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Agricultural Agro-Ecosystem Specialist Assessment for the Development of a Light Industrial Area on Portion 58 of the Farm Vaalbank 289 JS, Middelburg

Submitted by TerraAfrica Consult cc
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July 2020

DECLARATION OF INDEPENCE OF THE SPECIALIST

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Declaration of Independence

I, Mariné Pienaar, hereby declare that TerraAfrica Consult, an independent consulting firm, has no interest or personal gains in this project whatsoever, except receiving fair payment for rendering an independent professional service.

I further declare that I was responsible for collecting data and compiling this report. All assumptions, assessments and recommendations are made in good faith and are considered to be correct to the best of my knowledge and the information available at this stage.

TerraAfrica Consult cc represented by M Pienaar
July 2020

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1. INTRODUCTION

AdiEnvironmental cc appointed TerraAfrica Consult cc to conduct the Agricultural Agro-Ecosystem Specialist Assessment as part of the Basic Assessment (BAR) process for the proposed development of a light industrial area by Bakkos Projects (Pty) Ltd. The site is approximately 22 ha in extent and located in a triangle close to the N4 national road to the north, bordering on the R35 (Bethal Road) to the west and the road to Pienaarsdam Leisure Resort to the south.

The affected area where the proposed development will be is located on Portion 58 of the Farm Vaalbank 289 JS. The land portion is approximately 2.5km south of the Middelburg Mall within the Steve Tshwete Local Municipality and Nkangala District Municipality in the Mpumalanga Province (Figure 1). The N4 national road is in close proximity to the northern border of the development site, the Black Wattle Colliery across the R35 public road in the west and a recently rehabilitated colliery and agricultural small holdings across the Pienaarsdam road to the south.

2. PURPOSE AND OBJECTIVES

The overarching purpose of the Agricultural Agro-Ecosystem Assessment that will be included in the Basic Assessment report, is to ensure that the sensitivity of the site to the proposed land use change (from agriculture to light industrial) is sufficiently considered. Also, that the information provided in this report, enables the Competent Authority to come to a sound conclusion on the impact of the proposed project on the food production potential of the site.

To meet this objective, site sensitivity verification must be conducted of which the results must meet the following objectives:

- It must confirm or dispute the current land use and the environmental sensitivity as was indicated by the National Environmental Screening Tool.
- It must contain proof of the current land use and environmental sensitivity pertaining to the study field.
- All data and conclusions are submitted together with the Basic Assessment report for the proposed Vaalbank industrial area development project.

According to GN320, the agricultural compliance statement that is submitted must meet the following requirements:

- It must identify the extent of the impact of the proposed development on the agricultural resources.
- It has to indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site, and in the event where it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources.

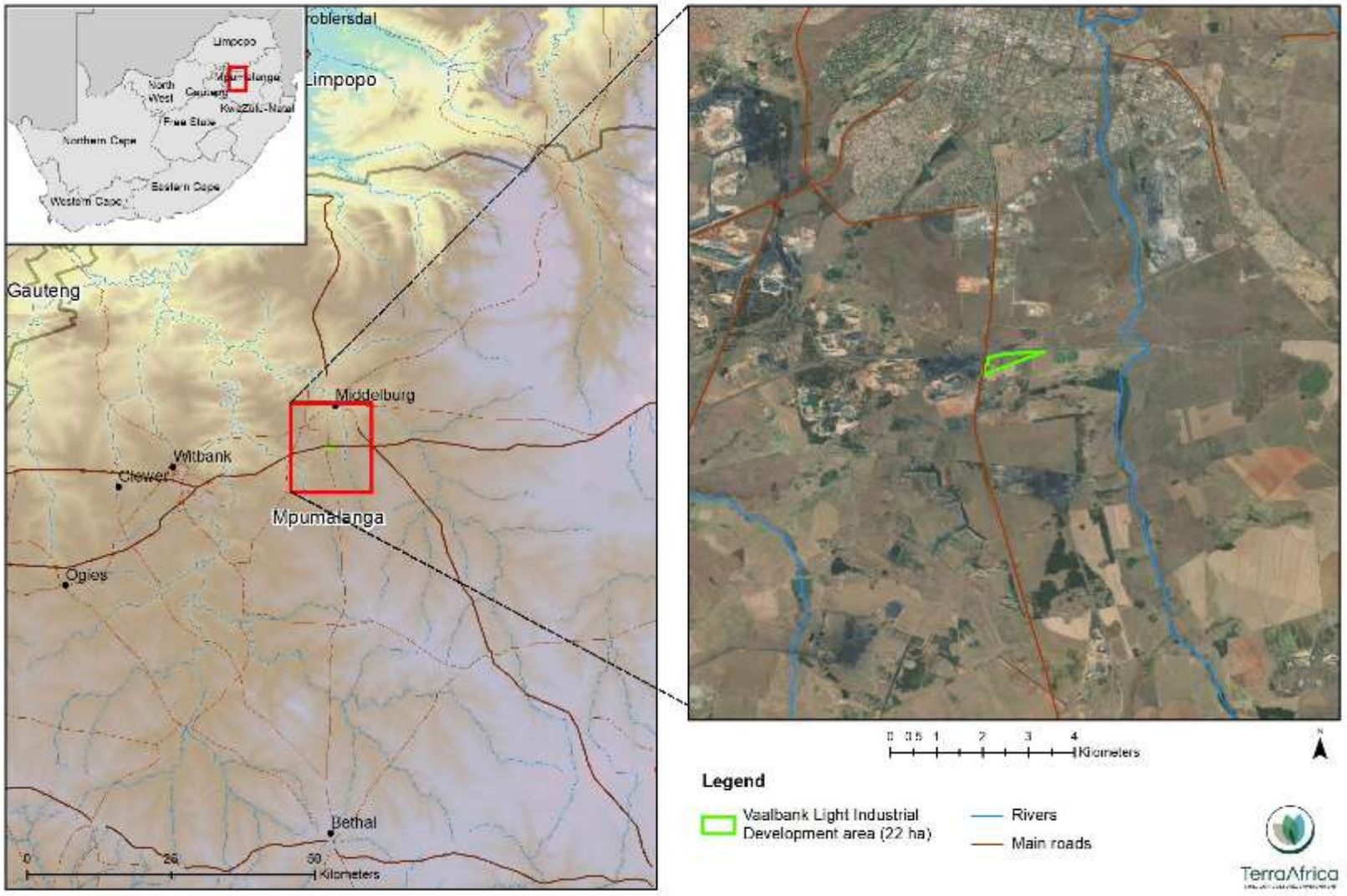

Figure 1: Locality map of the Vaalbank Light Industrial development area

3. TERMS OF REFERENCE

In addition to the requirements stipulated in GN320, the following Terms of Reference as stipulated by AdiEnvironmental cc applies to the Agricultural Agro-Ecosystem Specialist Assessment:

- Consider all the baseline data that was gathered during the site survey together with all the relevant spatial data to understand the in-situ soil properties and agricultural production value of the site.
- Identify and assess potential impacts on both agricultural potential as well as soil, resulting from the proposed Vaalbank industrial area development project.
- Identify and describe potential cumulative soil, agricultural potential and land capability impacts resulting from the proposed development in relation to proposed and existing developments in the surrounding area.
- Recommend mitigation, management and monitoring measures to minimise impacts and/or optimise benefits associated with the proposed project.

4. LEGISLATIVE FRAMEWORK FOR THE ASSESSMENT

Since the development of a light industrial area on Portion 58 of the farm Vaalbank 289 JS is on a site with high sensitivity for agricultural resources, the report follows the protocols as stipulated for agricultural assessment in Government Notice 320 of 2020 (GN320). This Notice provides the procedures and minimum criteria for reporting in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (No. 107 of 1998) (from here onwards referred to as NEMA). It replaces the previous requirements of Appendix 6 of the Environmental Impact Assessment Regulations of NEMA.

In addition to the specific requirements for this study, the following South African legislation is also considered applicable to the interpretation of the data and conclusions made with regards to environmental sensitivity:

- The Conservation of Agricultural Resources (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal. This Act requires the protection of land against soil erosion and the prevention of water logging and salinisation of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.
- Section 3 of the Subdivision of Agricultural Land Act 70 of 1970 may also be relevant to the development.
- In addition to this, the National Water Act (Act 36 of 1998) deals with the protection of water resources, including wetlands. The soil assessment therefore also focused on the identification of any hydromorphic soil forms with wetland functionality that may be present in the study area.

5. SENSIVITY ANALYSIS OF THE SITE ACCORDING TO THE ENVIRONMENTAL SCREENING TOOL

The result of screening the proposed site with the Environmental Screening Tool of the Department of Environmental Affairs, showed that the area has high combined agricultural sensitivity (Figure 2). The map from the screening report was provided by AdiEnvironmental. The area boundaries of the site are inclusive of the infrastructure layout that are proposed for the light industrial area. All planned infrastructure will be situated within the boundaries as indicated in **Figure 2**.

Figure 2 Agricultural Combined Sensitivity of the proposed light industrial development (source: Environmental Screening Tool)

6. METHODOLOGY

6.1 Desktop analysis of aerial imagery and other spatial data

Satellite imagery accessed on Google Earth, was analysed to determine areas of existing impact and land uses within the study area as well as the larger landscape. It was also scanned for any areas where crop production and farming infrastructure may be present.

Prior to the site assessment, the study area boundary was superimposed on available spatial data layers. The following was analysed:

- The newly released National Land Capability Evaluation Raster Data Layer was obtained from the Department of Agriculture, Forestry and Fisheries (DAFF) to determine the land capability classes of the development area according to this system. The new data was developed by DAFF to address the shortcomings of the 2002 national land capability data set. The new data was developed using a spatial evaluation modelling approach (DAFF, 2017).
- The long-term grazing capacity for South Africa 2018 was also analysed for the area within which the Vaalbank industrial development area falls. This data set includes incorporation of the RSA grazing capacity map of 1993, the Vegetation type of SA 2006 (as published by Mucina L. & Rutherford M.C.), the Land Types of South Africa data set as well as the KZN Bioresource classification data. The values indicated for the different areas represent long term grazing capacity with the understanding that the veld is in a relatively good condition.
- The Mpumalanga Field Boundaries (November 2019) was analysed to determine whether the proposed Vaalbank industrial area project infrastructure falls within the boundaries of any crop production areas. The crop production areas may include rainfed annual crops, non-pivot and pivot irrigated annual crops, horticulture, old fields, smallholdings and subsistence farming. This data was also used to allocate a sensitivity rating for the proposed development area as well as a 50m buffer area around it.
- Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 – 2006). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units (in the cross section).

6.2 Site assessment

The project site (Portion 58 of the farm Vaalbank 289 JS) was visited on 11 March 2020 (autumn) for a site assessment that included a soil classification survey. The site was visited again on 30 May 2020 for the verification of a number of survey points and for the collection of more photographic evidence. The season has no effect on the outcome of the assessment. The soil profiles were examined to a maximum depth of 1.5m or the point of refusal using a hand-held soil auger. Observations were made regarding soil texture, structure, colour and soil depth at each survey point. A cold 10% hydrochloric acid solution was used on site to test for the presence of carbonates in the soil. The soils are described using the S.A. Soil Classification: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018). For soil mapping of the areas assessed in detail, the soils were grouped into classes with relatively similar soil characteristics. The locality of each of the 29 survey points, are indicated in Figure 3 below. The data recorded for each survey point, is attached as Appendix 2.

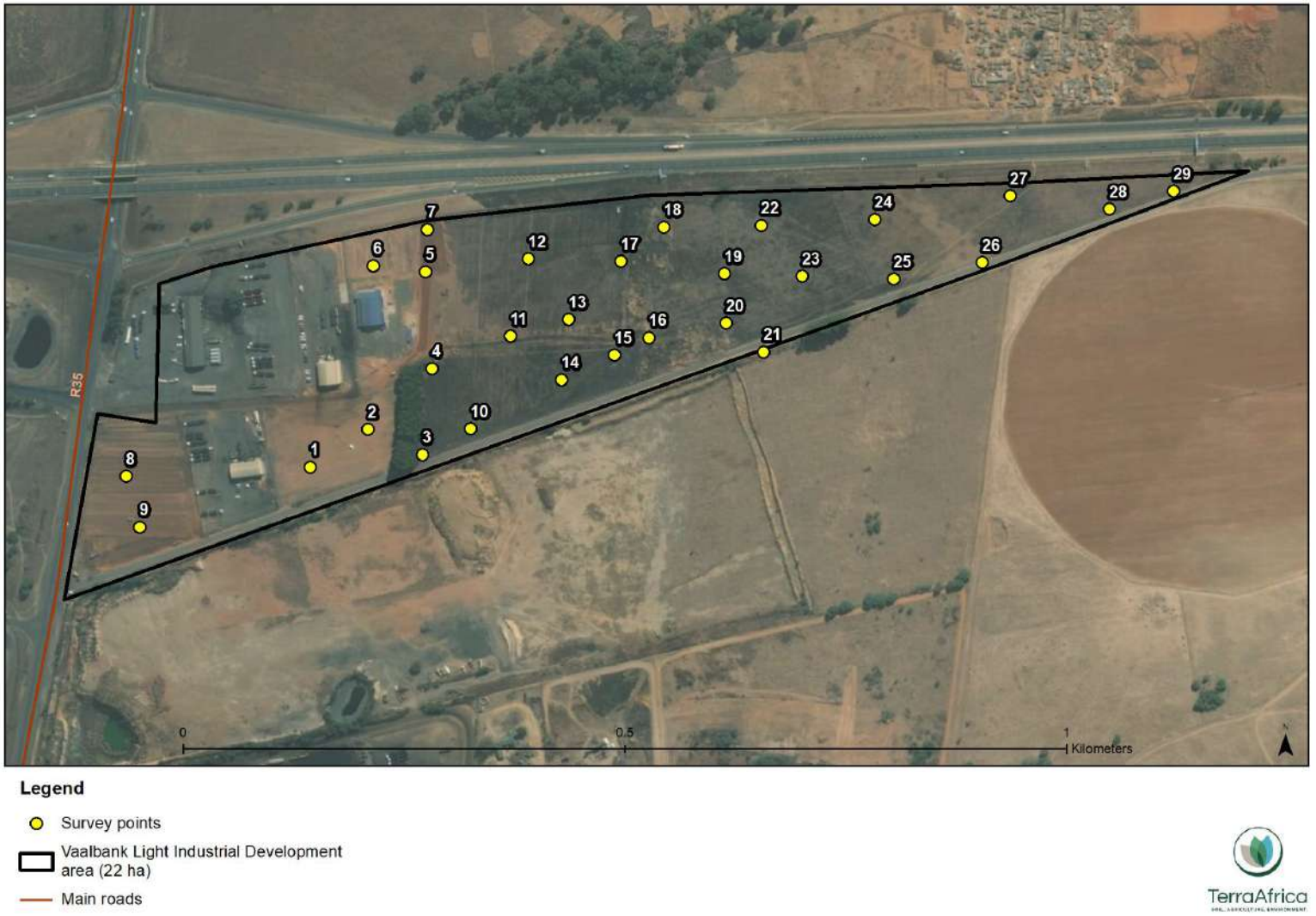

Figure 3 Locality of survey points within the proposed Vaalbank Light Industrial project site

6.3 Analysis of soil samples

Four soil samples were collected from three modal soil profiles in the study area. Soil samples were sealed in clean soil sampling plastic bags and sent to Eco Analytica Laboratory at North-West University for analyses. Samples taken to determine baseline soil fertility were analysed for electrical conductivity (EC), pH (KCl), phosphorus (Bray1), exchangeable cations (calcium, magnesium, potassium, sodium) and texture classes (relative fractions of sand, silt and clay).

6.4 Impact assessment methodology

The first stage of impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (Table 1, Table 2 and Table 3).

The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact.

The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when added up, can obtain a maximum value of 15. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary (even impacts considered to be of low significance may still require mitigation).

Table 1: Likelihood descriptors for impact assessment

Frequency of Activity	**RATING**
Annually or less / low	**1**
6 monthly / temporary	**2**
Monthly / infrequent	**3**
Weekly / life of operation / regularly / likely	**4**
Daily / permanent / high	**5**
Frequency of Impact	**RATING**
Almost never / almost impossible	**1**
Very seldom / highly unlikely	**2**
Infrequent / unlikely / seldom	**3**
Often / regularly / likely / possible	**4**
Daily / highly likely / definitely	**5**

Table 2: Consequence descriptors

Severity of impact	**RATING**
Insignificant / ecosystem structure and function unchanged	**1**
Small / ecosystem structure and function largely unchanged	**2**
Significant / ecosystem structure and function moderately altered	**3**
Great / harmful / ecosystem structure and function largely altered	**4**
Disastrous / ecosystem structure and function seriously to critically altered	**5**
Spatial scope of impact	**RATING**

Activity specific / < 5 ha impacted / Linear features affected < 100m	**1**
Development specific / within the site boundary / < 100 ha impacted / Linear features > 100m	**2**
Local area / within 1 km of the site boundary / < 2000 ha impacted / Linear features < 1000m	**3**
Regional within 5 km of site boundary / < 5000 ha impacted / Linear features affected < 10 000m	**4**
Entire habitat unit / Entire system / > 5000 impacted / Linear features affected > 10 000m	**5**
Duration of impact	**RATING**
One day to one month	**1**
One month to one year	**2**
One year to five years	**3**
Life of operation or less than 20 years	**4**
Permanent	**5**

Table 3: Significance rating matrix

	CONSEQUENCE (Severity + Spatial Scope + Duration)														
LIKELIHOOD (Frequency of activity + Frequency of Impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

The assessment of significance is undertaken twice. Initial significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment considers the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The impact assessment model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information to be in line with international best practice guidelines in instances of uncertainty or lack of information by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table 4: Positive / Negative Mitigation Ratings

Significance Rating	Value	Negative impact Management Recommendation	Positive Impact Management Recommendation
Very High	126-150	Improve current management	Maintain current management
High	101-125	Improve current management	Maintain current management
Medium – high	76-100	Improve current management	Maintain current management
Medium – low	51-75	Maintain current management	Improve current management
Low	26-50	Maintain current management	Improve current management
Very low	1-25	Maintain current management	Improve current management

7. DATA LIMITATIONS, ASSUMPTIONS AND STUDY GAPS

- There is no data available on any historical production figures of the project area and it is assumed that there are no other farming activities on the site as no evidence of it could be found.
- It was also assumed that the desktop grazing capacity and field crop boundary data obtained from DAFF, has high correlation with the actual conditions on site.
- The applicant was not able to provide estimations of the anticipated employment figures that will be associated with the project. Similarly, the predicted gross income that the project will generate within the first five years from onset, could not be provided. Both the employment figures and the predicted income that will be generated, is dependent on the type of light industries that will rent the space from the developer.
- No other uncertainties and gaps have been identified that may affect the conclusions made in this report.

8. RESPONSE TO CONCERNS RAISED BY INTERESTED AND AFFECTED PARTIES

Thus far, no concerns were raised by I & APs during the Public Participation Process pertaining to the continuation of existing land uses in the surrounding area. Should any comment be received, it will be addressed in this report.

9. RESULTS OF THE DESKTOP ASSESSMENT

9.1 Land capability

The proposed Vaalbank Light Industrial Development area includes three different land capability classes according to the land capability raster data layer (DAFF, 2017). Figure 4 indicates the position of the different classes in the landscape. The area of development of the Light Industrial Park is a mixture of Class 08 (Moderate), Class 09 (Moderate – High) and Class 10 (Moderate – High) land capabilities.

9.2 Field crop boundaries

The position of field crops around the proposed Vaalbank Light Industrial Development area is illustrated in Figure 5. According to this data, the development area includes agricultural smallholdings (DAFF, 2019). Directly east of the site boundaries, four areas with pivot irrigation is present while a large cluster of smallholdings are also present south of the project site. Further south as well as south-east of the project site, the field crop data indicate that there are blocks where rainfed annual crops or planted pasture is present.

9.3 Grazing capacity

Following the metadata layer obtained from DAFF, the grazing capacity of the entire area within which the Vaalbank Light Industrial Development area falls, has grazing capacity of 5 ha/LSU (Figure 6). When converting this figure to Small Stock Units (SSU), the area has grazing capacity of 1.25 ha/SSU.

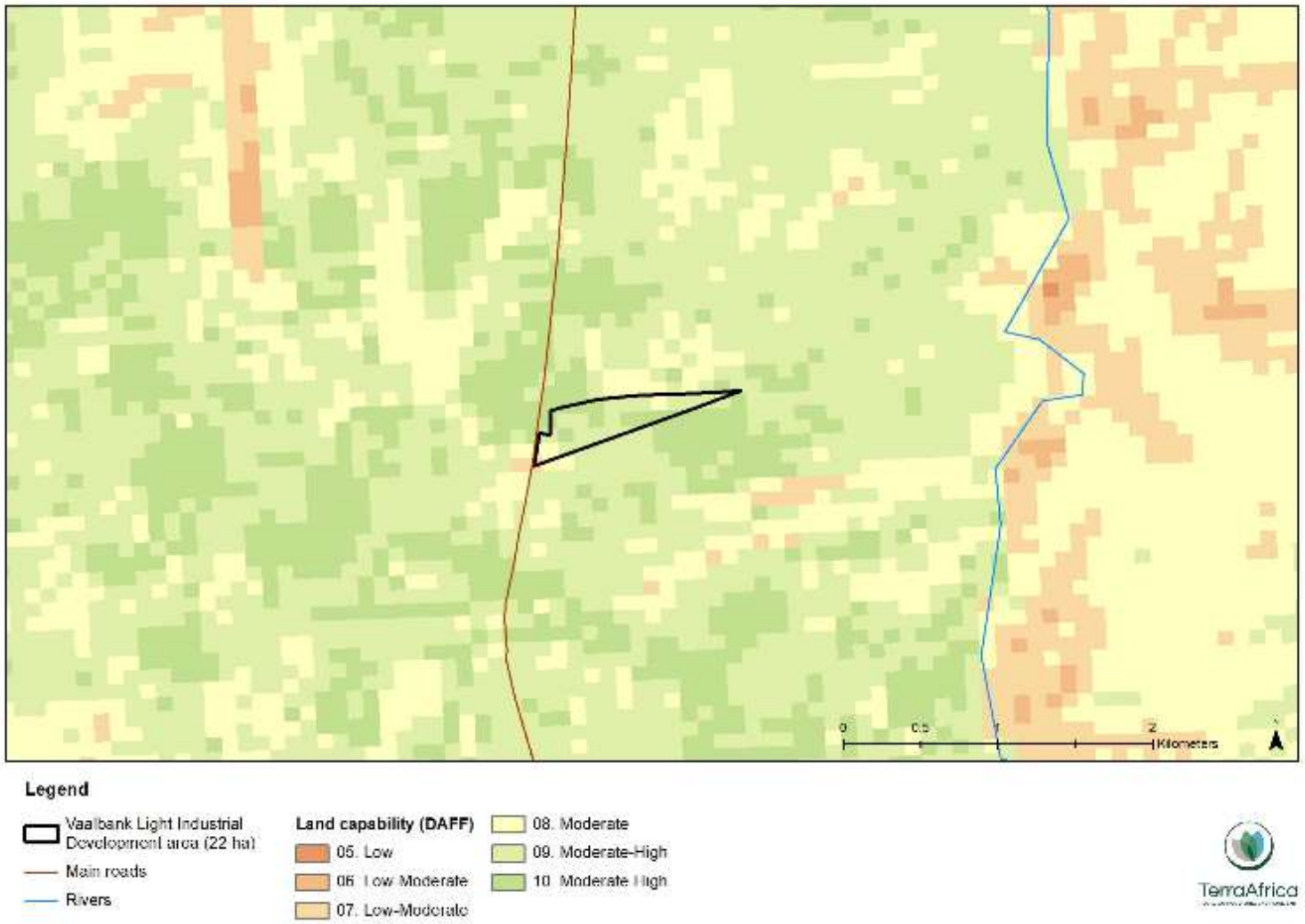

Figure 4 Land capability classification of the Vaalbank Light Industrial Development area and surrounding area (data source: DAFF, 2017)

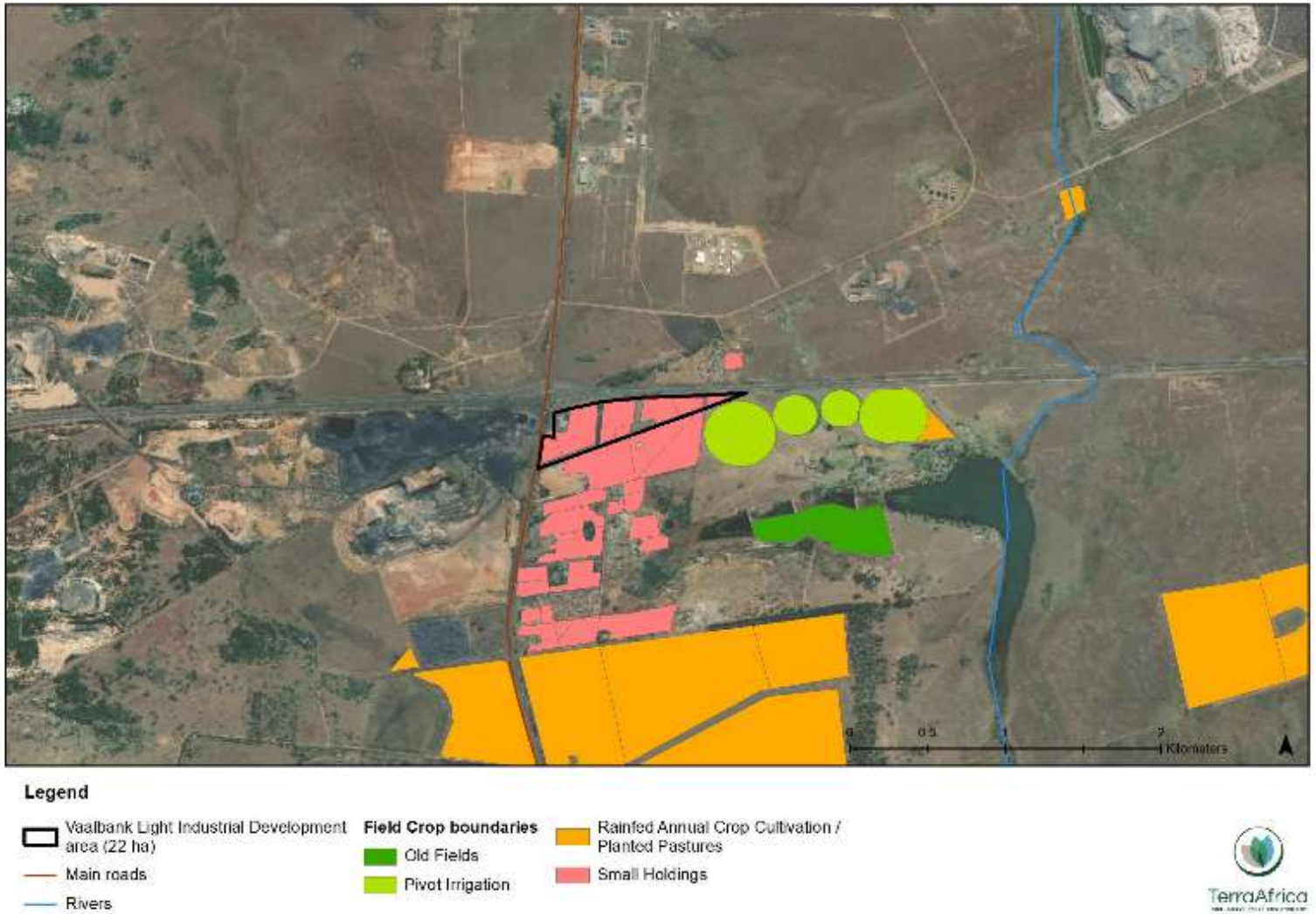

Figure 5 Location of field crop boundaries within and around proposed project area (data source: DAFF, 2019)

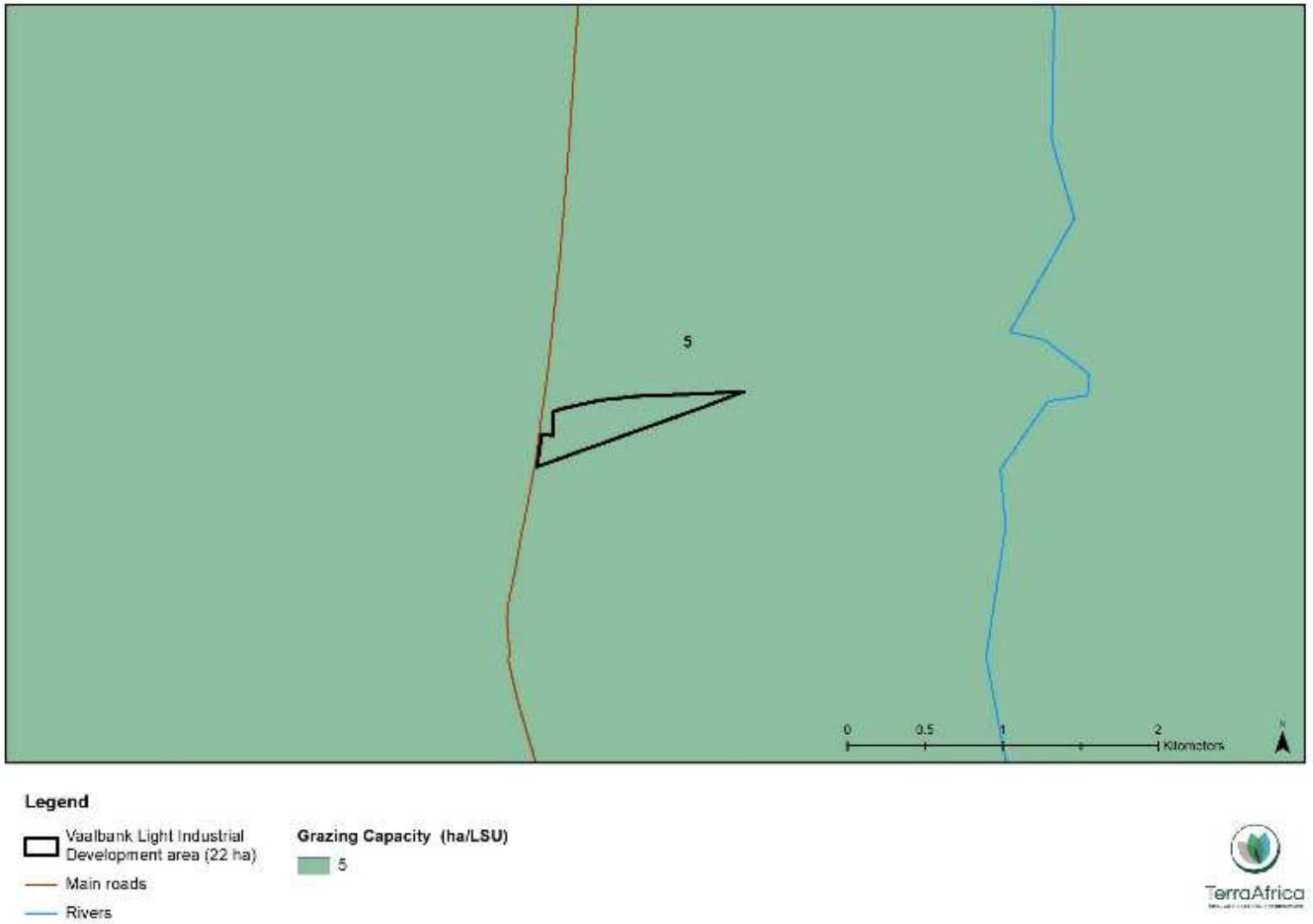

Figure 6 Grazing capacity of the proposed project area and the surrounding area

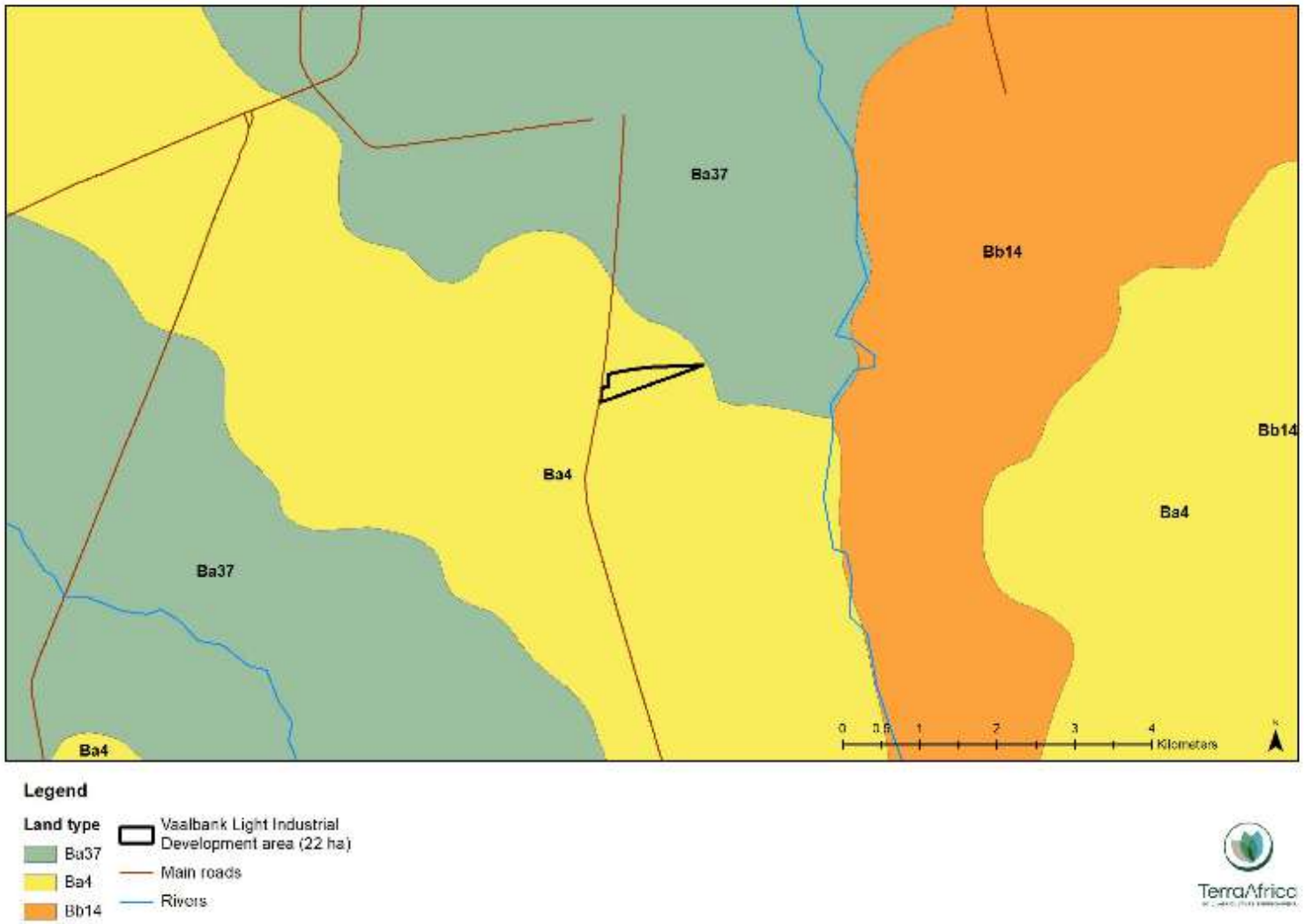

Figure 7 Land type classification of the proposed project area and the surrounding area.

9.4 Land types

The entire development area consists of only one land type i.e. Land Type Ba4 (Figure 7). According to the land type data sheet, Land Type Ba4 is underlain by shale and sandstone of the Ecca Group, Karoo Sequence. Following Figure 8, this land type also has four different terrain units with the higher lying flat plains of Terrain unit 1, dominating the landscape and consists of 35% deep Hutton soils, 10% Avalon soils and 10% Glencoe soils. Terrain unit 5 (indicating small depressions where water can accumulate in the landscape after rainfall events) is dominated by the Mispah form interspersed with approximately 10% of Hutton soil profiles. Terrain unit 3 is situated on slight slopes (2 – 3 %) consists of 50% deep Hutton soils, 15 % Avalon soils, 10 % Longlands soils and other soil forms. Terrain unit 4 (toe-slope positions) is dominated by Longlands, Avalon and Clovelly soil forms.

The project area slopes from the higher elevation in the west (1575 m.a.s.l.) to the lower elevation of 1560 m.a.s.l. in the east. The slope of the site is approximately 1.36% in the west-east direction. Following the terrain form sketch (**Figure 8**) and description of the terrain units above, the proposed site is situated on a crest (Terrain unit 1) that transitions into Terrain unit 3 in the far-eastern part of the site.

The complete data sheet for Land Type Ba4, is attached in Appendix 1.

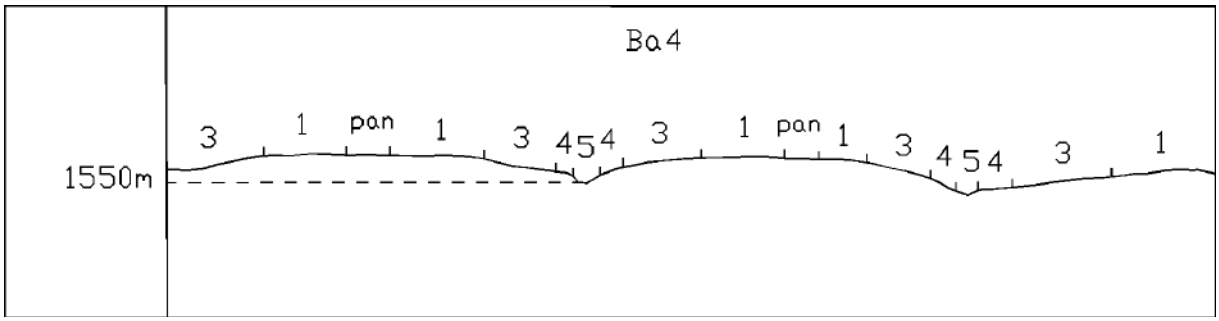

Figure 8: Terrain form sketch of Land Type Ba4

10. SITE ASSESSMENT RESULTS

10.1 Soil forms

Four different soil forms have been identified within the proposed development site. In two areas, two of these soil forms (Hutton and Anthrosol) have been grouped together. Five metre (5m) contours of the area were also overlaid on the soil classification map to indicate the direction of the slight slope (1.36%) of the site. Below follows a description of each of the soil map units of which the positions are indicated in Figure 12.

Anthrosol:

Two areas consisting of Anthrosols have been identified within the project site (Figure 12). The section on the western side of the site, is 5.46ha in extent and consist of an area where there are currently existing light industrial facilities. Anthrosols are soil where the original soil horizons have been disturbed by human activities but have not undergone intentional

transporation (Soil Classification Workin Group, 2018). Included in the definition for Anthrosols, are soils that have undergone significant compaction. It is anticipated that a number of impacts such as disturbance of the surface horizons and soil compaction, may have already occurred in this area. The second area where Anthrosols is present, is 0.47ha in extent and located in the middle of the site (Figure 9).

Figure 9 Photographic evidence of the 0.47ha of Anthrosol located in the middle of the proposed project site

Anthrosol/Hutton:

This soil group is present in two areas in the western section of the project site. The far western section is approximately 1.96 ha and the section directly east of the Anthrosol, is 2.61ha in extent (Figure **12**12). These two soil forms have been grouped together as the main characteristics of the original soil profile (red apedal Hutton soil, deeper than 1.5m) are still evident but the profiles are significantly compacted (as observed through augering the profiles) as a result of vehicles traversing and parking in the area.

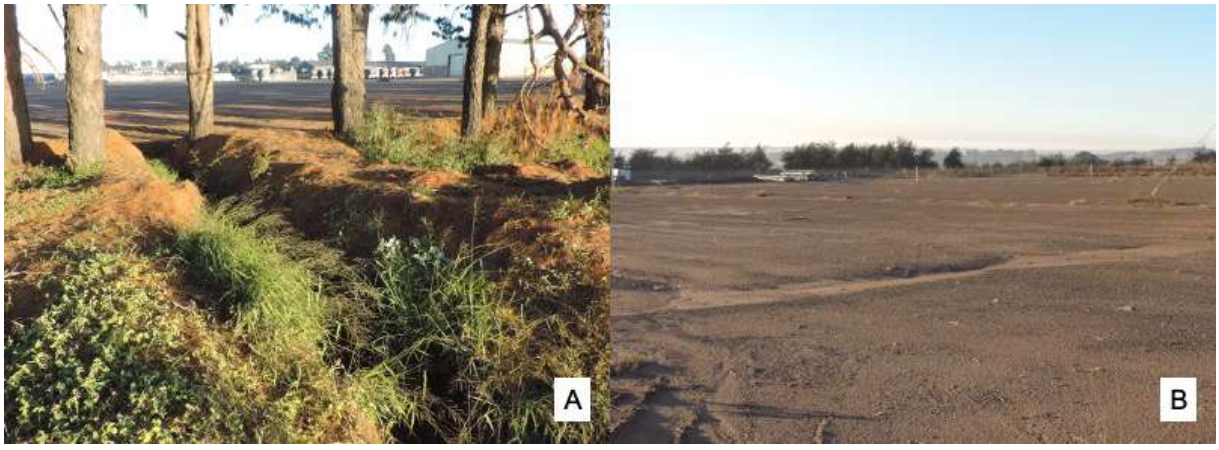

Figure 10 Areas where Hutton soil profiles have been affected by physical impacts such as trench digging (A) and compaction by vehicles traversing over the surface (B)

Other disturbances include a trench that was dug (Figure 10a). The topsoil horizon of these areas are also prone to soil particle removal through wind erosion as a result of the bare soil surfaces in these areas. The soil in this area may still have arable land capability, including rain-fed crop production but only after compaction has been alleviated with deep-ripping techniques.

Hutton:

The area where Hutton soils are present, occupies 3.66ha of the site (located between the Anthrosol/Hutton grouping to the west and the Pinedene soil in the east; Figure 12). Following the newly updated Soil Classification System for South Africa (Soil Classification Group, 2018), this soil form consist of orthic topsoil (0.35m thick) that covers a thick, red apedal horizon that reaches deeper than 1.5m. This soil form has high suitability for arable agriculture, including rain-fed crop production.

Pinedene:

The Pinedene soil form is present in one area of approximately 2.14ha in extent in the middle of the site between the Hutton form (to the west of it) and the Glencoe form (to the east of it) (Figure 12). The Pinedene soil profiles observed range in depth between 1.2 and 1.5m. The Pinedene form consist of chromic (yellow-brown) topsoil that overlies yellow-brown apedal subsoil. The subsoil is underlain by gleyic material at depths between 1.2 and 1.5m. The Pinedene soil form is highly suitable for both irrigated and rainfed crop production.

Glencoe:
The Glencoe form is present in the eastern section of the proposed Vaalbank Light Industrial project site (Figure 12). The Glencoe form consists of yellow-brown (chromic) structureless topsoil, overlying yellow-brown apedal subsoil that is limited in depth by a hard plinthic horizon. The total area of Glencoe soils is 5.84ha. Distinction was made between the deeper Glencoe profiles (between 1.0 and 1.4m deep) that is present directly east of the Pinedene soils and the shallower Glencoe soils where the underlying hard plinthite is found at depths between 0.4 and 0.6m.

The deeper soil profiles occupy an area of 3.55ha and the shallower profiles, an area of 2.29ha. Although Glencoe soils can indicate areas of temporary wetness, very few mottles (less than 10%) was observed in the 0.15m layer of yellow brown apedal soil directly above the hard plinthite. This indicates that the dominant flow path may be lateral down the slope but that the period of water stagnation is of such short duration, that it does not support wetland habitat. The area is therefore not considered to be a wetland zone. Both the deep and more shallow Glencoe profiles of the site are suitable for both irrigated and rainfed crop production.

10.2 Soil fertility

Samples 01 (topsoil) and 02 (subsoil) were collected from the Hutton profile at Survey point 10 and Samples 03 (topsoil) and 04 (subsoil) from the Glencoe profile at Survey point 20 (**Figure 3**). The laboratory analysis results for the four samples analysed, has been attached as Appendix 3.

The pH(KCl) values range from neutral (6.65) in the topsoil of Sample 01 to very strongly acidic (4.45) in the subsoil of Sample 02. The pH of Sample 03 is extremely acidic (4.23) while the subsoil (Sample 04), is very strongly acidic.

The plant-available phosphorus levels range between 4.1mg/kg (Sample 01) and 11.8 mg/kg (Sample 02). From the perspective of soil fertility for crop production, phosphorus will have to be supplemented as an essential plant nutrient. However, the levels are sufficient for the growth of veld grass.

The cation levels of the samples range from severely deficient for crop production in Samples 02 and 03 to slightly deficient in Samples 01 and 04. Sodium is not an essential plant nutrient but high concentrations may cause soil sodicity. However, this does not seem to be a risk on site as the total plant-available sodium levels are below 6mg/kg (ranging between 2.4mg/kg in Sample 04 and 5.6mg/kg in Sample 01).

The electrical conductivity (EC) of the samples were measured in milliSiemens per metre (mS/m) by the laboratory and was converted to deciSiemens per metre (dS/m) for interpretation of the values. The EC of Sample 01 is 0.06 dS/m, Sample 02 is 0.11 dS/m and both Samples 03 and 04 are 0.07 dS/m. According to Sparks (2003), EC limits below 2 dS/m indicate that soil salinity is absent and that plant roots will not be harmed by salt levels in the soil. The EC values of all four samples are well below this value and there are currently no risk of existing soil salinity on site.

10.3 Soil texture

The soil texture of the soil forms present within the proposed development area, was calculated by using the results of the particle size analysis for the soil texture triangle formulas as provided on the website of the United States Department of Agriculture's under Natural Resource Conservation Services (Soil) (www.nrcs.usda.gov). The soil texture triangle is illustrated in Figure 11. The results of the particle size analysis of the soil samples as well as the soil texture class into which results translate, are presented in Table 5 below.

Table 5 Soil texture (calculated from particle size analysis)

Sample no.	**Soil form**	**Soil horizon**	**Sand**	**Silt**	**Clay**	**Soil texture**
			(% smaller than 2mm)			
Sample 01	Hutton	Topsoil (Orthic)	84,8	3,3	11,9	Loamy Sand
Sample 02	Hutton	Subsoil (Red apedal)	91,8	1,0	7,2	Sand
Sample 03	Glencoe	Topsoil (Orthic)	89,6	1,3	9,1	Sand
Sample 04	Glencoe	Subsoil (Yellow-brown apedal)	89,8	1,0	9,2	Sand

Following the results in Table 5, the soil textures in the area are sand to loamy sand. In-field determination of soil texture during the survey, also indicated that these are the dominant texture classes. The sandy soil texture will be prone to compaction when earthworks of the proposed project are conducted during wet soil conditions (such as after a rainfall event).

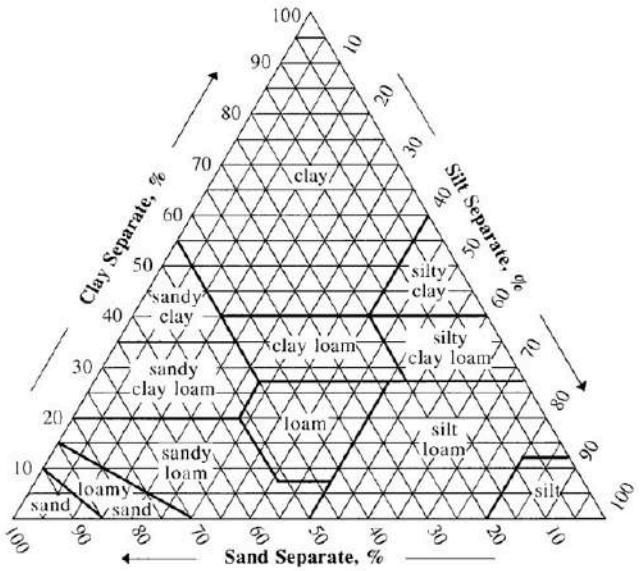

Figure 11 Soil texture triangle

10.4 Land capability classification

Using the soil classification data, the project site can be divided into four different land capability classes based on its suitability for rainfed crop production. The position of the different land capability classes as well as the proposed layout of the project infrastructure of light industrial development, are indicated in Figure 13. The area of 5.46ha that has already been changed into a light industrial area, is considered to no longer have food production capability and has therefore not been included in the classification.

Approximately 9.3ha of land has Moderate-High (Class 10) land capability and consist of the Hutton, Pinedene and deep Glencoe soils. According to the project infrastructure layout, this entire area will be used for the development of the infrastructure associated with the proposed project. The two areas in the western section (1.96 and 2.61ha respectively) of the proposed project site (where the Hutton/Anthrosol soil group is present) has Moderate (Class 8) land capability. Although it can still be used for rainfed crop production, the land capability has been reduced by the anthropogenic impacts such as soil compaction, that has already taken place in these areas.

The area of 0.47ha in the middle of the site where topsoil has been stripped (indicated as Anthrosol, Figure 12), has Low-Moderate (Class 06) land capability. The entire topsoil horizon has been removed by earth-moving equipment and has been stored in berms around this area. The area is now considered more suitable for grazing purposes (should the vegetation naturally re-established in these areas). An area of 2.29ha of Glencoe soils with soil depths ranging

between 0.4m and 0.6m in the most eastern section of the project site, has Moderate-High (Class 09) land capability. This area is considered suitable for rain-fed crop production.

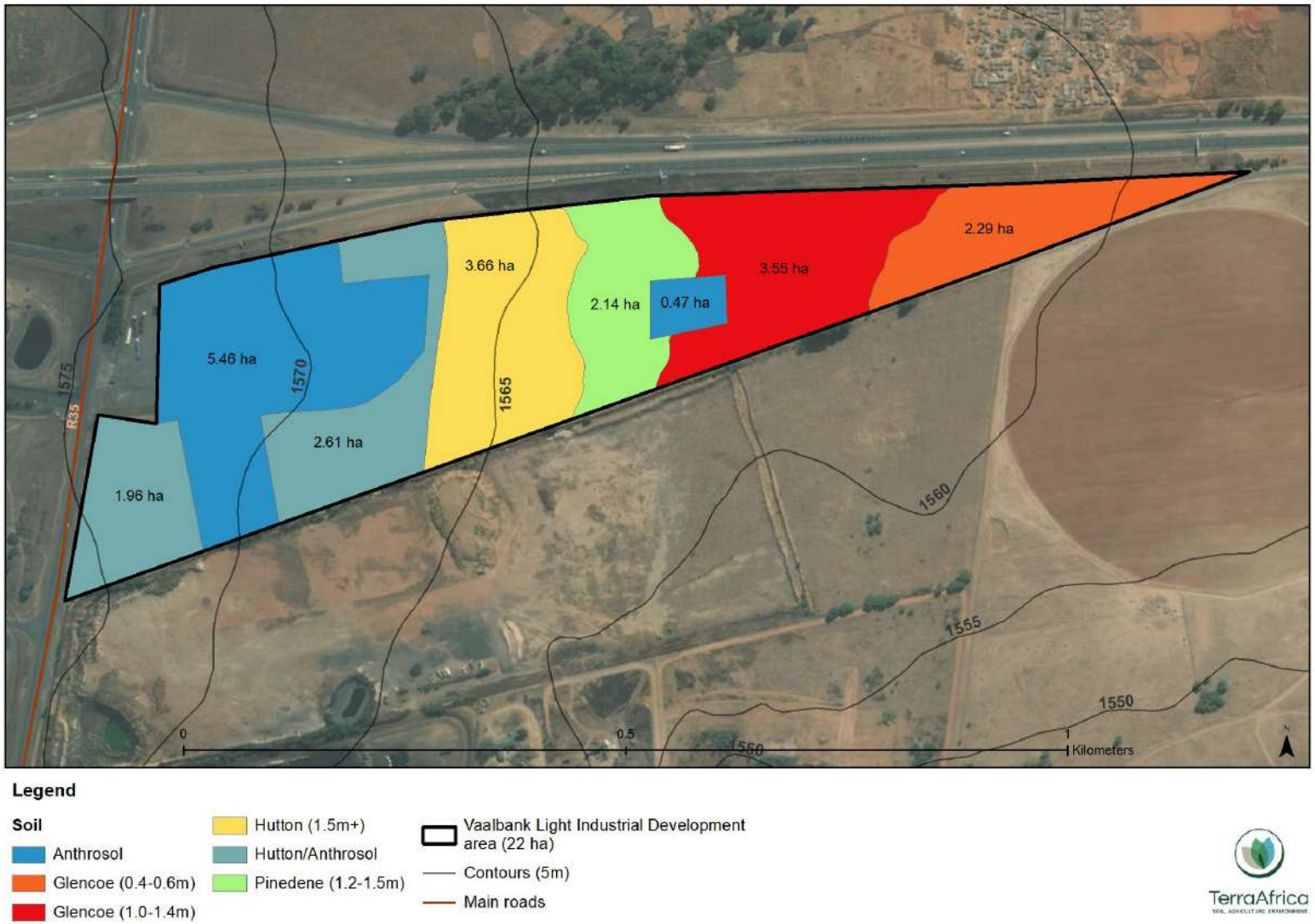

Figure 12 Soil classification map of the proposed Vaalbank Light Industrial project area

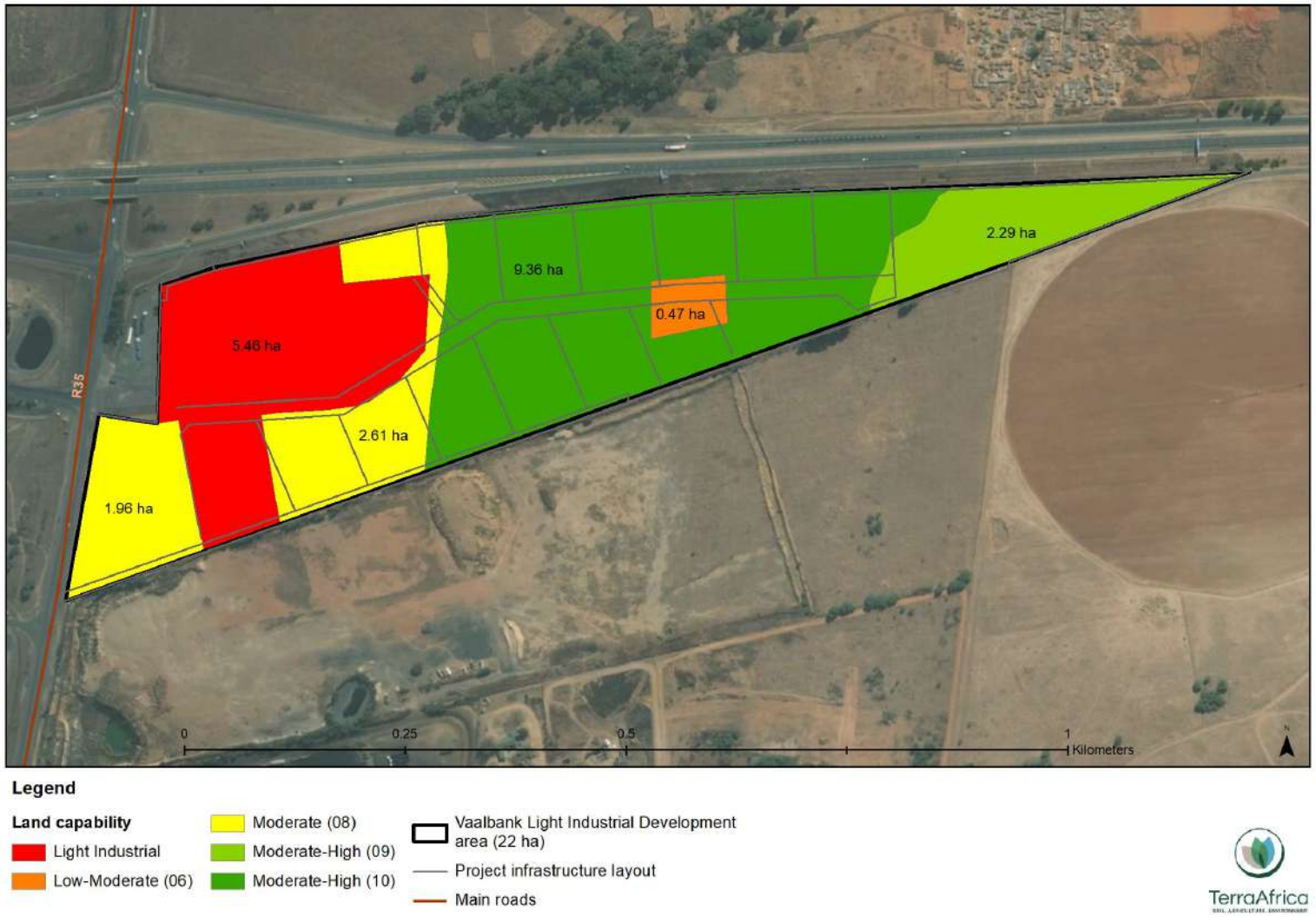

Figure 13 Land capability classification of the proposed Vaalbank Light Industrial Development area

Figure 14 Recent aerial imagery showing the land uses and surrounding land uses of the project site

10.5 Current land use and surrounding land use

For analysis of current land uses in the larger area around the site, Google Earth imagery was used. The imagery that indicates current land uses, are dated 13 October 2019 (Figure 14). The area south of the proposed project site, consists of an area that is now a rehabilitated colliery. Towards the east and directly south-east of the project site, four centre pivot irrigation fields are clustered together. The area west from the project site consist of an opencast coal mine while a small informal settlement is located north of the eastern tip of the project site.

During the site visit, evidence was found of a farmstead that was completely demolished and removed. The only trace left is a patch of Kikuyu grass (*Pennisetum clandestinum)* and a few fruit trees, indicative of an old garden (Figure 5). No ruins are left and it can be assumed that all agricultural activities have ceased on the farm portion.

Figure 15 Evidence of fruit trees in an area that was previously used as a garden

Other land uses in the area are the Black Wattle Colliery across the R35 public road from the development site and other light industrial businesses already established on part of the development area namely, a truck stop, kiosk, construction company and a diesel depot. Other light industrial activities south of the development site include Middelburg Yard, an auto-electrician workshop (Tj Auto Electrician), Harsco Metals Sand Plant Operations and Cool Ideas Truck Stop.

10.6 Current and historical agricultural activities

The analysis of historical aerial imagery on Google Earth indicate that the project site was historically used for crop cultivation. An image that dates from 22 October 2011, show that farm building(s) were present at the site (**Figure 16**).

Figure 16 Historical land use of the project site and surrounding area (dated 11 October 2011)

Figure 17 Land use of the project site and surrounding area in 2017 (dated 4 April 2017)

The land around the farm buildings show signs of previous soil tillage, most likely for crop production. The evidence can be seen in the old tillage lines in these blocks either run in a north-south direction or an northeast-southwest direction (indicated as light blue arrows in Figure 16). In this figure, three centre pivot irrigation areas are present east of the project site.

The area directly east of the project site, has seen the development of a new centre pivot irrigation area (Figure 17) that was not present in 2011 (Figure 16). This has likely increased the food production potential of the land.

Following the grazing capacities as depicted in **Error! Reference source not found.**6, the Vaalbank Light Industrial Development area is suitable for 4 head of cattle or 16 head of sheep or goats. During the site visit, no evidence of existing livestock farming and cattle herding activities were identified on site. This is likely because of the location of the land portion which is completely surrounded by public roads, namely the N4 national road, the R35 provincial road as well as the public road to Pienaarsdam Leisure Resort.

10.7 Agricultural income and employment

Table 1 of GN 320 (Section 2.5) requires an assessment of change in productivity of agricultural activities based on income in the past five years, change in employment figures for the past five years and alternative development footprints within the preferred site which would have medium or low sensitivity for agricultural resources.

Conclusions following the assessment of the proposed Vaalbank Light Industrial Development project, are as follows:

- No evidence of recent irrigated or rain-fed crop production was found on site.
- There is no evidence of livestock farming on the site which would only be possible if there were fences along the very busy roads.
- The grazing capacity of 5ha/LSU would allow for 4 head of cattle or 16 head of sheep on the entire site which is not enough for an employment opportunity.
- It is anticipated that job opportunities will be created during the construction and operational phases of the development. However, no figures are currently available on the employment opportunities that will be created by this project.
- No projection of the anticipated income that will be generated by the proposed project, was provided for consideration.

No layout alternatives were provided for the proposed infrastructure that will be constructed as part of the Light Industrial Development on Portion 58 of the Farm Vaalbank 289 JS. The current layout of this infrastructure is aimed at optimal use of the space available and will stay within the project site boundaries provided.

10.8 Verified site sensitivity

The proposed project site includes soil forms with high suitability for both rain-fed and irrigated crop production (Hutton, Pinedene and Glencoe forms). These soil forms have Moderate-High (Classes 9 and 10) land capability. Areas where deep Hutton soil profiles have already been impacted by the existing activities around the Light Industrial Area, have Moderate (Class 8)

land capability. These areas (a total of 16.22 ha), have High Sensitivity to the proposed development. The remaining areas (5.78 ha) have already been affected by the existing light industrial activities as well as topsoil stripping and is considered to have Low sensitivity to the proposed development.

However, analysis of historical aerial imagery (Figure 16 and Figure 17) shows that the area has not been used actively for crop farming the past nine years although the direction of previous tillage lines are visible in aerial imagery of 2011 (Figure 16). According to the Ecological Assessment for the proposed development on Portion 58 of the Farm Vaalbank 289 JS (March 2020), the vegetation present on site indicates crop fields that have been fallow for more than 20 years. It is therefore concluded that the area has not been used for crop production for a period of between 9 and 20 years.

The consideration of the site's land capabilities in combination with the absence of active production over the last five years, result in the site having an overall Medium Sensitivity to the proposed development of infrastructure that will support light industrial businesses.

11. IMPACT ASSESSMENT

11.1 Project description

A light industrial area is proposed to be developed by Bakkos Projects (Pty) Ltd on Portion 58 of the farm Vaalbank 289 JS. The project will include the following:

- Rezoning the property from Agriculture to Light Industrial.
- Make provision for the construction of motor showrooms, workshops, earthmoving equipment, etc.

There are already light industrial businesses on site namely a truck stop, kiosk (WowChow), a construction company (Cornwill Construction) and a diesel depot (Bulk Diesel). After rezoning, the intention is to expand the light industrial activities by developing an Industrial Park. The property is approximately 22 ha in extent but since industrial businesses are already present on site, the footprint of the development will be less than 20ha.

11.2 Construction phase impacts

11.2.1 Loss of current land capability

Once construction commences and soil is stripped, the current land capability of all areas where the surface infrastructure will be constructed, will be lost. The areas that will be directly impacted include: 9.36ha of land with Moderate-High (Class 10) land capability, 2.61ha of land with Moderate (Class 8) land capability and 0.47ha of land with Low-Moderate (Class 6) land capability. Less than 1ha of land with Moderate-High (Class 9) land capability will be impacted upon.

The impact will remain the same throughout the operational phase and it is not expected that the infrastructure will be decommissioned.

	Without mitigation	With mitigation / enhancement
Status	Negative (-)	Negative (-)
Severity	4	3
Spatial Scale	2	2
Duration	5	5
Frequency of activity	5	5
Frequency of impact	5	5
Impact rating	High (110) -	High (100) -
Mitigation: • The mitigation measures are limited as the project infrastructure is considered to become a permanent feature of the landscape. • The project infrastructure footprint should be kept to the project layout as provided by the client.		

11.2.2 Loss of agricultural production and agricultural-related employment

Although the field crops boundaries data indicates that the project area consists of several smallholdings, no evidence was found of any livestock farming activities. Also, no crops are produced on site and historical imagery indicates that there has been no active crop production for at least the past 9 years. It is expected that the impact on agricultural production and agricultural-related employment will remain the same during the operational phase and there will be no decommissioning.

	Without mitigation	With mitigation / enhancement
Status	Negative (-)	Negative (-)
Severity	2	2
Spatial Scale	2	2
Duration	5	5
Frequency of activity	4	4
Frequency of impact	1	1
Impact rating	Low (45) -	Low (45) -
Mitigation: • The on-site mitigation measures are limited as the project infrastructure is considered to become a permanent feature of the landscape. • The project infrastructure footprint should be kept within the site boundaries as provided by the client.		

11.2.3 Disturbance of soil horizon organisation

Prior to construction, the available topsoil (a combination of all soil horizons above the underlying material such the hard plinthic subsoil-horizon of the Glencoe form) will be removed and stored elsewhere. Once the soil is stripped and transported from its original position, it becomes a new matrix with different physical and biological properties as a result of mixing of the soil horizons and storing it in stockpiles.

	Without mitigation	With mitigation / enhancement
Status	Negative (-)	Negative (-)
Severity	4	4
Spatial Scale	2	2
Duration	5	5
Frequency of activity	5	5
Frequency of impact	5	5
Impact rating	High (110) -	High (110) -
Mitigation:		

- The mitigation measures are limited as the topsoil will necessarily be removed for the purpose of infrastructure construction.
- The project infrastructure footprint should be kept within the site boundaries as provided by the client.
- Any topsoil stockpiles must be protected against wind and water erosion until vegetation has established on the exposed topsoil surfaces.
- Dust can be suppressed by either using clean water or water containing dust suppressants during the construction phase.
- If it is observed that topsoil stockpile surfaces remain bare, natural vegetation must be established on the topsoil stockpiles.
- Topsoil must be used in the rehabilitation of open areas after construction and/or for gardens on-site.

11.2.4 Soil contamination with hydrocarbons and solid waste

The following construction activities can result in the pollution of soil with hydrocarbons and/or solid waste:

- Petroleum hydrocarbon (present in oil and diesel) spills by machinery and vehicles during earthworks and the mechanical removal of vegetation during site clearing.
- Spills from vehicles transporting workers, equipment and construction material to and from the construction site.
- The generation of domestic waste by construction and operational workers.
- Spills from fuel storage tanks during construction.
- Polluted water from wash bays and workshops during the construction phase.
- Accidental spills of other hazardous chemicals used and stored on site.
- Pollution from concrete mixing.

	Without mitigation	With mitigation / enhancement
Status	Negative (-)	Negative (-)
Severity	3	2
Spatial Scale	1	1
Duration	4	2
Frequency of activity	4	4
Frequency of impact	5	3
Impact rating	Medium-low (72) -	Low (35) -
Mitigation:		

- High level maintenance must be undertaken on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills;
- Impermeable and bunded surfaces must be used for storage tanks and to park vehicles on;
- Site surface water and wash water must be contained and treated before reuse or discharge from site;
- Spills of fuel and lubricants from vehicles and equipment must be contained using a drip tray with plastic sheeting filled with adsorbent material;
- Spill kits should be available on site and should be serviced regularly;
- Waste disposal at the construction site and during operation must be avoided by separating, trucking out and recycling of waste;
- Potentially contaminating fluids and other wastes must be contained in containers stored on hard surface levels in bunded locations; and
- Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately by trained staff with the correct equipment and protocols.

11.2.4 Soil erosion

Once earthworks commence at the proposed project site, vegetation will be removed from the surface and expose the soil surfaces underneath to soil erosion that can be caused by both wind and water movement. Soil erosion will result in removal of soil particles from site to the areas where it is deposited as dust particles or as sediment in lower landscape positions.

	Without mitigation	**With mitigation / enhancement**
Status	Negative (-)	Negative (-)
Severity	3	2
Spatial Scale	1	1
Duration	4	2
Frequency of activity	4	4
Frequency of impact	5	3
Impact rating	Medium-low (72) -	Low (35) -

Mitigation:

- Only remove vegetation prior to construction in an area.
- Avoid stripping vegetation and stockpiling of topsoil during periods of heavy rain or periods with excessive wind (such as the month of August).
- Construct a storm water system as part of the Stormwater Management Plan of the site.
- Park vehicles and equipment in designated parking areas to prevent vegetation disturbance of additional areas.
- Monitor the area to determine whether there is any erosion and rehabilitated eroded areas direclyt after detection.

11.2.4 Soil compaction and surface sealing

Where permanent buildings and surface roads will be constructed, soil will become permanently sealed-off from rainwater infiltration. Soil will also be compacted as part of civil engineering procedures to ensure the stability of the infrastructure. Soil compaction affects the soil porosity, thereby decreasing the water infiltration rate of

soil. Compacted soil surfaces and sealed off areas increase stormwater runoff rates and can cause soil erosion in areas outside the site boundary.

	Without mitigation	With mitigation / management
Status	Negative (-)	Negative (-)
Severity	4	4
Spatial Scale	2	2
Duration	5	5
Frequency of activity	5	5
Frequency of impact	5	5
Impact rating	High (110) -	High (110) -
Mitigation: • Restrict traffic and vehicle movement to access roads and within the site boundaries. • Demarcate parking areas and monitor that vehicles and equipment are not parked outside of these areas in nearby fields during the construction phase.		

11.3 Operational phase impacts

During the operational phase, the impacts on land capability and physical soil properties within the site boundary, will remain unchanged. However, emissions and run-off from the light industrial site can result in soil contamination outside of the site.

11.3.1 Soil pollution of soil outside the site boundaries, including agricultural fields

Emissions containing trace element particles as well as organic (carbon-containing) contaminants, will settle on surfaces outside of the site. Stormwater run-off can also contain pollutants such as petroleum hydrocarbons that spilled on sealed surfaces inside of the site. Both dust and stormwater run-off can result in elevated levels of soil contaminants in nearby soil, including the agricultural crop-fields.

	Without mitigation	With mitigation / enhancement
Status	Negative (-)	Negative (-)
Severity	3	1
Spatial Scale	2	1
Duration	4	2
Frequency of activity	4	3
Frequency of impact	4	3
Impact rating	Medium-low (72) -	Low (30) -
Mitigation: • High level maintenance must be undertaken on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills; • Impermeable and bunded surfaces must be used for storage tanks and to park vehicles on; • Site surface water and wash water must be contained and treated before reuse or discharge from site; • Spills of fuel and lubricants from vehicles and equipment must be contained using a drip tray with plastic sheeting filled with adsorbent material;		

- Potentially contaminating fluids and other wastes must be contained in containers stored on hard surface levels in bunded locations; and
- Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately by trained staff with the correct equipment and protocols.
- In dry months, dust suppression of unsurfaced areas within the site, will reduce dust fallout in adjacent crop fields.

11.4 Decommissioning and closure phase

It is expected that the infrastructure will remain on site and there will be no decommissioning and closure phases.

12. ACCEPTABILITY STATEMENT

The proposed Light Industrial Park project area is located on natural soil forms (Hutton, Glencoe and Pinedene forms) as well as soils already affected by human activities (Anthrosols). The grazing capacity of the entire area is 5 (ha/LSU) and the site therefore has grazing available for 4 head of cattle. However, no evidence of current cattle (or other livestock) has been observed on site.

An area that was probably an old crop field that was left fallow for many years is covered by common grass species that is typical of secondary grassland. There is also an area that is covered by *Pennisetum clandestinum* (Kikuyu grass) that originate from an old garden. The property is currently not fenced off.

The site is already partially developed with large cleared areas. According to the vegetation specialist, Kyllinga Consulting (March, 2020), the type of secondary grassland that occur on the old crop field, is indicative of land that has been left fallow likely for more than 20 years. The proposed Light Industrial Park project is next to the N4 national road, and across the R35 from the Black Wattle Colliery in the west. Across the road to the south is a recently rehabilitated colliery.

No agricultural production figures for the past 5 years are available but from the observations made during the site visit, the following conclusions were reached:

- No crop production took place on the site in the past five years.
- There is no evidence of livestock farming on the site.
- The grazing capacity of the entire site would allow for 4 head of cattle or 16 head of sheep which is not enough for an employment opportunity.
- It is anticipated that job opportunities will be created during the construction and operational phases of the development. No figures were received from the applicant but can be added to the report as soon as it become available.

The Light Industrial Park is considered a viable land use option for an area where it is evident that all agricultural activities ceased for many years and located in close proximity to other businesses (2.5 km south of Middelburg Mall). It is my professional opinion that this application be considered favourably, permitting that the soil management measures are followed to prevent soil erosion and pollution. The project infrastructure should also remain within the development area boundaries indicated in the project layout.

13. REFERENCE LIST

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South Africa (Republic) 2018. *Long-term grazing capacity for South Africa*: Data layer. Government Gazette Vol. 638, No. 41870. 31 August 2018. Regulation 10 of the Conservation of Agricultural Resources Act (CARA): Act 43 of 1983. Pretoria. Government Printing Works.

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The Soil Classification Working Group (2018). *Soil Classification – Taxonomic System for South Africa.* Dept. of Agric., Pretoria.

Appendix 1 – Data sheet of Land Type Ba4

LAND TYPE / *LANDTIPE* : **Ba4**

CLIMATE ZONE / *KLIMAATSONE* : 24S

Area / *Oppervlakte* : 93300 ha

Estimated area unavailable for agriculture

Beraamde oppervlakte onbeskikbaar vir landbou : 1500 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte :*

2528 Pretoria (45840 ha) 2628 East Rand (47460 ha)

Inventory by / *Inventaris deur :*

J L Schoeman

Modal Profiles / *Modale profiele :*

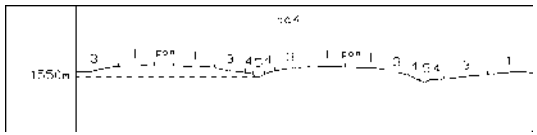
None / Geen

Terrain unit / *Terreineenheid*	1	3	4	5
% of land type / *% van landtipe*	45	40	10	5
Area / *Oppervlakte (ha)*	41985	37320	9330	4665
Slope / *Helling (%)*	0 - 2	1 - 3	1 - 2	0 - 1
Slope length / *Hellingslengte (m)*	1000 - 3000	1000 - 3000	200 - 500	5 - 150
Slope shape / *Hellingsvorm*	Y	Y	X-Z	X-Z
MB0, MB1 (ha)	31489	37320	9330	4665
MB2 - MB4 (ha)	10496	0	0	0

Soil series or land classes / ***Grondseries of landklasse***	**Depth** / ***Diepte***									**Total** / ***Totaal***		**Clay content %** / ***Klei-inhoud %***				**Texture** / ***Tekstuur***	**Depth limiting material** / ***Diepte-beperkende materiaal***
	(mm)	**MB**	**ha**	**%**	**ha**	**%**	**ha**	**%**	**ha**	**%**	**ha**	**%**	**A**	**E**	**B21**	**Hor**	**Class / *Klas***	
Hutton Hu16	900-1200+	0	12596	30	13062	35					25658	27.5	15-20		15-25	B	fi/meSaLm-SaClLm	so,lc,hp
Ruston Av16, Kanhym Av14	800-1200+	0	4198	10	5598	15	2799	30			12596	13.5	8-20		12-25	B	LmmeSa-SaClLm	sp
Longlands Lo21	700-1000	0			3732	10	3732	40	1400	30	8864	9.5	8-15	8-15	25-35	A	meSa-SaLm	sp
Middelburg Hu14, Kyalami Hu15	900-1200+	0	2099	5	5598	15					7697	8.3	8-15		8-15	B	me/coSa-SaLm	so,lc
Wasbank Wa21	500-700	0	4198	10	1866	5	466	5			6531	7.0	8-15	8-15		A	meSa-SaLm	hp
Appam Gc16, Weltevrede Gc14	600-900	0	4198	10	1866	5					6064	6.5	8-20		8-20	B	meSa-SaLm	hp
Oatsdale Cv16, Mossdale Cv14	700-1200+	0	2099	5	1866	5	1866	20			5831	6.3	8-20		8-20	B	meSa-SaLm	so,lc
Cartref Cf21, Kusasa Cf31	300-600	0	2099	5	1866	5	466	5	466	10	4898	5.3	8-15	6-15		A	me/coSa-SaLm	lc
Klipfontein Ms11	250-400	3	2099	5							2099	2.3	8-15			A	meSa-SaLm	hp
Katspruit Ka10, Killarney Ka20	300-500	0							1866	40	1866	2.0	20-25		25-30	A	fi/meSaClLm	gc
Rosehill Sw30, Swartland Sw31	250-400	0			1866	5					1866	2.0	20-25		30-35	A	fi/meSaClLm	vp
Rensburg Rg20, Willowbrook Wo11	400-500	0							933	20	933	1.0	40-60			A	SaCl-Cl	gc
Pans/Panne		4	8397	20							8397	9.0						

Terrain type / *Terreintipe :* A3

Terrain form sketch / *Terreinvormskets*



For an explanation of this table consult LAND TYPE INVENTORY (table of contents)

Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Geology: Shale and sandstone of the Ecca Group, Karoo Sequence.

Geologie: Skalie en sandsteen van die Groep Ecca, Opeenvolging Karoo.

Appendix 2 – Soil survey data

Survey point	Coordinates		Soil form	Texture		Soil depth (m)	Soil structure	Presence of carbonates
	Longitude	Latitude		Topsoil	Subsoil			
1	29,46195331	-25,83521104	Hutton/Anthrosol	Loamy sand	Sand	>1.5	Apedal	None
2	29,46253838	-25,83482716	Hutton/Anthrosol	Loamy sand	Sand	>1.5	Apedal	None
3	29,463092	-25,835084	Hutton/Anthrosol	Loamy sand	Sand	>1.5	Apedal	None
4	29,463189	-25,834205	Hutton/Anthrosol	Sand	Sand	>1.5	Apedal	None
5	29,463121	-25,83322	Hutton/Anthrosol	Sand	Sand	>1.5	Apedal	None
6	29,46259238	-25,83316032	Hutton/Anthrosol	Sand	Sand	>1.5	Apedal	None
7	29,463144	-25,83279	Hutton/Anthrosol	Sand	Sand	>1.5	Apedal	None
8	29,46007424	-25,83530364	Hutton/Anthrosol	Sand	Sand	>1.5	Apedal	None
9	29,46021602	-25,83582056	Hutton/Anthrosol	Sand	Sand	>1.5	Apedal	None
10	29,463585	-25,83482	Hutton	Loamy sand	Sand	>1.5	Apedal	None
11	29,4639907	-25,8338773	Hutton	Sand	Sand	>1.5	Apedal	None
12	29,46417018	-25,83309178	Hutton	Sand	Sand	>1.5	Apedal	None
13	29,46458	-25,833706	Pinedene	Loamy sand	Loamy sand	1.5	Apedal	None
14	29,46450645	-25,83432126	Hutton	Loamy sand	Sand	1.5	Apedal	None
15	29,465045	-25,834071	Pinedene	Sand	Sand	1.5	Apedal	None
16	29,465397	-25,833892	Anthrosol	N/A	Loamy sand	1.4	Apedal	None
17	29,4651164	-25,83311542	Pinedene	Loamy sand	Sand	1.4	Apedal	None
18	29,46554974	-25,83276587	Pinedene	Loamy sand	Loamy sand	1.2	Apedal	None
19	29,466166	-25,833242	Anthrosol	N/A	Loamy sand	1.3	Apedal	None
20	29,466184	-25,833743	Glencoe	Sand	Sand	1.4	Apedal	None
21	29,466566	-25,834038	Glencoe	Sand	Sand	1.4	Apedal	None
22	29,46654278	-25,83274792	Glencoe	Sand	Sand	1.3	Apedal	None
23	29,4669573	-25,83326712	Glencoe	Sand	Sand	1.2	Apedal	None
24	29,46769757	-25,83268753	Glencoe	Sand	Sand	1.0	Apedal	None
25	29,467887	-25,833296	Glencoe	Sand	Sand	0.6	Apedal	None
26	29,46879312	-25,8331253	Glencoe	Sand	Sand	0.6	Apedal	None
27	29,46907468	-25,8324483	Glencoe	Sand	Sand	0.4	Apedal	None
28	29,470082	-25,832582	Glencoe	Sand	Sand	0.4	Apedal	None
29	29,47073931	-25,83239933	Glencoe	Sand	Sand	0.4	Apedal	None

Appendix 3 – Sample analysis results

NOORDWES UNIVERSITEIT
ECO-ANALYTICA

Eco Analytica
Posbus 19140
NOORDBRUG 2522
Tel: 018-285 2732/3/4

TERRA AFRICA (PTN 58 VAALBANK)

22-6-2020 **Nutritional Status**

Sample no.	Ca	Mg	K	Na	P	pH(KCl)	EC
	(mg/kg)						(mS/m)
1	153,6	68,2	8,8	5,6	4,1	6,65	6
2	73,2	16,6	13,5	5,1	11,8	4,45	11
3	29,8	0,1	5,8	4,5	5,1	4,23	7
4	216,6	33,7	14,7	2,4	6,5	4,94	7

Exchangeable Cations

Sample no.	Ca	Mg	K	Na	S-value
	(cmol(+)/kg)				
1	0,77	0,56	0,02	0,02	1,37
2	0,37	0,14	0,03	0,02	0,56
3	0,15	0,00	0,01	0,02	0,18
4	1,08	0,28	0,04	0,01	1,41

Cation ratios

Sample	Ca:Mg	Mg:K	Ca+Mg:K	K%	Ca%	Mg%	Na%
1	1,37	24,91	58,93	1,64	55,76	40,84	1,76
2	2,68	3,94	14,51	6,19	65,43	24,41	3,97
3	328,06	0,03	10,00	8,12	80,94	0,25	10,70
4	3,90	7,37	36,13	2,67	76,88	19,70	0,75

"HANDBOOK OF STANDARD SOIL TESTING METHODS FOR ADVISORY PURPOSES"

UITRUILBARE KATIONE:	1 M NH_4-asetaat pH=7	FOSFAAT:	Bray 1 - Ekstrak
KUK:	1 M NH_4-asetaat pH=7	pH H_2O/KCl:	1:2,5 - Ekstrak
		EG:	Versadigde Ekstrak

22/6/2020 **Particle Size Distribution**

Sample no.	> 2mm (%)	Sand	Silt	Clay
		(% < 2mm)		
1	0,4	84,8	3,3	11,9
2	6,0	91,8	1,0	7,2
3	23,7	89,6	1,3	9,1
4	0,2	89,8	1,0	9,2

Ten einde betroubaarheid van analises te verseker, neem Eco-Analytica deel aan die volgende instansies se kontroleskemas:
International Soil-Analytical Exchange (ISE), Wageningen, Nederland
Geen verantwoordelikheid word egter deur Noordwes Universiteit aanvaar vir enige
verliese wat uit die gebruik van hierdie data mag spruit nie

Appendix 4 – Curriculum vitae of specialist

MARINÉ PIENAAR

Specialist Scientist

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Wolmaransstad,
South Africa

EXPERTISE

Soil Quality Assessment

Soil Policy and Guidelines

Agricultural Agro-Ecosystem Assessment

Sustainable Agriculture

Data Consolidation

Land Use Planning

Soil Pollution

Hydropedology

EDUCATION

MASTER'S DEGREE
Environmental Science
University of Witwatersrand
2010 – 2018

BACHELOR'S DEGREE
Agricultural Science
University of Pretoria
2001 – 2004

PROFESSIONAL PROFILE

I contribute specialist knowledge on agriculture and soil management to ensure long-term sustainability of projects in Africa. For the past thirteen years, it has been my calling and I have consulted on more than 200 projects. My clients include environmental and engineering companies, mining houses, and project developers. I enjoy the multi-disciplinary nature of the projects that I work on and I am fascinated by the evolving nature of my field of practice. The next section provide examples of the range of projects completed. A comprehensive project list is available on request.

PROJECT EXPERIENCE

Global Assessment on Soil Pollution

Food and Agricultural Organisation (FAO) of the United Nations (UN)

Author of the regional assessment of Soil in Sub-Saharan Africa. The report is due for release in February 2021. The different sections included:

- Analysis of soil and soil-related policies and guidelines for each of the 48 regional countries
- Description of the major sources of soil pollution in the region
- The extent of soil pollution in the region and as well as the nature and extent of soil monitoring
- Case study discussions of the impacts of soil pollution on human and environmental health in the region
- Recommendations and guidelines for policy development and capacitation to address soil pollution in Sub-Saharan Africa

Data Consolidation and Amendment

Range of projects: Mining Projects, Renewal Energy

These projects included developments where previous agricultural and soil studies are available that are not aligned with the current legal and international best practice requirements such as the IFC Principles. Other projects are expansion projects or changes in the project infrastructure layout. Tasks on such projects include the incorporation of all relevant data, site verification, updated baseline reporting and alignment of management and monitoring measures.

Project examples:

- Northam Platinum's Booysendal Mine, South Africa
- Musonoi Mine, Kolwezi District, Democratic Republic of Congo
- Polihali Reservoir and Associated Infrastructure, Lesotho
- Kaiha 2 Hydropower Project, Liberia
- Aquarius Platinum's Kroondal and Marikana Mines

MARINÉ PIENAAR

Specialist Scientist

PROFESSIONAL MEMBERSHIP

South African Council for Natural Scientific Professions (SACNASP)

Soil Science Society of South Africa (SSSSA)

Soil Science Society of America (SSSA)

Network for Industrially Contaminated Land in Africa (NICOLA)

LANGUAGES

English (Fluent)

Afrikaans (Native)

French (Basic)

PRESENTATIONS

There is spinach in my fish pond
TEDx Talk
Available on YouTube

♦

Soil and the Extractive Industries
Session organiser and presenter
Global Soil Week, Berlin (2015)

♦

How to dismantle an atomic bomb
Conference presentation (2014)
Environmental Law Association (SA)

PROJECT EXPERIENCE (Continued)

Agricultural Agro-Ecosystem Assessments

Range of projects: Renewable Energy, Industrial and Residential Developments, Mining, Linear Developments (railways and power lines)

The assessments were conducted as part of the Environmental and Social Impact Assessment processes. The assessment process includes the assessment of soil physical and chemical properties as well as other natural resources that contributes to the land capability of the area.

Project examples:

- Mocuba Solar PV Development, Mozambique
- Italthai Railway between Tete and Quelimane, Mozambique
- Lichtenburg PV Solar Developments, South Africa
- Manica Gold Mine Project, Mozambique
- Khunab Solar PV Developments near Upington, South Africa
- Bomi Hills and Mano River Mines, Liberia
- King City near Sekondi-Takoradi and Appolonia City near Accra, Ghana
- Limpopo-Lipadi Game Reserve, Botswana
- Namoya Gold Mine, Democratic Republic of Congo

Sustainable Agriculture

Range of projects: Policy Development for Financial Institutions, Mine Closure Planning, Agricultural Project and Business Development Planning

Each of the projects completed had a unique scope of works and the methodology was designed to answer the questions. While global indicators of sustainable agriculture are considered, the unique challenges to viable food production in Africa, especially climate change and a lack of infrastructure, in these analyses.

Project examples:

- Measurement of sustainability of agricultural practices of South African farmers – survey design and pilot testing for the LandBank of South Africa
- Analysis of the viability of avocado and mango large-scale farming developments in Angola for McKinsey & Company
- Closure options analysis for the Tshipi Borwa Mine to increase agricultural productivity in the area, consultation to SLR Consulting
- Analysis of risks and opportunities for farm feeds and supplement suppliers of the Southern African livestock and dairy farming industries
- Sustainable agricultural options development for mine closure planning of the Camutue Diamond Mine, Angola

MARINÉ PIENAAR

Specialist Scientist

PROFESSIONAL DEVELOPMENT

Contaminated Land Management 101 Training
Network for Industrially Contaminated Land in Africa
2020

Intensive Agriculture in Arid & Semi-Arid Environments
CINADCO/MASHAV R&D Course, Israel
2015

World Soils and their Assessment Course
ISRIC – World Soil Information Centre, Netherlands
2015

Wetland Rehabilitation Course
University of Pretoria
2010

Course in Advanced Modelling of Water Flow and Solute Transport in the Vadose Zone with Hydrus
University of Kwazulu-Natal
2010

Environmental Law for Environmental Managers
North-West University Centre for Environmental Management
2009

PROJECT EXPERIENCE (Continued)

Soil Quality Assessments

Range of projects: Rehabilitated Land Audits, Mine Closure Applications, Mineral and Ore Processing Facilities, Human Resettlement Plans

The soil quality assessments included physical and chemical analysis of soil quality parameters to determine the success of land rehabilitation towards productive landscapes. The assessments are also used to understand the suitability for areas for Human Resettlement Plans

Project examples:

- Closure Planning for Yoctolux Colliery
- Soil and vegetation monitoring at Kingston Vale Waste Facility
- Exxaro Belfast Resettlement Action Plan Soil Assessment
- Soil Quality Monitoring of Wastewater Irrigated Areas around Matimba Power Station
- Keaton Vanggatfontein Colliery Bi-Annual Soil Quality Monitoring

REFERENCES

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