

Plant Family	Species	Protected	Specially protected
Aizoaceae	*Ruschia spinosa*	X	
Amaryllidaceae	*Boophone disticha*	X	
Fabaceae	*Vachellia haematoxylon*	X	
Pedaliaceae	*Harpagophytum procumbens* subsp *procumbens*		X

Alien plant species

No alien invasive plant species were found in this vegetation unit.

List of species found during the study:

The following is a list of plant species identified during the survey, where * indicates alien invasive species and plants regarded as problem plants by Bromilow (2018):

Plant Family	Species	Growth form
Acanthaceae	*Blepharis capensis*	Dwarf shrub, Shrub
Acanthaceae	*Justicia incana*	Herb
Aizoaceae	*Ruschia spinosa*	Succulent
Amaryllidaceae	*Boophone disticha*	Succulent, Geophyte
Anacardiaceae	*Searsia burchellii*	Shrub, Tree
Anacardiaceae	*Searsia lancea*	Shrub, Tree
Asparagaceae	*Asparagus capensis*	Shrub

Plant Family	Species	Growth form
Asparagaceae	*Asparagus retrofractus*	Shrub, Scrambler
Asparagaceae	*Asparagus suaveolens*	Shrub
Asteraceae	*Chrysocoma ciliata*	Shrub
Asteraceae	*Dicoma capensis*	Herb
Asteraceae	*Dicoma schinzii*	Herb
Asteraceae	*Eriocephalus ericoides*	Shrub
Asteraceae	*Felicia fascicularis*	Shrub
Asteraceae	*Felicia filifolia*	Shrub
Asteraceae	*Pentzia incana*	Shrub
Asteraceae	*Rosenia humilis*	Shrub
Asteraceae	*Senecio abruptus*	Herb
Asteraceae	*Pteronia* sp.	—
Boraginaceae	*Ehretia alba*	Shrub
Fabaceae	*Dichilus lebeckioides*	Herb, Dwarf shrub
Fabaceae	*Melolobium microphyllm*	Dwarf shrub, Shrub
Fabaceae	*Senegalia mellifera*	Shrub, Tree
Fabaceae	*Vachellia haematoxylon*	Shrub, Tree
Fabaceae	*Vachellia tortilis*	Shrub, Tree
Hyacinthaceae	*Albuca tenifolia*	Geophyte
Hyacinthaceae	*Ledebouria revoluta*	Geophyte
Malvaceae	*Hermannia comosa*	Herb
Neuradaceae	*Grielum humifusum*	Herb
Pedaliaceae	*Harpagophytum procumbens* subsp *procumbens*	Herb
Poaceae	*Aristida congesta*	Graminoid
Poaceae	*Eragrostis lehmanniana*	Graminoid
Poaceae	*Setaria verticillata*	Graminoid
Poaceae	*Stipagrostis uniplumis*	Graminoid
Rhamnaceae	*Ziziphus mucronata*	Shrub, Tree
Ruscaceae	*Sansevieria aethiopica*	Succulent, Geophyte
Solanaceae	*Lycium bosciifolium*	Shrub, Tree
Solanaceae	*Lycium cinereum*	Dwarf shrub, Shrub
Solanaceae	*Lycium schizocalyx*	Dwarf shrub, Shrub
Solanaceae	*Solanum supinum*	Dwarf shrub
Thymalaeaceae	*Lasiosiphon polycephalus*	Dwarf shrub

DISCUSSION

VEGETATION

Vegetation type

The vegetation type present in the study areas is considered as **least threatened** Kimberley Thornveld (SVk4) Figure 14 (Mucina and Rutherford, 2006). Only 2% of this vegetation type is statutorily conserved in National Parks and Nature Reserves The transformed areas were mostly affected by cultivation. Large parts of this vegetation type are used for cattle farming or game ranching. Erosion in this vegetation type is very low. Overgrazing is known to occur in this vegetation type where the vegetation will then be dominated by *Senegalia mellifera.*

Important taxa according to Mucina and Rutherford (2006) include Tall trees: *Vachellia erioloba.* Small Trees: *Vachellia karroo, Senegalia mellifera, Vachellia tortilis, Searsia lancea.* Tall shrubs: *Tarchonanthus camphoratus, Diosyros pallens, Ehretia rigida, Euclea crispa, Grewia flava, Lycium arenicola, L. hirutum, Searsia tridactyla.* Low shrubs: *Vachellia hebeclada, Anthospermum rigidum, Helichrysum zeyheri, Hermannia comosa, Lycium pilifolium, Melolobium microphyllum, Pavonia burchellii, Peliostomum leucorrhizum, Plinthus sericeus, Wahlenbergia nodosa.* Succulent shrubs: *Aloe hereroensis, Lycium cinereum.* Graminoids: *Eragrostis lehmanniana, Aristida canescens, A. congesta, A. mollissima, Cymbopogon pospischilii, Digitaria argyrograpta, D. eriantha, Enneapogon cenchroides, E. scoparius, Ergarostis rigidior, Heteropogon contortus, Themeda triandra.* Herbs: *Barleria macrostegia, Dicoma schinzii, Harpagophytum procumbens* subsp. *procumbens, Helichrysum cerastioides, Hermbstaeditia odorata, Hibiscus marlothianus, Jamesbrittenia aurantiaca, Lippia scaber-rima, Osteospermum muricatum, Vahlia capensis.* Succulent Herbs: *Aloe grandidentata, Piaranthus decipiens*

Biogeographically Important Taxa according to Mucina and Rutherford (2006) include: Low Shrubs: *Blepharis marginata*, Succulent shrub: *Euphorbia bergii.* Graminoid: *Panicum kalaharense*. Herbs: *Helichrysum arenicola*, *Neuradopsis bechauanensis*. Succulent Herb: *Lithops aucampiae* subsp. *aucampiae*, *Tridentea marientalensis* subsp. *marientalensis*.

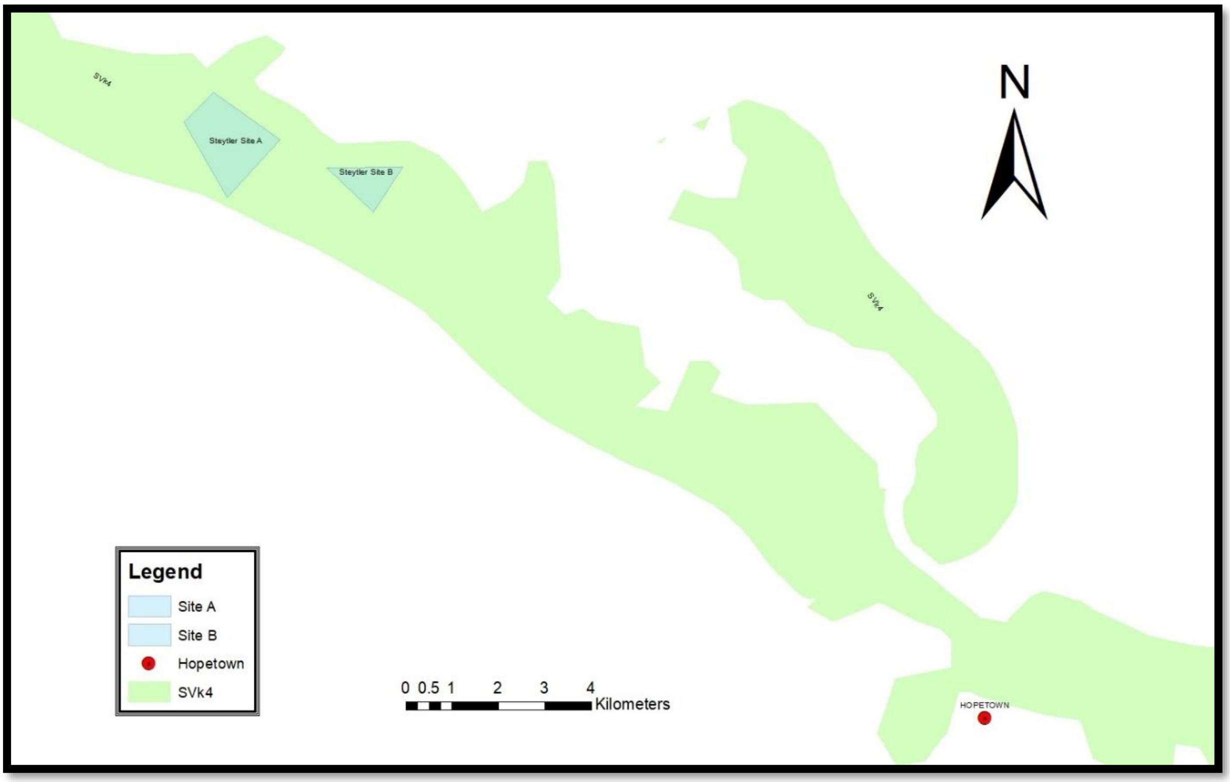

Figure 14: Location of the study sites within the Kimberley Thornveld (Svk 4) vegetation type after Mucina and Rutherford (2006).

<u>Vegetation units</u>

Study site A

Vegetation unit 1 (Wetland/drainage line vegetation unit) has a well-developed sedge layer composed of *Afroscirpiodes dioeca* and *Pseudoschoenus inanis*. Woody vegetation in the form of alien invasive *Prosopis glandulosa* and *Tamarix ramosissima* also dominates this vegetation unit. Other invasive and problem plants include *Atriplex semibaccata, Cirsium vulgare, Erigeron bonariensis, Sonchus oleraceus, Lipidium didymum, Oenothera stricta, Argemone ochroleuca, Paspalum dilatatum, Urtica urens* and *Verbena bonariensis*. Protected species in this vegetation unit include *Babiana hypogaea.* Although there are natural components in this vegetation unit it can be considered invaded due to the presence of *Prosopis glandulosa* and *Tamarix ramosissima.*

Vegetation unit 2 (Karroid vegetation unit) has a well-developed shrub layer dominated by shrubs such as: *Eriocephalus ericoides, Lasiosiphon polycephala, Chrysocoma cilliata*, *Thesium hystrix*, *Pentzia incana* and various species of *Lycium* and

Asparagus. Grasses that are prominent in this unit include *Eragrostis lehmanniana, Pennisetum sphacealatum* and various species of *Stipagrostis* and *Aristida congesta.* Alien invasive or problem plant species in this vegetation unit include *Salvia verbenaca, Erigeron bonariensis* and *Cirsium vulgare.* The specially protected *Pelargonium nanum* (Schedule 1 of the Northern Cape Conservation Act (2011)) was also found in this vegetation unit. Other protected species include: *Ruschia spinosa, Boophone disticha, Brunvigia* sp. and *Vachellia haematoxylon.* This karroid vegetation unit is considered natural.

Vegetation unit 3 (Three-thorn vegetation unit) has a well-developed shrub layer dominated by *Rhigozum trichotomum* and *Senegalia mellifera* as well as various species of *Lycium* and *Asparagus.* Van Rooyen (2019) indicated that *Rhigozum trichotomum* and *Senegalia mellifera* (Mucina and Rutherford, 2006) are both species indicative of historical overgrazed veld conditions. Groundcover is composed of sparsely distributed grasses, forbs and herbs. Scattered trees such as *Senegalia mellifera, Searsia lancea* and *Ziziphus mucronata* and the alien invasive *Prosopis glandulosa* also occurred in this vegetation unit. Protected species in this vegetation unit include *Ruschia spinosa, Jamesbrittenia pinnatifida* and *Anacampseros filamentosa.* Other alien invasive species include *Salvia verbenaca.* This vegetation unit contains natural vegetation.

Vegetation unit 4 (Grass dominated shrubland vegetation unit) is dominated by the grass species *Aristida congesta, Eragrostis lehmanniana* and *Stipagrostis namaquensis* and the shrubs *Eriocephalus ercoides, Osteospermum leptolobum, Lasiosiphon polycephlum* and various species of *Lycium* and *Asparagus.* Scattered trees species such as *Vachellia erioloba, V. heamatoxylon, V. tortilis, Senegalia mellifera, Ziziphus mucronata, Searsia lancea* and the alien invasive *Prosopis glandulosa* occur in this vegetation unit. Specially protected species in this area include *Harpagophytum procumbens* subsp. *procumbens*. Protected species include *Boophone distica, Vachellia erioloba* and *Vachellia haematoxylon.* Various individuals of *Vachellia haematoxylon* were found and a rough count of individuals resulted in approximately 120 individuals. Vegetation in this vegetation unit is considered natural.

During the field visit a deep trench with running water was observed on the western boundary of Study site A. In the south-eastern corner of this study site there was trampling by domestic cattle and removal of various tree species that could not be positively identified.

Study site B

Vegetation unit 1 (Three-thorn vegetation unit) has a well-developed shrub layer that is dominated by *Rhigozum trichotomum* and *Senegalia mellifera* and various species of *Lycium* and *Asparagus*. *Rhigozum trichotomum* and *Senegalia mellifera* are indicative of historical overgrazed veld according to van Rooyen (2019) as well as Mucina and Rutherford (2006). Scattered trees were present in this area and include: *Vachellia tortils, Senegalia mellifera, Searsia lancea* and *Ziziphus mucronata.* Groundcover is composed of a few sparsely distributed grass species, forbs and herbs. Several fruits of the specially protected *Harpagophytum procumbens* subsp. *procumbens* were found in this unit. Another protected bulb, *Boophone distincta* were also present. *Plinthus karooicus, Ruschia spinosa* and *Jamesbrittenia pinnatifida* are also protected species found in this vegetation unit according to Schedule 2 of the Northern Cape Conservation Act (2011). The succulent *Aloe claviflora* was also found in this unit, however, this species is not protected.

In this vegetation unit there is also open areas where the vegetation is not dominated by *Rhigozum trichotomum* and *Senegalia mellifera.* These areas have large rocks present at the surface and are mostly dominated by *Ruschia spinosa* as well as forbs and herbs. Vegetation in all the areas in Vegetation unit 1 is natural.

Vegetation unit 2 (Open Grass vegetation unit) has a well-developed grass layer that is dominated by *Aristida congesta*, however, other grass species also include *Stipagrostis uniplumis, Eragrosthis lehmanniana* and *Setaria verticillata*. Some herb and forb species were also found in this unit. The scattered trees found in this unit are *Vachellia haematoxylon*, *Vachellia trotilis, Senegalia mellifera, Searsia lancea* and *Ziziphus mucronata.* Various shrubs were also found scattered in this vegetation unit and include various species of *Lycium* and *Asparagus* as well as *Eriocephalus ericoides* and *Lasiosiphon polycephalus.* This vegetation unit also have the following protected species: *Boophone distincta, Vachellia haematoxylon* (protected) and *Harpagophytum procumbens* subsp. *procumbens* (Specially protected). According to the International Union for Conservation of Nature *Solanum supinum* is considered a vulnerable species.

In this vegetation unit there are also open areas dominated by the shrub *Lasiosiphon polycephala* and *Chrysocoma cilliata* with sparse vegetation cover. These areas are very small but worth mentioning since the vegetation composition is significantly different from the surrounding Open Grassland vegetation unit. The vegetation present in this Open grassland vegetation unit is natural.

Alien plant species

Species	Category		Vegetation unit					
			Study site A				Study site B	
	CARA	NEMBA	1	2	3	4	1	2
Argemone ochroleuca	1	1b	X					
Cirsium vulgare	1	1b	X	X				
Lepidium didymum	1	not listed	X					
Prosopis glandulosa	2	3	X	X	X	X		
Tamarix ramosissima	1	1b	X					
Verbena bonariensis	not listed	1b	X					

Alien species pose a risk to the natural environment, locally as well as in the surrounding areas. These species are indicative of degraded conditions in the areas where they occur. Alien plant species outperform the indigenous plant species in terms of reproduction and establishment, furthermore, they also cause deterioration of the habitat in terms of soil water content, soil pH and erosion.

Protected and specially protected species

According to the The Red List of South African Plants compiled by SANBI (2020) no red data species could be found for the study area. Therefore, a list of protected and specially protected species is presented here.

(Please note that the list is confidential and may not be made available for public perusal)

Species	Northern Cape Nature Conservation Act	
	Schedule 1 Specially protected	**Schedule 2 Protected**
Anacampseros filamentosa		**X**
Babiana hypogaea		**X**
Boophone disticha		**X**
Brunsvigia sp		**X**
Harpagophytum procumbens subsp. *procumbens*	**X**	
Jamesbrittenia pinnatifida		**X**
Pelargonium nanum	**X**	
Plinthus karooicus		**X**
Ruschia spinosa		**X**
Vachellia erioloba		**X**
Vachellia haematoxylon		**X**

Drainage and connectivity

In the study area there are two study sites namely Study site A and Study site B. Study site A is located along the R3112 between Hopetown and Douglas on the left side. Study site B is located between the R3112 (between Hopetown and Douglas) on the Orange River side of the road (right side).

Study site A has a wetland and drainage lines with a north-western aspect. Study site B has no prominent drainage lines or connectivity. There is no direct connectivity to the nearby Orange River from any of these Study sites.

Ecosystem classification

The study site falls within the Griqualand West centre of endemism however, a 2019 study by Frisby *et al.* indicated that the increasingly densely populated Kimberley area, the banded ironstone hill ranges as well as the unique environment of the Ghaap Plateau are highlighted as areas of conservation importance. Hopetown and its surrounding environment as well as the location of the study are does not fall within the mentioned areas of conservation importance. The study area falls on the boundary of the Griqualand West Centre of endemism where at least one endemic plant species occurs per quarter-degree-grid.

CONCLUSION AND RECOMMENDATIONS

The study sites are on both sides of the R3112 between Hopetown and Douglas. Study site A is surrounded by pivots and the R3112 road. Study site B has natural vegetation along the north-eastern and north-western boundaries. The north-eastern boundary has an access road for ESKOM. The south-eastern boundary is composed of agricultural land with pivots for irrigation. The areas surrounding Study site A is and has already been impacted by development of agriculture or roads. Study site B is in a more natural condition, however, the strong presence of *Rhigozum trichotomum* and *Senegalia mellifera* is indicative of historical overgrazing.

The study area can be divided into two sections namely Study site A and Study site B. **Study site A** can be divided into four different vegetation units. Due to the wetland/drainage line and the grass dominated shrubland with various individuals of *Vachellia haematoxylon* and *Vachellia erioloba* this site should be considered as having high ecological importance. Vegetation unit 1 cannot be regarded as pristine and is seen as invaded due to the presence of *Prosopis glandulosa* and *Tamarix ramosissima* and other alien invasive and problem plants. However, this area is considered an area with high ecological sensitivity due to the area being a wetland/drainage line with an important ecosystem function. The presence of the protected *Babiana hypogaea* further supports this.

Vegetation unit 2 is in a natural state containing vegetation typical of karoo veld. This vegetation is dominated by the presence of *Eriocephalus ericoides, Lasiosiphon polycephalus, Pentzia incana, Melolobium microphyllum, M. canescens* and various species of *Lycium.* There are also various grasses mostly form the genus *Stipagrostis* present in this vegetation unit. This vegetation unit has a medium conservation value due to the natural state thereof, and the presence of *Boophone distica* and *Brunsvigia* sp., *Ruschia spinosa, Vachellia haematoxylon* and *Pelargoium nanum.* The low cover abundance or the alien invasive *Prosopis glandulosa* has little effect on the natural state of this vegetation unit at present.

Vegetation unit 3 dominated by shrubs such as *Rhigozum trichotomum* and *Senegalia mellifera* indicating possible historical overgrazing, can also be regarded as natural with a medium conservation value. This unit also contains protected species such as *Ruschia spinosa* and *Jamesbrittenia pinnatifida*. Vegetation unit 4 can be seen as shrub-veld dominated by grasses such as *Aristida congesta, Eragrostis lehmanniana* and *Stipagrostis namaquensis.* Other shrubs include *Ericephalus ericoides, Osteospermum leptolobum* and several species of *Asparagus* and *Lycium.* Two protected tree species (Vachellia *haematoxylon* and *Vachellia erioloba*) are also present in this vegetation unit. Although only a few individuals of *V. erioloba* were found, *V haematoxylon* were much more prominent and numerous. Other protected species includes *Boophone disticha* and the specially protected *Harpagophytum procumbens* subsp*. procumbens.*

Study site B can be divided into 2 vegetation units. Vegetation unit 1 is seen as natural with a medium conservation priority. This vegetation unit is similar to vegetation unit three in Study site A. The species composition is also similar and in a natural state with a medium conservation priority. Dominated shrubs include *Rhigozum trichotomum* and *Senegalia mellifera* indicating possible historical overgrazing. This unit also contains protected species such as *Ruschia spinosa, Plinthus karooicus, Boophone disticha, Harpagophytum procumbens* subsp. *procubens* and *Jamesbrittenia pinnatifida*. This vegetation unit contains vegetation typical of karoo veld.

Vegetation unit 2 is mostly dominated by the grass *Aristida congesta* with *Eragrostis lehmanniana, Stipagrosits uniplumis* and *Setaria verti-cilliata.* The dominant shrubs include *Lasiosiphon polycephalus, Lycium bosciifolium, L. cinerieum, Asparagus suaveolens, A. capensis, Chrysocoma cilliata* and *Eriocephalus ericoides.* Protected species in this unit include *Ruschia spinosa, Boophone disticha, Vachellia haematoxylon* and *Harpagophytum procumbens* subsp. *procumbens.*

The species found in the above-mentioned vegetation units is typical of species from the Kimberley Thornveld (SVk4) and karroid vegetation. With the above-mentioned factors in mind the site is not listed as an endangered or protected ecosystem with only the wetland/drainage line as an important ecological feature with ecological functions. Another area of concern is the Grass dominated shrubland in Study site B due to the presence of high numbers of the protected *Vachellia haematoxylon.*

Study site A is surrounded by existing agricultural land on the north-western, south-western and south-eastern boundaries as well as the R3112 on the north-eastern boundary with no connection to any natural vegetation. Study site B is connected to the natural vegetation of SVk4 on the north-eastern and north-western boundaries. The north-eastern boundary contains an access road for the ESKOM power line; however, this is a rarely used road. The south-easter and south- western boundaries border with agricultural land under irrigation and the R3112 between Hopetown and Douglas respectively. It is thus clear that Study site A has very limited connection to other natural environments of the Kimberley Thornveld. However, Study site B still has well established connection with natural vegetation of the Kimberley Thornveld.

Most of the areas surrounding the study area is already transformed and it is, therefore, recommended that most of the geophytes be transplanted in other natural areas. Several large trees of the protected *Vachellia haematoxylon* and *Vachellia erioloba* were found at the study site. If development does take place it is recommended that effort be made to protect as many as possible of these species. Permits need to be obtained before any of the protected and specially protected species can be removed. No red data species were found to be present in the study area.

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

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Phase 1 Heritage Impact Assessment for proposed establishment of agricultural pivots on Farm Naauwtes Fontein 78, Hopetown, NC Province.

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October 2021

Summary

A Phase 1 Heritage Impact Assessment was carried out for the proposed installation of new irrigation pivots and associated infrastructure at two proposed sites located on the farm Naauwtes Fontein 78 near Hopetown in the Northern Cape Province. Two areas, designated Sites A and B were identified for assessment. Site A comprises four pivot footprints covering a total of 198 ha and Site B comprises two pivot footprints covering a total of 71 ha. The field assessment indicates that Sites A and B are located on fairly low topography terrain with limited outcrop visibility. The terrain is capped by a well-developed calcareous soil, and unconsolidated windblown sand with a thickness of > 80 cm. No evidence was found of *in situ* Stone Age material or capped assemblages within the sandy substrate. No fossils (Quaternary) or fossil exposures were observed in the footprint areas. There are no indications of prehistoric structures or rock art or aboveground evidence of graves or historical structures older than 60 years within the confines of the footprints. The proposed pivot development at Sites A and B will primarily affect geologically recent and culturally sterile soils (unconsolidated wind-blown sand). The footprints are not considered palaeontologically or archaeologically vulnerable and are assigned a site rating of Generally Protected C.

Contents

Introduction

A Phase 1 Heritage Impact Assessment was carried out for the proposed installation of new irrigation pivots and associated infrastructure at two proposed sites located on the farm Naauwtes Fontein 78 near Hopetown in the Northern Cape Province (**Fig. 1**). The extent of the proposed development (over 5000 m2) falls within the requirements for a Heritage Impact Assessment (HIA) as required by Section 38 (Heritage Resources Management) of the South African National Heritage Resources Act (Act No. 25 of 1999). The site visit and subsequent assessment took place in November 2013. The task involved identification of possible archaeological and paleontological sites or occurrences in the proposed zone, an assessment of their significance, possible impact by the proposed development and recommendations for mitigation where relevant.

Methodology

The palaeontological and archaeological significance of the affected area was based on existing field data, database information, published literature and maps. This was followed up with a field assessment by means of a pedestrian survey and investigation of all exposed sections within the footprint. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes.

Site significance classification standards prescribed by SAHRA (2005) were used to indicate overall significance and mitigation procedures where relevant (**Table 1**).

Locality Data

Maps: 1:50 000 topographical map 2923 DB Rooidam

1:250 000 geological map 2922 Prieska

The proposed development footprints are located next to the R3112 going to Prieska, about 19 km northwest of Hopetown on the farm Naauwtes Fontein 78 (**Fig. 2).** Two areas, designated Sites A and B were identified for assessment (**Fig. 3**). Site A comprises four pivot footprints covering a total of 198 ha and Site B comprises two pivot footprints covering a total of 71 ha (**Fig. 3).**

<u>Site Centroid Coordinates</u>

Site A, 55 ha; 29°30'29.22"S 23°56'29.88"E

Site A, 55 ha; 29°30'45.75"S 23°56'54.34"E

Site A, 15 ha; 29°30'50.25"S 23°56'31.27"E

Site A, 20 ha; 29°31'3.87"S 23°56'40.47"E

Site B, 7 ha; 29°31'5.09"S 23°58'1.62"E

Site B, 40 ha; 29°31'11.65"S 23°58'19.34"E

Background

Palaeontology

Downcutting and incision by the Orange river indicate that region is underlain by Precambrian, Ventersdorp Supergroup lavas (Allanridge Formation, *Ra*), which is composed of resistant-weathering, dark green lavas and associated pyroclastic rocks (Zawada 1992) (**Fig. 4**). Outcropping further southeast of the study area, the Ventersdorp lavas are unconformably overlain by Dwyka Group tillites of the Mbizane Formation (*C-Pd*), a a largely heterolithic unit recognized in the upper part of the Dwyka Group of the Karoo Supergroup (Von Brunn & Visser 1999; Visser et al. 1977-78, 1990; Zawada 1992; Johnson et al. 2006). It represents valley and inlet fill deposits left behind on Ventersdorp basement rocks by retreating glaciers about 300 million years ago. These Dwyka-aged palaeovalleys bear evidence of glaciated pavements, consisting of well-preserved polished surfaces striations on basement rocks, which abound throughout the area (McLachlan and Anderson 1973). 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).

Localized outcrops of Early Permian, Whitehill Formation mudrocks (Ecca Group, *Ppw*) generally occur near Jurassic dolerite contact zones, outcropping north, south and east of Hopetown (Zawada 1992). Fossils from the Whitehill Formation (Ecca Group) include mesosaurid reptiles, crustaceans, palaeoniscoid fish, fossil wood and leaves (*Glossopteris*), sponge spicules and ichnofossils (Cole and Basson 1991).

Dolerite, in the form of dykes and sills, is common throughout the region. Regarded as feeders of Drakensberg lavas, dolerites are not palaeontologically significant and can be excluded from further consideration in the present evaluation. On the other hand, dolerite outcrop, together with Ventersdorp andesites, can be regarded as archaeologically significant since Stone Age lithic artifacts in the region are mostly made of andesite or hornfels, the latter being a fine-grained isotropic rock found in the hot-contact zone between the dolerites and shales in the area. As a result, stone tool factory sites are commonly found near dolerite-shale contact zones. In addition, rock engravings in the region are consistently found on dolerite.

According to the 1:250 000 geological map 2922 Prieska, the study areas are mantled by unconsolidated Kalahari Group sand (*Qs*) and alluvium along stream incisions associated with the nearby Orange River.

To the northwest of Hopetown 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 vertebrate fossil remains have been identified. No fossils have been explicitly reported from Quaternary alluvial deposits near Hopetown yet, but a variety of fossil fauna have been retrieved from alluvial gravel terraces along the Lower Vaal River basin northeast of Kimberly (Cooke 1949; Maglio and Cooke 1978; Partridge and Maud 2000). Here, gravel terraces contain sandy lenses that have yielded several extinct vertebrate taxa including proboscidians *(Mammuthus subplanifrons* and *Elephas iolensis)*, suids (*Notochoerus capensis*) and a variety of bovids.

Archaeology

The Stone Age archaeological footprint is well-represented north of Hopetown and around Kimberley by Early and Middle Stone Age localities from lacustrine and alluvial contexts as well as rock engravings on dolerite outcrop (**Fig. 6 & 7**). Engraving sites have been recorded on a number of farms in the Hopetown district, including Beeshoek, Brandfontein Disselfontein, Doornbult Karee Kloof, Lemietskop and Rooikop (**Fig. 8**). Archaeological records and historical eyewitness accounts show evidence of Bushman hunter-gatherer and Khoi herder occupation in the region prior to European settlement (Sampson 1972; Elphick 1977). Early travellers frequently encountered Koranna, Griqua and Bushmen groups in the region (Burchell 1824; Skead 2009). Iron Age occupation is absent from the region as the most southerly distribution of Iron Age settlement in the northern Cape was limited to north of the Orange River by the end of 18th century (Maggs 1974; Humphreys 1976). The Orange River area between Douglas and Hopetown also lies within the confines of the historical Albania settlement of Griqualand West that lasted from 1866 to its demise in 1878 (**Fig. 9**) (Kurtz 1988).

Hopetown itself was established in 1854. The town experienced a boom after the discovery of diamonds 1866 and 1868, which led to the famous diamond rush of the 1870's. The historical Orange River Station and blockhouse lie on the southern bank of the Orange River, 12 kilometres east of Hopetown. South of the station lies the Doornbult concentration camp, established in 1901 by the British, which housed at least 1600 people during the Anglo-Boer War.

Field Assessment

The field assessment indicates that Sites A & B are located on fairly low topography terrain with negligible outcrop visibility (**Fig. 10**). The terrain is capped by a well-developed calcareous soil, and unconsolidated windblown sand with a thickness of > 80 cm (**Fig. 10**). No evidence was found of *in situ* Stone Age material or capped assemblages within the sandy substrate. No fossils (Quaternary) or fossil exposures were observed in the footprint areas. There are no indications of prehistoric structures or rock art or aboveground evidence of graves or historical structures older than 60 years within the confines of the footprints.

Impact Statement and Recommendation

The field assessment indicates that the proposed pivot development at Sites A and B will primarily affect geologically recent and culturally sterile soils (unconsolidated wind-blown sand) (**Table 1**). The footprints are not considered palaeontologically or archaeologically vulnerable and are assigned a site rating of Generally Protected C (**Table 1**).

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DECLARATION OF INDEPENDENCE

I, Lloyd Rossouw, declare that I act as an independent specialist consultant. I do not have 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. I have no interest in secondary or downstream developments as a result of the authorization of this project.

26 / 10 / 2021

Tables & Figures

Table 1. Archaeological 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

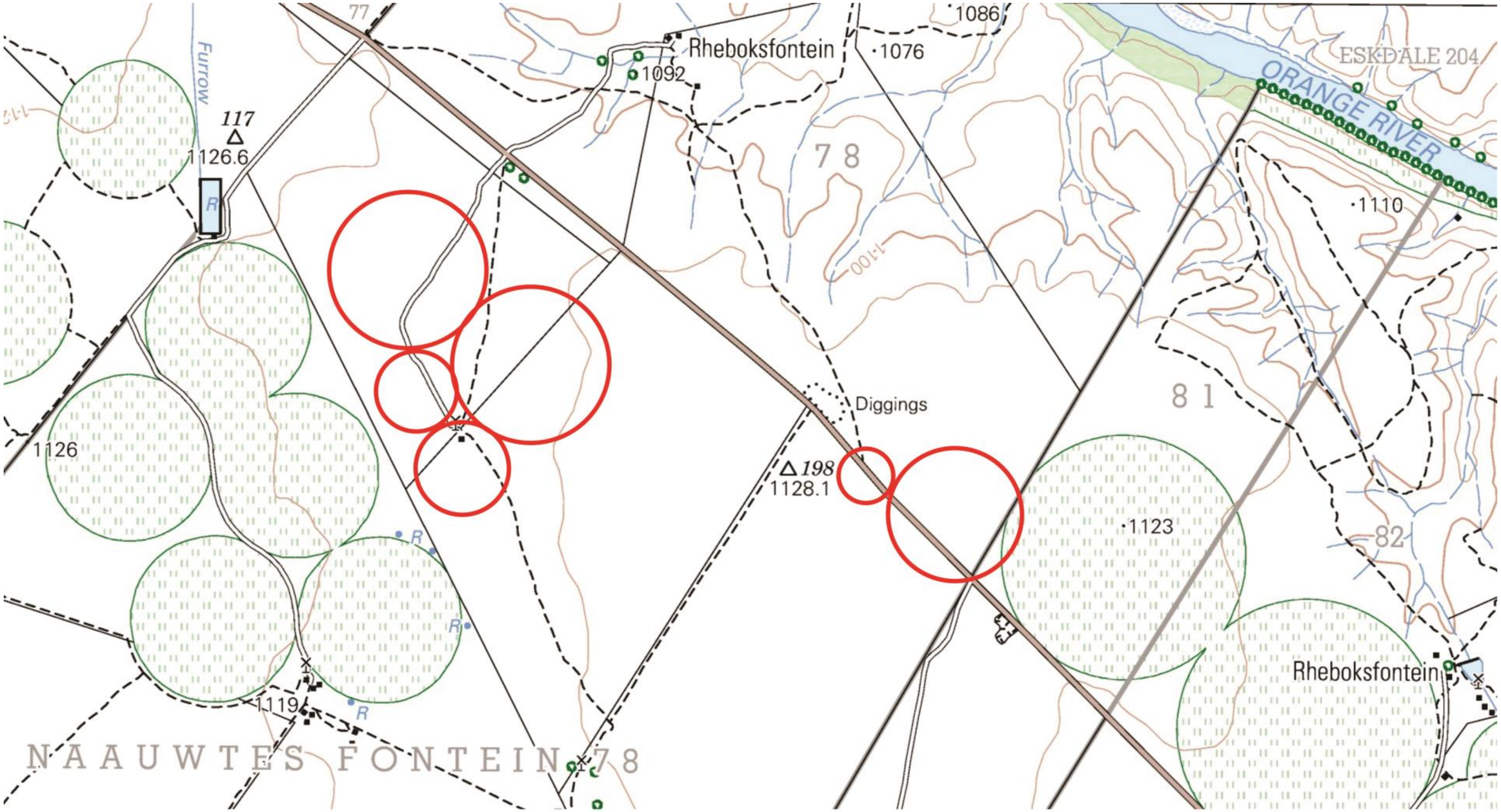


Figure 1. Map of the proposed pivot footprints (portion of 1:50 000 scale topographic map 2923DB Rooidam).

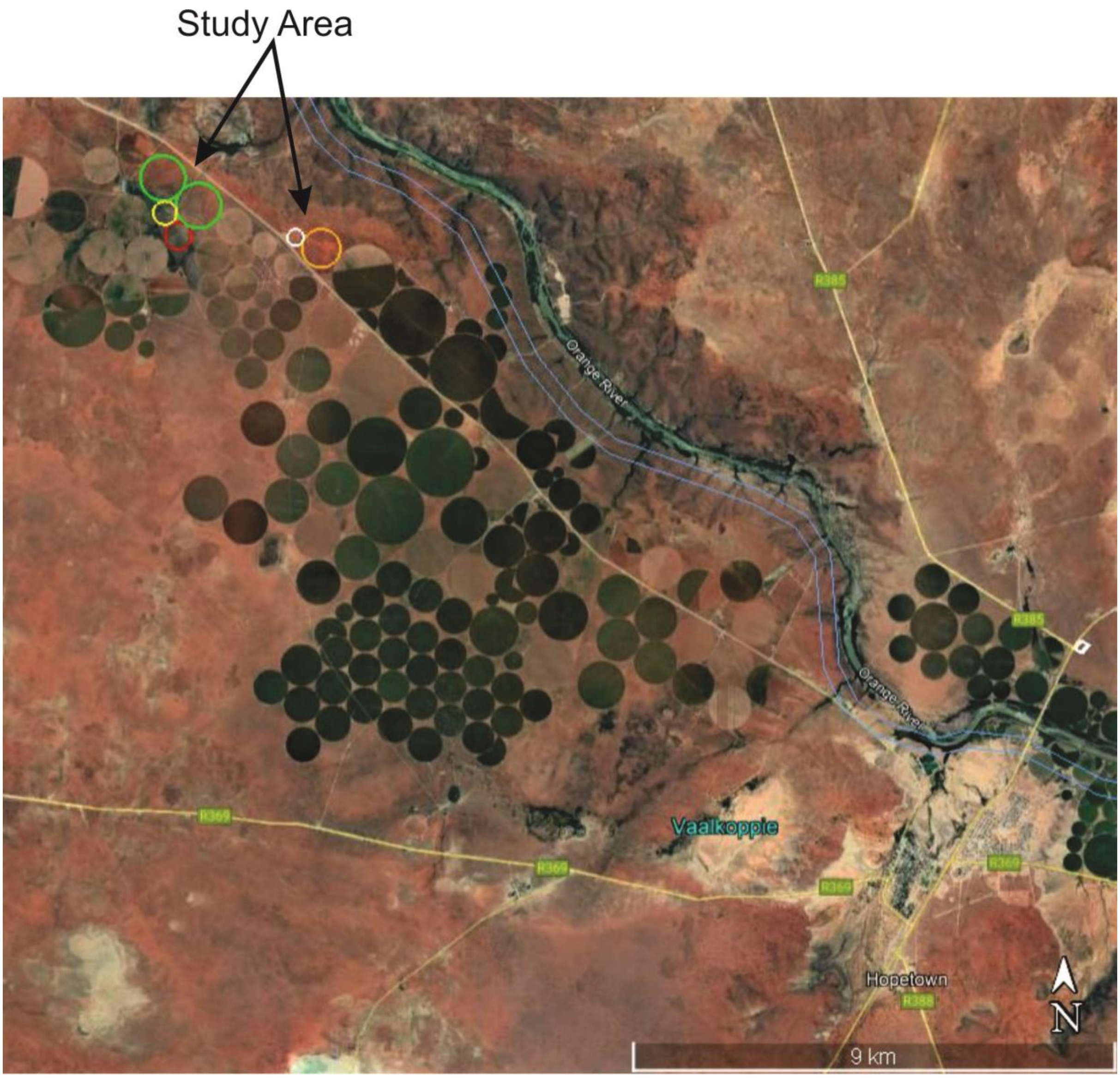


Figure 2. Position of study area in relation to Hopetown.

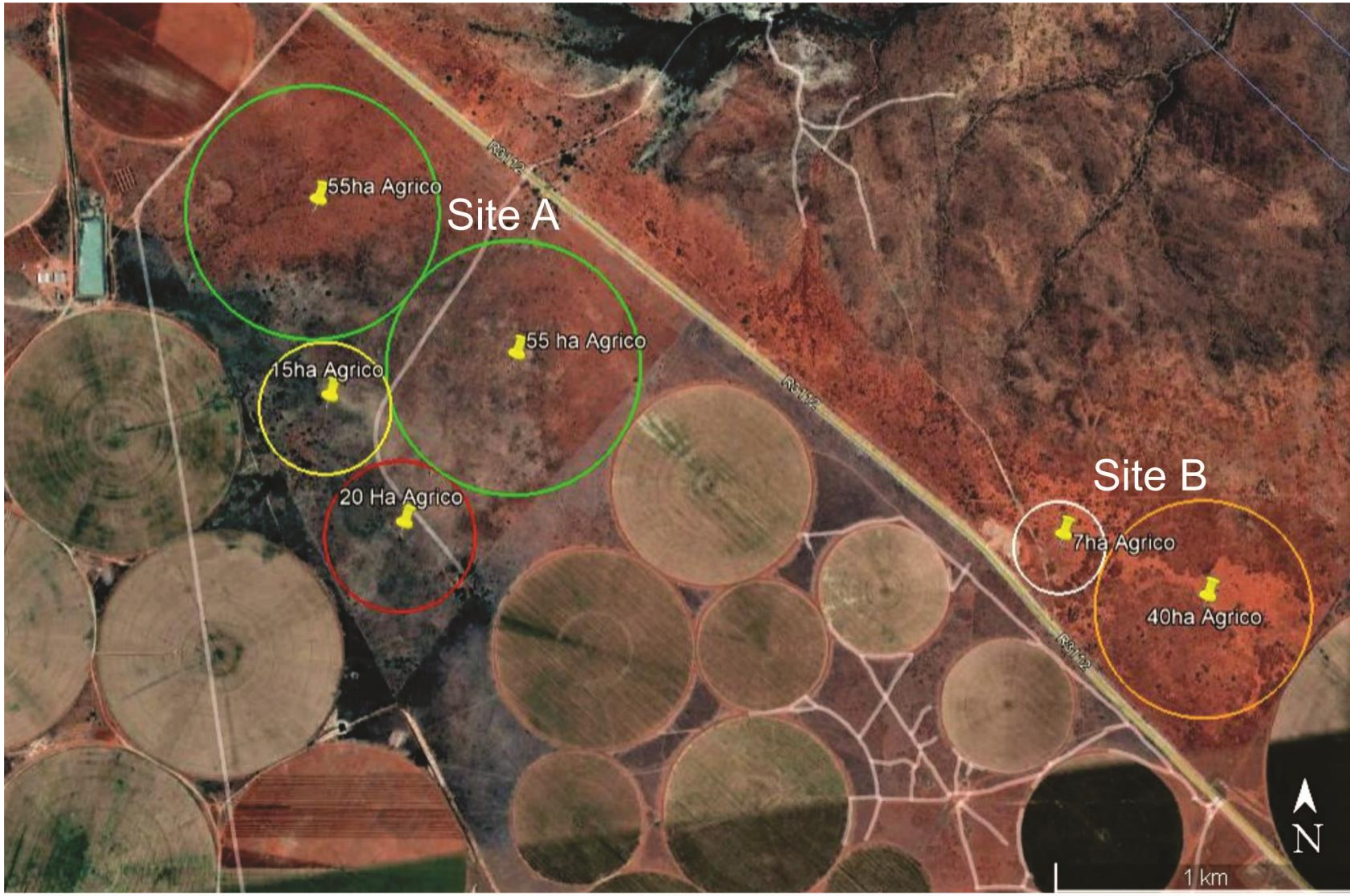


Figure 2. Aerial view of the study areas.

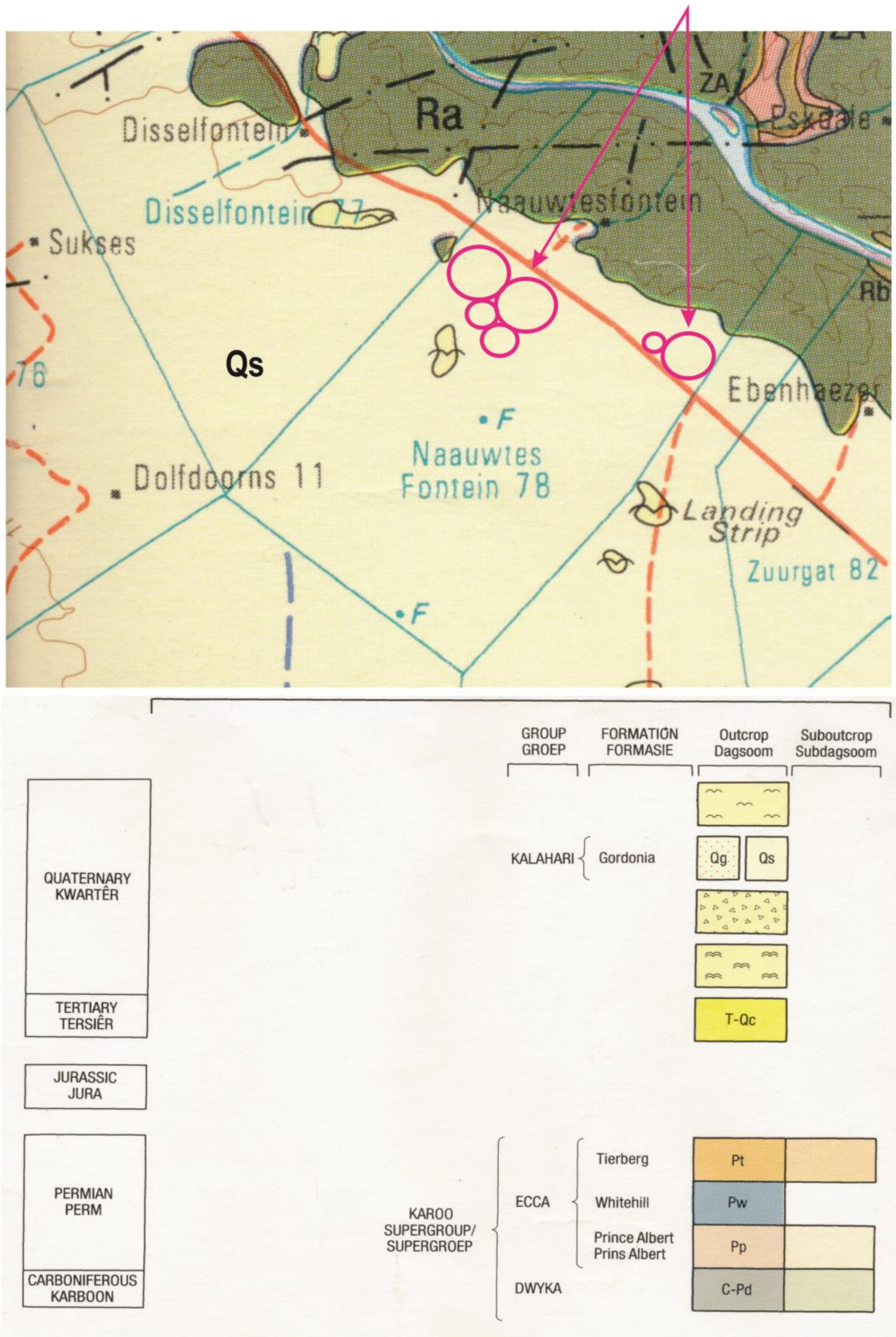


Figure 4. Portion of 1: 250 000 geological map 2922 Prieska (Council for Geoscience, Pretoria). The area around Hopetown is underlain at depth by Precambrian lavas of the Allanridge Formation (Ventersdorp Group, *Ra)* as well as Dwyka tillites (Mbizane Formation, *C-Pd*) and basal Ecca mudrocks (Whitehall Formation, *Ppw*) of the Karoo Supergroup. The basement lavas and Karoo sediments are largely overlain by Late Cenozoic (Quternary) deposits made up of calcretes, surface limestones (Qc), and Kalahari Group wind-blown sand (Qs) in the vicinity of the study area.

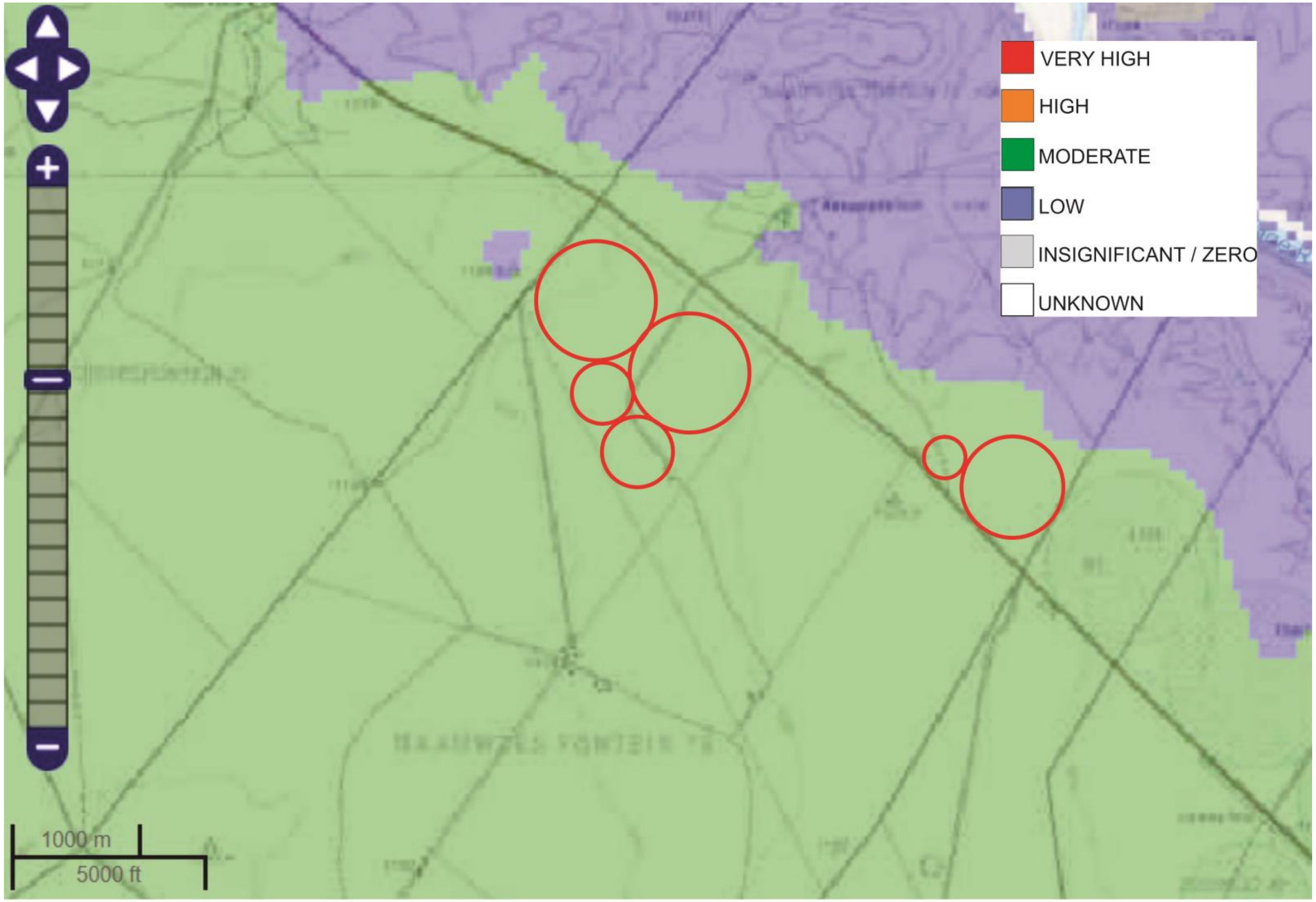


Figure 5. SAHRIS palaeosensitivity map of the study area (2021).

1. Pniel, Nooitgedacht & Powers Site - ESA, MSA and LSA
2. Canteen Koppie - ESA
3. Rooidam - ESA
4. Biesiesput - MSA
5. Driekopseiland - Glacial striations, rock engravings
6. Doornlaagte - ESA
7. Kareevloer - ESA, MSA
8. Alexandersfontein - 'palaeo-lake'
9. Liebensraum - ESA
10. Wildebeestkuil - Rock engravings
11. Witpan - Rock engravings
12. Orange River Station, Blockhouse & Concentration Camp

Figure 6. The Stone Age archaeological footprint is well-represented north of Hopetown and around Kimberley by Early and Middle Stone Age localities from lacustrine and alluvial contexts as well as rock engravings on dolerite outcrop.

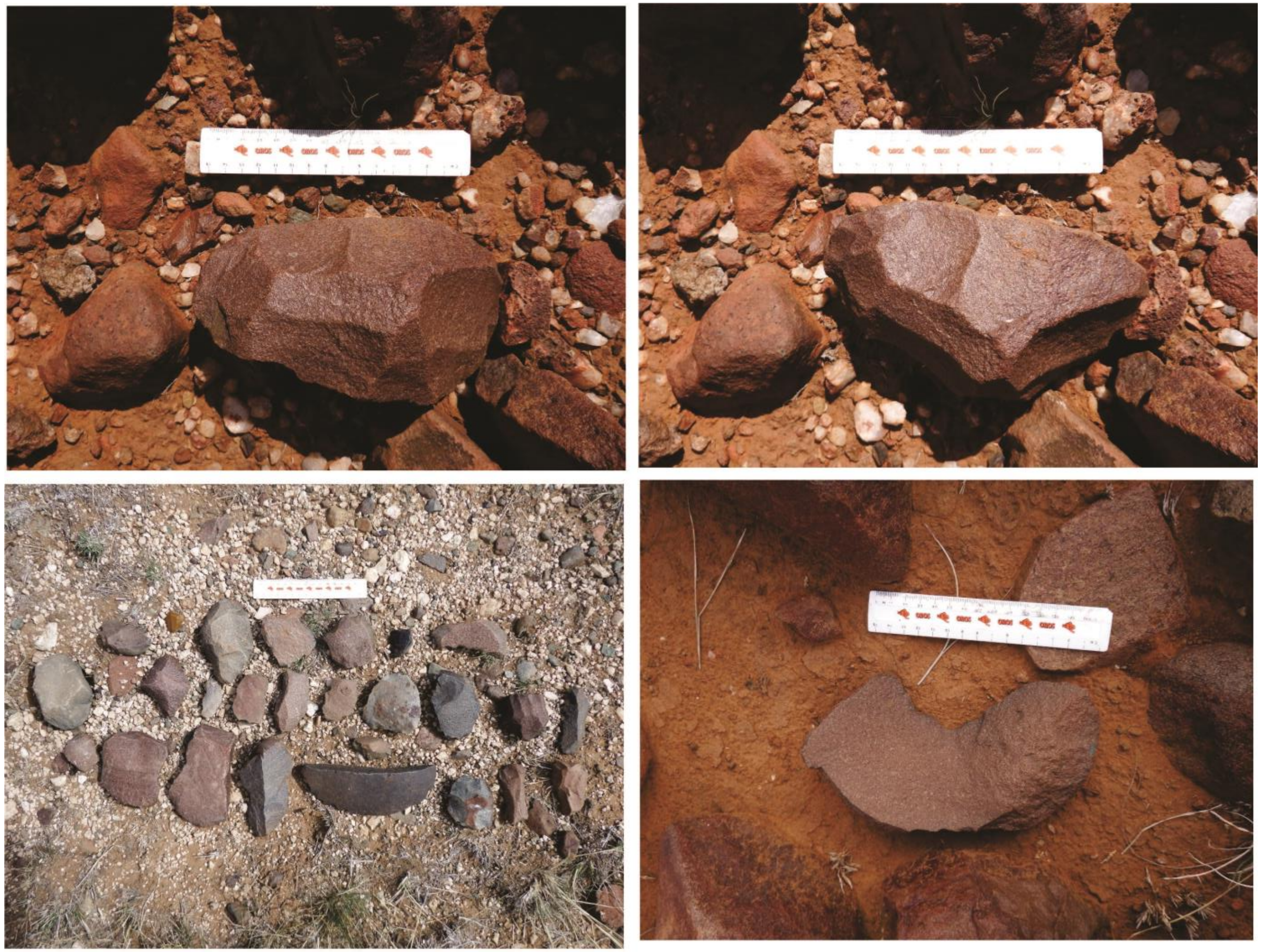


Figure 7. Individual or scatters of weathered Early and Middle Stone Age artifacts, made from Ventersdorp diabase, are a common feature generally associated with Orange River terrace and associated alluvial deposits between Hopetown and Douglas.

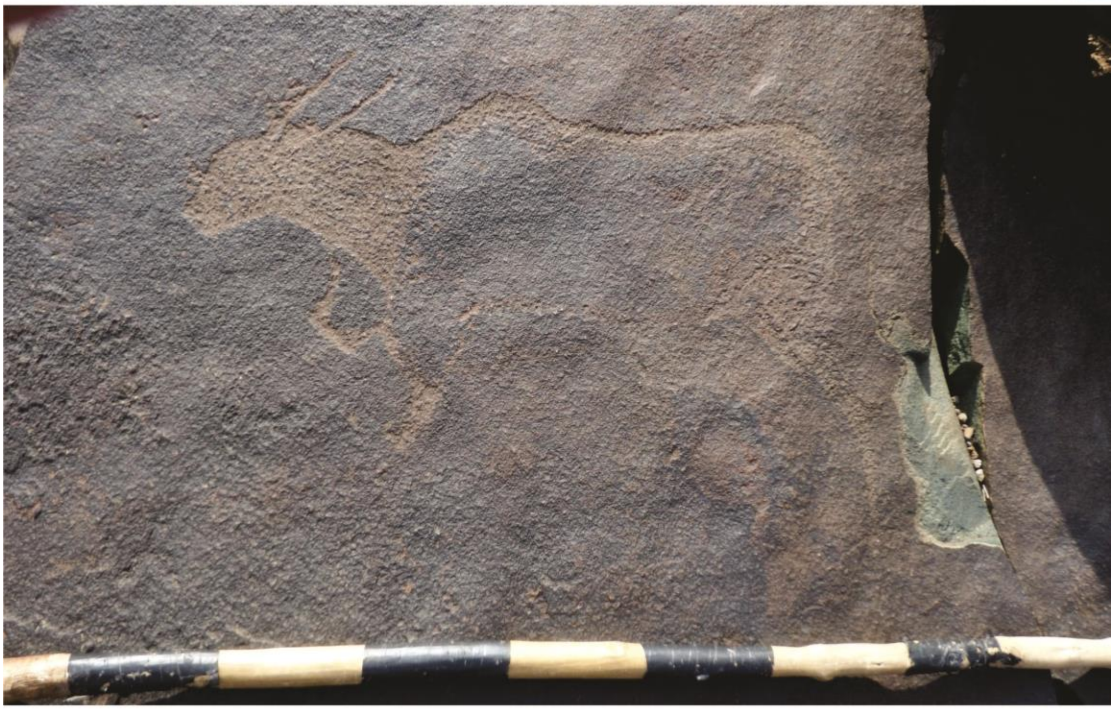
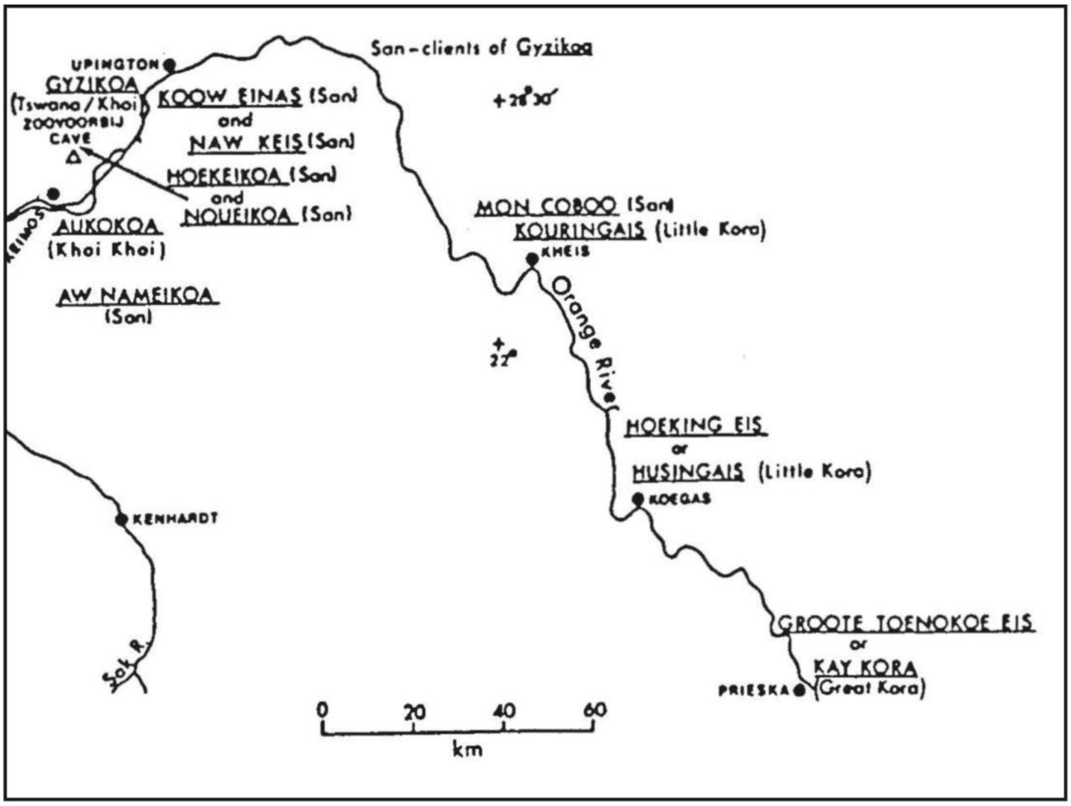


Figure 8. Rock engravings are common in high relief rocky terrain around Hopetown. Above depictions are representations of eland (*Taurotragus oryx*) located near the Orange River about 20 km northwest of Hopetown.
Scale 1 = 10 cm.



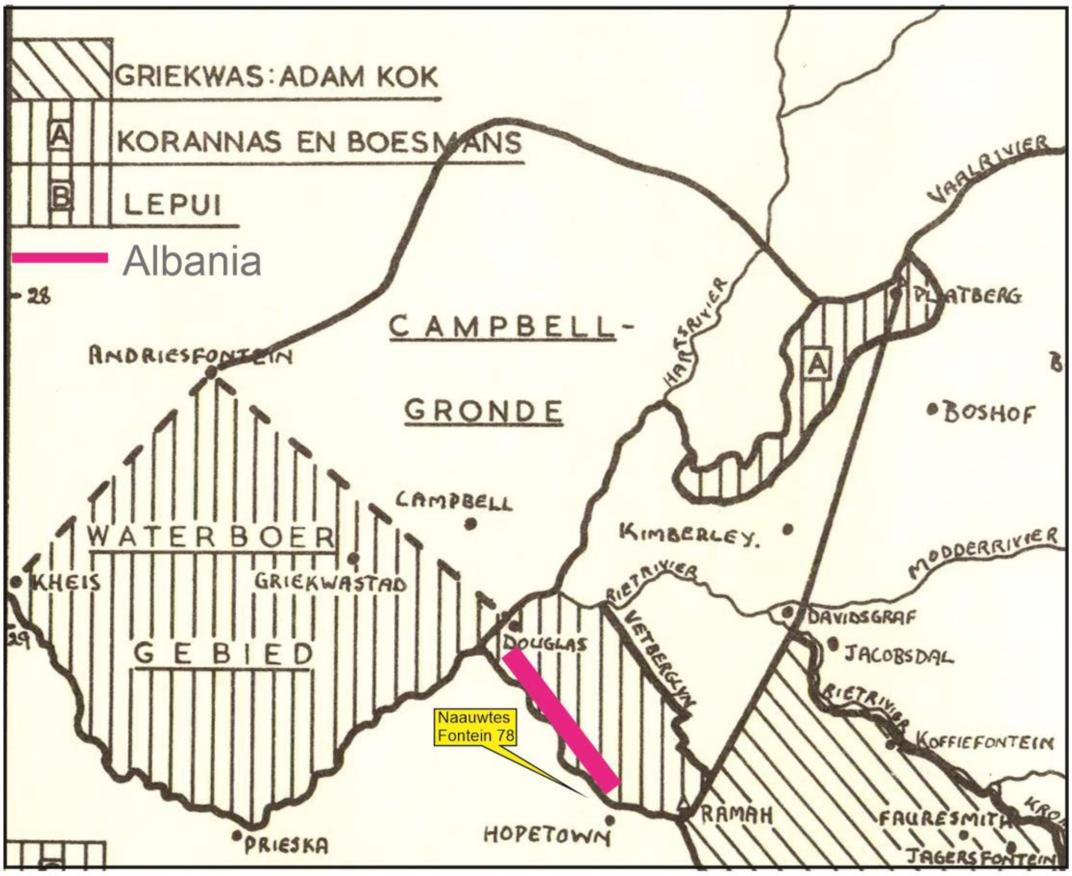


Figure 9. Historical maps based on eyewitness accounts show Bushman hunter-gatherer and Khoi herder occupation in the region prior to European settlement, e.g. Khoisan societies along the Orange River between Upinton and Prieska c. 1779 (above) while early travelers frequently encountered permanently setted Koranna, Griqua and Bushmen groups in the region c. 1850's. The historical Albania settlement of Griqualand West that lasted from 1866 until its demise in 1878 (below).

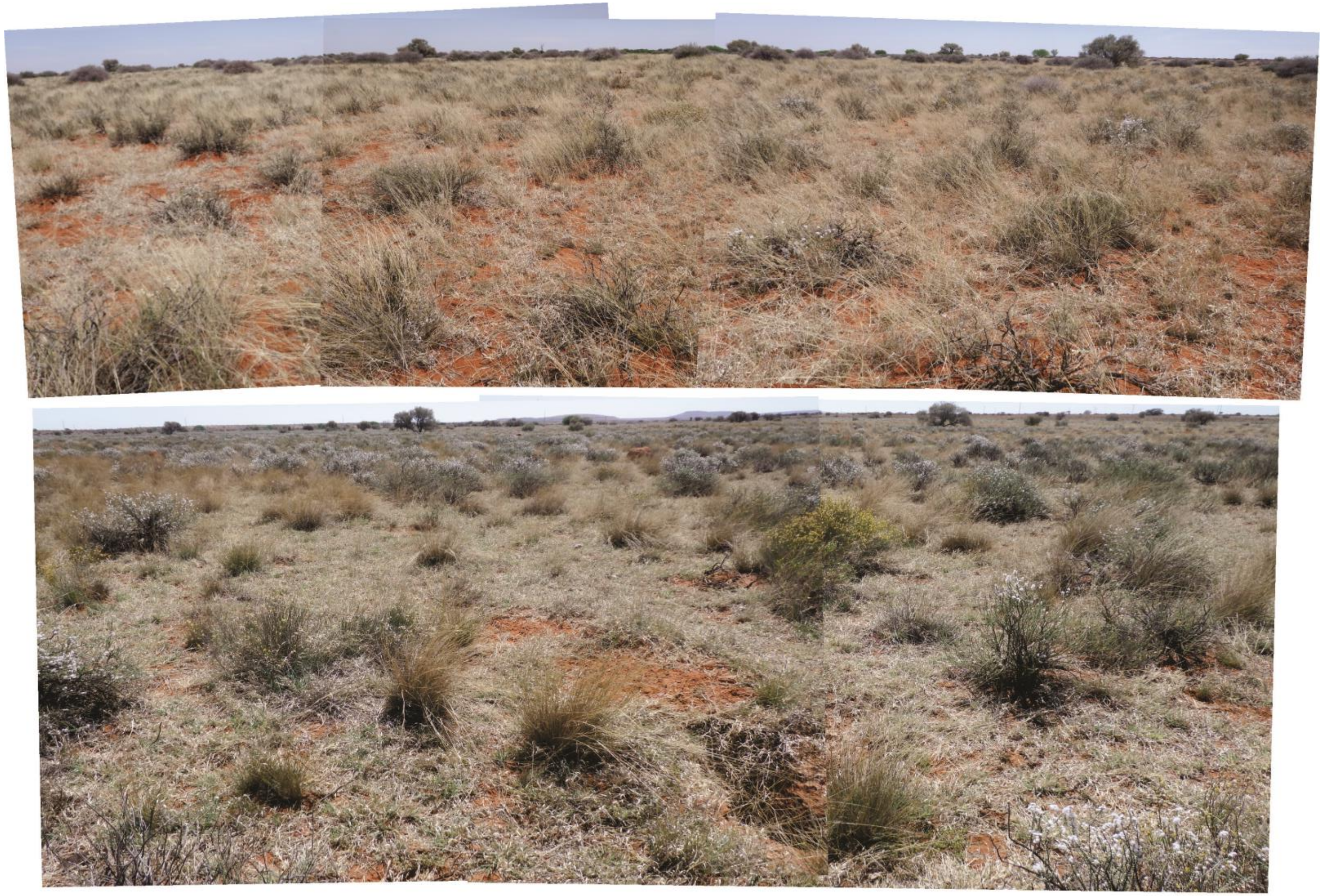


Figure 10. General view of Site A, 55 ha (North), looking west (above) and Site A, 55 ha (South) looking north (below).

Figure 11. General view of Site A, 20 ha footprint, looking northwest (above) and Site A 15 ha footprint, looking east and north (below).
Scale 1 = 10 cm.

Figure 12. General view of Site B, looking south and north (above left & right) and east (below).

Figure 13. Sites A & B are capped by a well-developed, unconsolidated windblown sand with a thickness of > 80 cm .
Scale 1 = 10 cm.