# Soil Compliance Statement for the proposed K4 Pollution Control Dam (PCD) Project

## Marikana, North-West Province, South Africa

July 2023

**CLIENTS**

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| Declaration | The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science. |

# Table of Contents

1 Introduction ..... 1
1.1 Project Information ..... 1
1.2 Scope of Work ..... 2
2 Project Area ..... 2
3 Methodology ..... 4
3.1 Desktop Assessment ..... 4
3.2 Field Survey ..... 4
3.3 Land Capability ..... 4
3.4 Limitations ..... 6
4 Project Area ..... 7
4.1 Climate ..... 7
4.2 Soils and Geology ..... 7
4.3 Terrain ..... 10
5 Results and Discussion ..... 12
5.1 Baseline Findings ..... 12
5.2 Sensitivity Verification ..... 16
6 Conclusion ..... 20
7 References ..... 21

# Figures

Figure 2-1 Locality map of the project area ..... 3
Figure 4-1 Summarised climate for the region (Mucina & Rutherford, 2006) ..... 7
Figure 4-2 Illustration of land type Ea 3 terrain units (Land Type Survey Staff, 1972 – 2006) ..... 7
Figure 4-3 Land type distribution within the proposed project area ..... 9
Figure 4-4 Slope percentage map for the project area ..... 10
Figure 4-5 Digital Elevation Model of the project area (Metres Above Sea Level) ..... 11
Figure 5-1 Soil forms found within the proposed project area; A&B) Vertic topsoil horizon; C) Wasbank soil form; D) Soft carbonate subsurface horizon; E) Lithic subsurface horizon below vertic topsoil horizon. F) Soft carbonate with a gley horizon below. ..... 12
Figure 5-2 Vertic topsoil swelling and shrinking which causes self-plough or cracking. ..... 13
Figure 5-3 A-D) General landscape of the project area with the identified soil forms. ..... 13
Figure 5-4 Dominant soil forms distribution identified in the project area. ..... 14
Figure 5-5 Land Potential of the soil forms identified in the project area. ..... 15
Figure 5-6 Map of the relative Agricultural Theme Sensitivity for the proposed project area generated by the Environmental Screening Tool ..... 17
Figure 5-7 The land capability sensitivity for the proposed project area (DAFF, 2017) ..... 18
Figure 5-8 The Crop Boundary sensitivity for the proposed project area (DFFE, 2023) ..... 19

# Tables

Table 3-1 Land capability class and intensity of use (Smith, 2006) ..... 4
Table 3-2 The combination table for land potential classification ..... 5
Table 3-3 The Land Potential Classes ..... 5
Table 3-4 National Land Capability Values (DAFF,2017) ..... 5
Table 4-1 Soils expected at the respective terrain units within the Ah 44 land type (Land Type Survey Staff, 1972 - 2006) ..... 8

# Declaration

I, Matthew Mamera declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

**Dr Matthew Mamera**

**Soil Scientist**

The Biodiversity Company

July 2023

# 1 Introduction

The Biodiversity Company (TBC) was commissioned to conduct a soil compliance report for the proposed K4 PCD Project and associated infrastructure at Sibanye-Stillwater, Marikana, North-West Province, South Africa.

The approach adopted for the assessments has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 20 March 2020: “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation”. The National Web based Environmental Screening Tool (DFFE, 2023) has characterised the agricultural theme sensitivity of the area as “Low to Medium”.

This report aims to present and discuss the findings from the soil resources identified within the 50 m regulated area. The report will also identify the soil suitability and land potential of these soils, the land uses within the assessment area and the risks associated with the proposed Sibanye-Stillwater planned K4 PCD project.

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

## 1.1 Project Information

Sibanye-Stillwater is the owner of the K4 Shaft that forms part of the Marikana Operations located near Marikana town, North-West Province. The Marikana Operations is divided into two entities consisting of Western Platinum (Pty) Ltd and Eastern Platinum (Pty) Ltd. The K4 Shaft falls under the Western Platinum (Pty) Ltd.

The shaft was placed under care and maintenance for a period of 6 years, but has been ramped up to be fully operational in the year 2024. The current waste rock dump on the property of the shaft has been established and initiated by the previous owner. Sibanye-Stillwater is planning to extend the Life of Mine (LOM) by approximately 30 years and the existing waste rock dump will be used to place the waste rock. The size of the waste rock dump will not exceed the approved footprint as authorised in the Western Platinum Limited – Environmental Management Programme.

Additional infrastructure that needs to be implemented include the construction of:

- A V-drain around the current waste rock dump. The V-drain is considered as catchment berms on either side of the waste rock dump and is located on a ridge;
- A Pollution Control Dam (PCD) that will be lined and completed with a recovery sump for the recycling of stormwater runoff for the mining operations;
- A pipeline from the K4 Shaft to the PCD; and
- An emergency spillway to manage the overflow.

Waste rock dump, berm and channels

The total final waste rock dump footprint area will be 203 830 m² and this footprint has already been authorised in the WPL EMPR:

- The berm will be 1353 m in length and 10,83 m wide.
- Catchment 203830 m² 10 years – phase 1 only.
- Berm length West 550 m, Berm Length East 600 m.

- Average width 10.83 m.

Pollution control dam

The PCD will have a capacity of 35 203 m³ and will have a maximum height of 3 m from the floor of the dam. The V-drain will discharge via 2 legs into the PCD. The trapezoidal channels will have a max flow of 6452 L/s from the East leg (a 1:100-year storm estimate flow is 2500 L/s/ leg).

Pipelines

The pipeline will be installed to transfer water from the PDC to the K4 Shaft for re-use. The pipeline will be 500 m in length with a total pump capacity of 60 m³/hour

### 1.2 Scope of Work

The following scope of work is applicable:

- The feasibility of the proposed activities;
- Confirmation about the “Low” and “Medium” sensitivities;
- The effects that the proposed activities will have on agricultural production in the area;
- A map superimposing the proposed footprint areas, a 50 m regulated area as well as the sensitivities pertaining to the screening tool;
- Confirmation that no agricultural segregation will take place and that all options have been considered to avoid segregation;
- The specialist’s opinion regarding the approval of the proposed activities; and
- Any potential mitigation measures described by the specialist to be included in the EMPr.

## 2 Project Area

The project area is located in Marikana, in the Rustenburg Local Municipality, Bojanala Platinum District Municipality, Northwest Province, South Africa. The area is situated approximately 11 km northwest of the Mooinooi town, 12 km north of Buffelspoort town and 23 km northeast of Rustenburg. The proposed project area is also approximately 8 km north of the N4 national road, 21 km east of the R104 regional road and 22 km southeast of the R510 national road (see Figure 2-1). The surrounding land uses include grazing, waterbodies, game farming and mining activities.

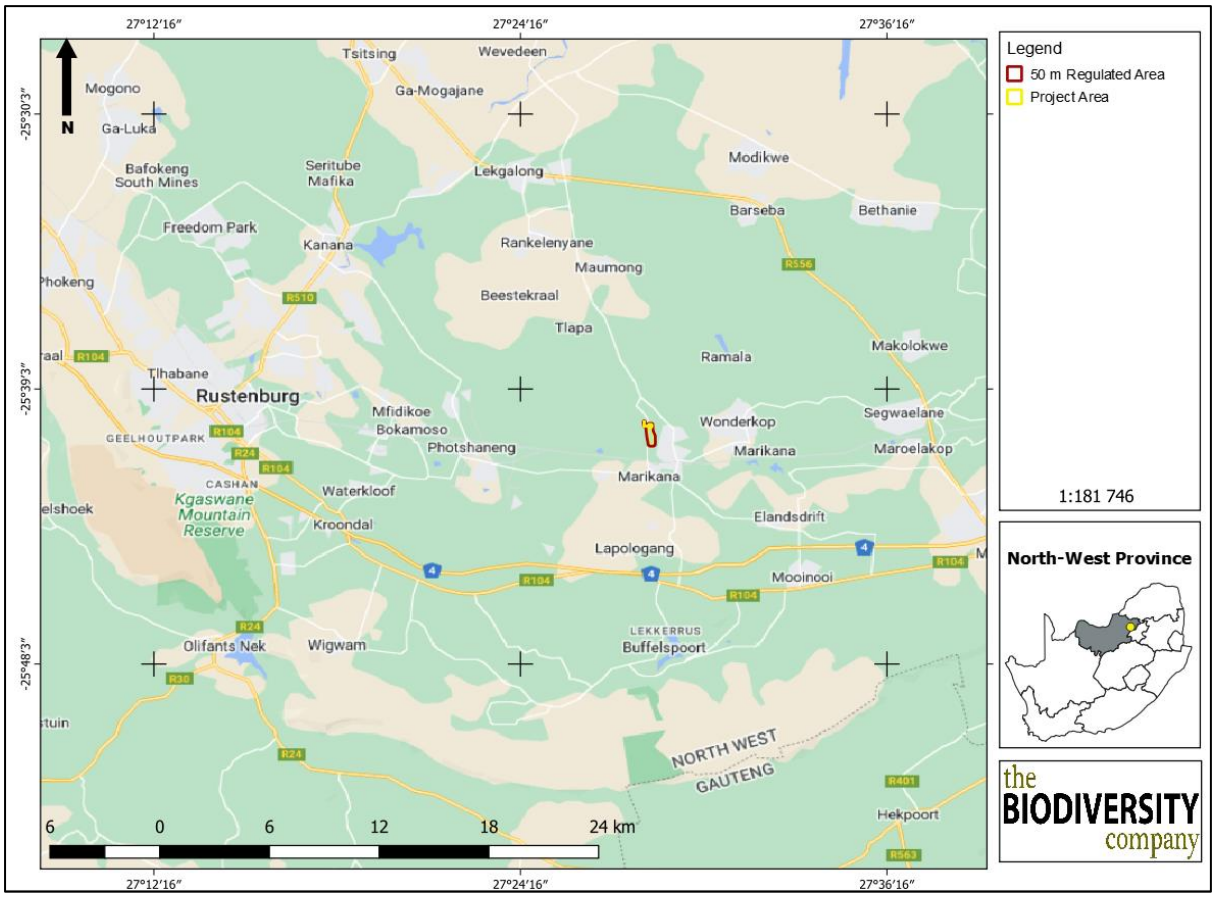



***Figure 2-1 Locality map of the project area***

# 3 Methodology

## 3.1 Desktop Assessment

As part of the desktop assessment, baseline soil information was obtained using published South African Land Type Data. 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 comprises of the division of land into land types. In addition, a Digital Elevation Model (DEM) as well as the slope percentage of the area was calculated by means of the NASA Shuttle Radar Topography Mission Global 1 arc second digital elevation data by means of QGIS and SAGA software.

## 3.2 Field Survey

An assessment of the soils present within the project area was conducted during the field survey in June 2023. The site was traversed on foot. A soil auger was used to determine the soil form/family and depth. The soil was hand augured to the first restricting layer or 0.5 m. Soil survey positions were recorded as waypoints using a handheld GPS. Soils were identified to the soil family level as per the "Soil Classification: A Taxonomic System for South Africa" (Soil Classification Working Group, 2018). Landscape features such as existing open trenches were also helpful in determining soil types and depth.

## 3.3 Land Capability

Given the nature of the compliance statement and the fact that baseline findings correlate with the screening tool's sensitivities, land capability was solely determined by means of the National Land Capability Evaluation Raster Data Layer (DAFF, 2017). Land capability and land potential will also briefly be calculated to match to that of the screening tool to ultimately determine the accuracy of the land capability sensitivity from (DAFF, 2017).

Land capability and agricultural potential will briefly be determined by a combination of soil, terrain and climate features. Land capability is defined by the most intensive long-term sustainable use of land under rain-fed conditions. At the same time an indication is given about the permanent limitations associated with the different land use classes.

Land capability is divided into eight classes, and these may be divided into three capability groups. Table 3-1 shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use increases from class I to class VIII (Smith, 2006).

***Table 3-1 Land capability class and intensity of use (Smith, 2006)***

| Land Capability Class | Increased Intensity of Use | | | | | | | | | Land Capability Groups |
|---|---|---|---|---|---|---|---|---|---|---|
| I | W | F | LG | MG | IG | LC | MC | IC | VIC | Arable Land |
| II | W | F | LG | MG | IG | LC | MC | IC | | |
| III | W | F | LG | MG | IG | LC | MC | | | |
| IV | W | F | LG | MG | IG | LC | | | | |
| V | W | F | LG | MG | | | | | | Grazing Land |
| VI | W | F | LG | MG | | | | | | |
| VII | W | F | LG | | | | | | | |
| VIII | W | | | | | | | | | Wildlife |
| | | | | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| W - Wildlife | | **MG - Moderate Grazing** | **MC - Moderate Cultivation** | | | |
| F- Forestry | | **IG - Intensive Grazing** | **IC - Intensive Cultivation** | | | |
| LG - Light Grazing | | **LC - Light Cultivation** | **VIC - Very Intensive Cultivation** | | | |

The land potential classes are determined by combining the land capability results and the climate capability of a region as shown in Table 3-2. The final land potential results are then described in Table 3-3.

***Table 3-2 The combination table for land potential classification***

| Land capability class | Climate capability class | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **C7** | **C8** |
| I | L1 | L1 | L2 | L2 | L3 | L3 | L4 | L4 |
| II | L1 | L2 | L2 | L3 | L3 | L4 | L4 | L5 |
| III | L2 | L2 | L3 | L3 | L4 | L4 | L5 | L6 |
| IV | L2 | L3 | L3 | L4 | L4 | L5 | L5 | L6 |
| V | Vlei | Vlei | Vlei | Vlei | Vlei | Vlei | Vlei | Vlei |
| VI | L4 | L4 | L5 | L5 | L5 | L6 | L6 | L7 |
| VII | L5 | L5 | L6 | L6 | L7 | L7 | L7 | L8 |
| VIII | L6 | L6 | L7 | L7 | L8 | L8 | L8 | L8 |

***Table 3-3 The Land Potential Classes***

| Land potential | Description of land potential class |
|---|---|
| L1 | Very high potential: No limitations. Appropriate contour protection must be implemented and inspected. |
| L2 | High potential: Very infrequent and/or minor limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected. |
| L3 | Good potential: Infrequent and/or moderate limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected. |
| L4 | Moderate potential: Moderately regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall. Appropriate permission is required before ploughing virgin land. |
| L5 | Restricted potential: Regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall. |
| L6 | Very restricted potential: Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable |
| L7 | Low potential: Severe limitations due to soil, slope, temperatures or rainfall. Non-arable |
| L8 | Very low potential: Very severe limitations due to soil, slope, temperatures, or rainfall. Non-arable |

The land capability of the proposed footprint was compared to the National Land Capability which was refined in 2014- 2016. The National Land Capability methodology is based on a spatial evaluation modelling approach and a raster spatial data layer consisting of fifteen (15) land capability evaluation values (Table 3-4), usable on a scale of 1:50 000 – 1:100 000 (DAFF, 2017). The previous system is based on a classification approach, with 8 classes (Table 3-1).

***Table 3-4 National Land Capability Values (DAFF,2017)***

| Land Capability Evaluation Value | Land Capability Description |
|---|---|
| **1** | Very low |
| **2** | |
| **3** | Very Low to Low |
| **4** | |

| | |
|---|---|
| 5 | Low |
| 6 | Low to Moderate |
| 7 | |
| 8 | Moderate |
| 9 | Moderate to High |
| 10 | |
| 11 | High |
| 12 | High to Very High |
| 13 | |
| 14 | Very High |
| 15 | |

### 3.4 Limitations

The following limitations are relevant to this agricultural potential assessment:

- The handheld GPS used potentially could have inaccuracies up to 5 m. Any and all delineations therefore could be inaccurate within 5 m; and
- No heavy metals have been assessed nor fertility been analysed for the relevant classified soils.

# 4 Project Area

## 4.1 Climate

The project area falls within the Marikana Thornveld vegetation. The area is characterised by summer rainfall with very dry winters. The MAP of area is about 600-700 mm. Frost fairly frequent in winter in lower lying areas, less on hills (Mucina & Rutherford, 2006). The mean average temperature for the project area ranges with the maximum temperatures of 36.7°C in summer and minimum temperature of -2.2°C for February and July respectively (see Figure 4-1).

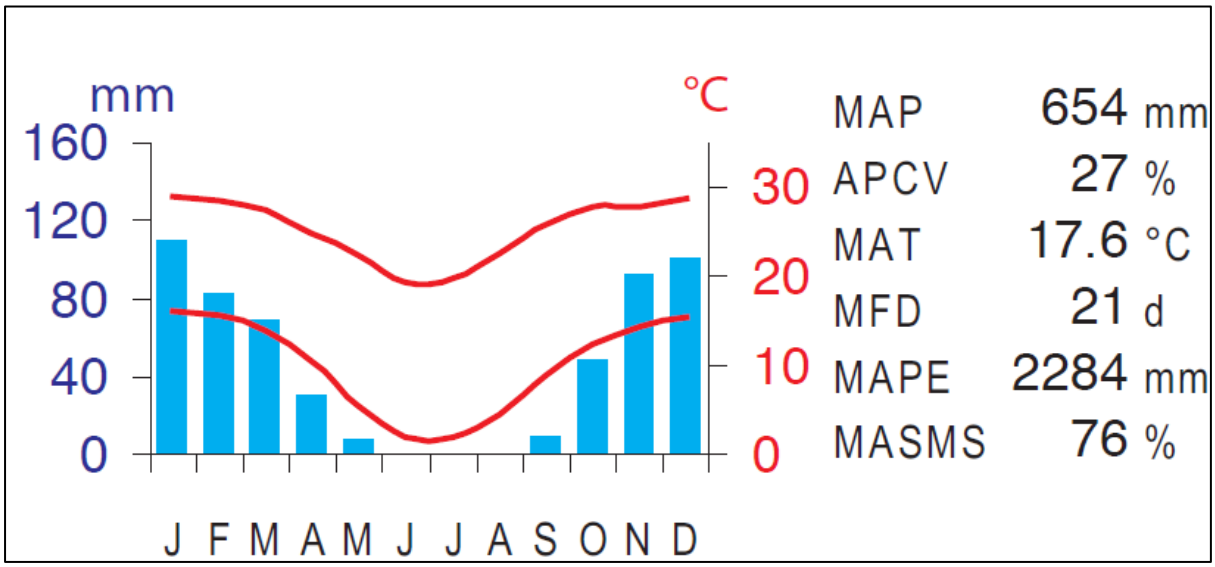



***Figure 4-1 Summarised climate for the region (Mucina & Rutherford, 2006)***

## 4.2 Soils and Geology

The geology of the area is characterised by potassium and sodium-rich mainly foyaite, lava and tuff with some syenite. According to the land type database (Land Type Survey Staff, 1972 - 2006) the assessment corridor to be focused on falls within the Ea 3 land type (see Figure 4-3). The Ea 3 land type mostly consist of Arcadia, Bare Rock and Oakleaf soil forms according to the SA soil classification working group (1990) with the possibility of other soils occurring throughout. The land type consists of low chroma dark soils mostly vertic and melanic soils with also occurrence of red structured soils. Lime is rare or absent within this land type in upland soils but generally present in low-lying areas. The terrain units and expected soils for the Ea 3 land type is illustrated in **Error! Reference source not found.** and **Error! Reference source not found.** respectively.

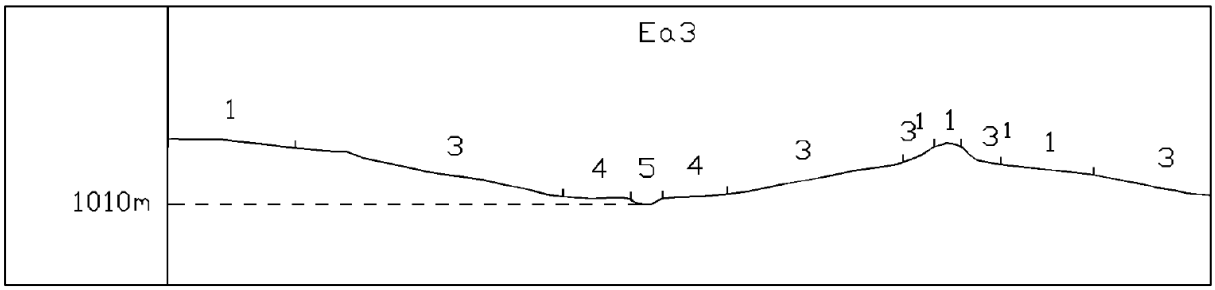



***Figure 4-2 Illustration of land type Ea 3 terrain units (Land Type Survey Staff, 1972 – 2006)***

***Table 4-1*** ***Soils expected at the respective terrain units within the Ea 3 land type (Land Type Survey Staff, 1972 - 2006)***

| Terrain Units | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 (30%)** | | **1 (1) (0.5)** | | **3 (44.5%)** | | **3(1) (1%)** | | **4 (15%)** | | **5 (9%)** | |
| Arcadia | 70% | Bare Rocks | 80% | Arcadia | 76% | Bare Rocks | 70% | Arcadia | 89% | Oakleaf | 67% |
| Bare Rocks | 14% | Mispah | 9% | Bare Rocks | 10% | Mispah | 30% | Hutton | 3% | Arcadia | 22% |
| Mispah | 9% | | | Mispah | 6% | | | Shortlands | 3% | Shortlands | 6% |
| Hutton | 4% | | | Hutton | 4% | | | Swartland | 3% | Hutton | 5% |
| Shortlands | 3% | | | Shortlands | 3% | | | | | | |
| | | | | Glenrosa | 4% | | | | | | |
| | | | | Swartland | 1% | | | | | | |

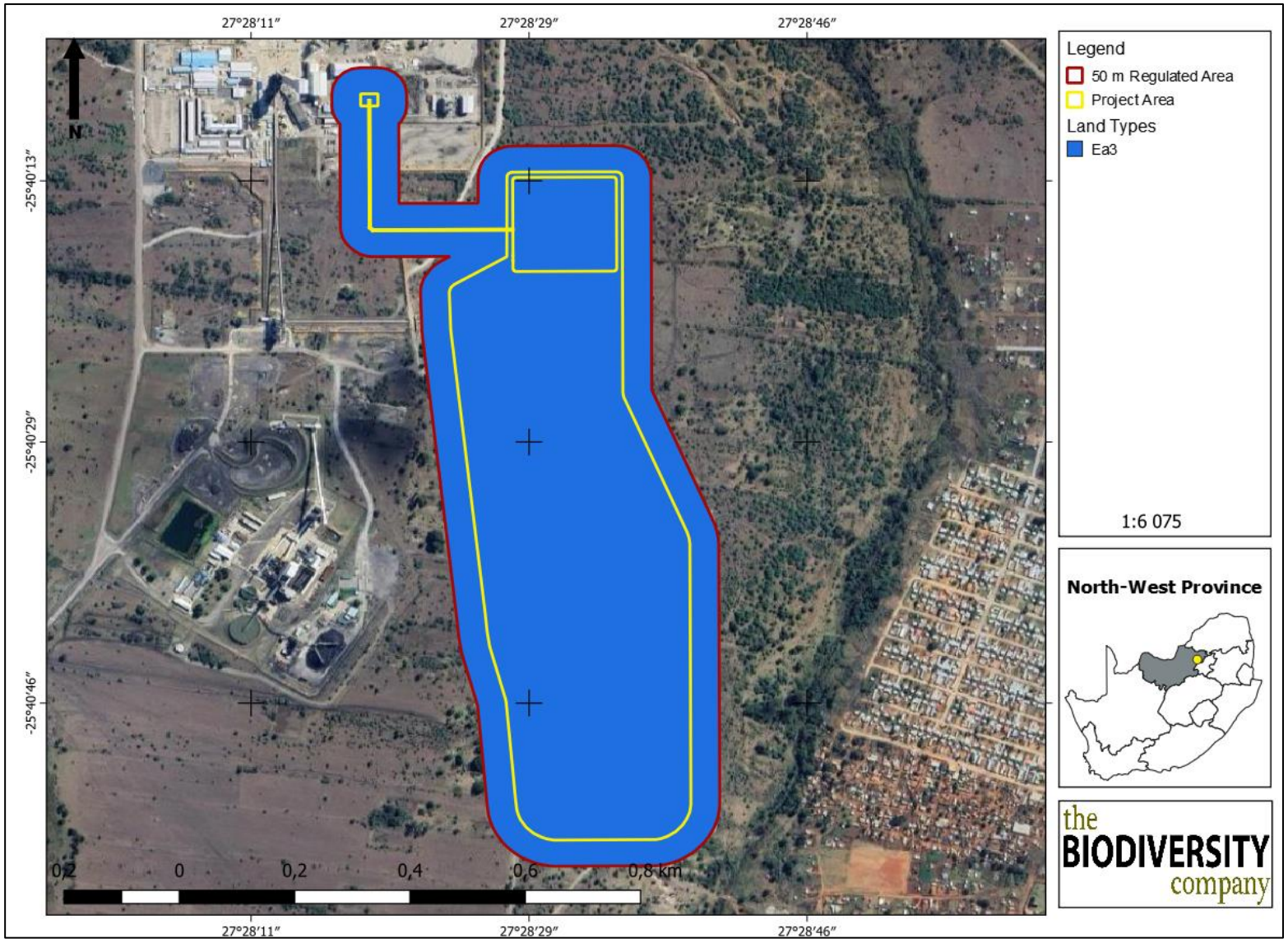



***Figure 4-3 Land type distribution within the proposed project area***

### 4.3 Terrain

The slope percentage of the project area has been calculated and is illustrated in Figure 4-4. Most of the regulated area is characterised by a slope percentage between 0 - 4% with some few irregularities in areas with slopes reaching above 10%. This illustration indicates a uniform topography with occurrence of a few steep sloping areas being present associated to the tailings stockpiles. The Digital Elevation Model (DEM) of the project area (Figure 4-5) indicates an elevation of 1 137 to 1 154 Metres Above Sea Level (MASL).

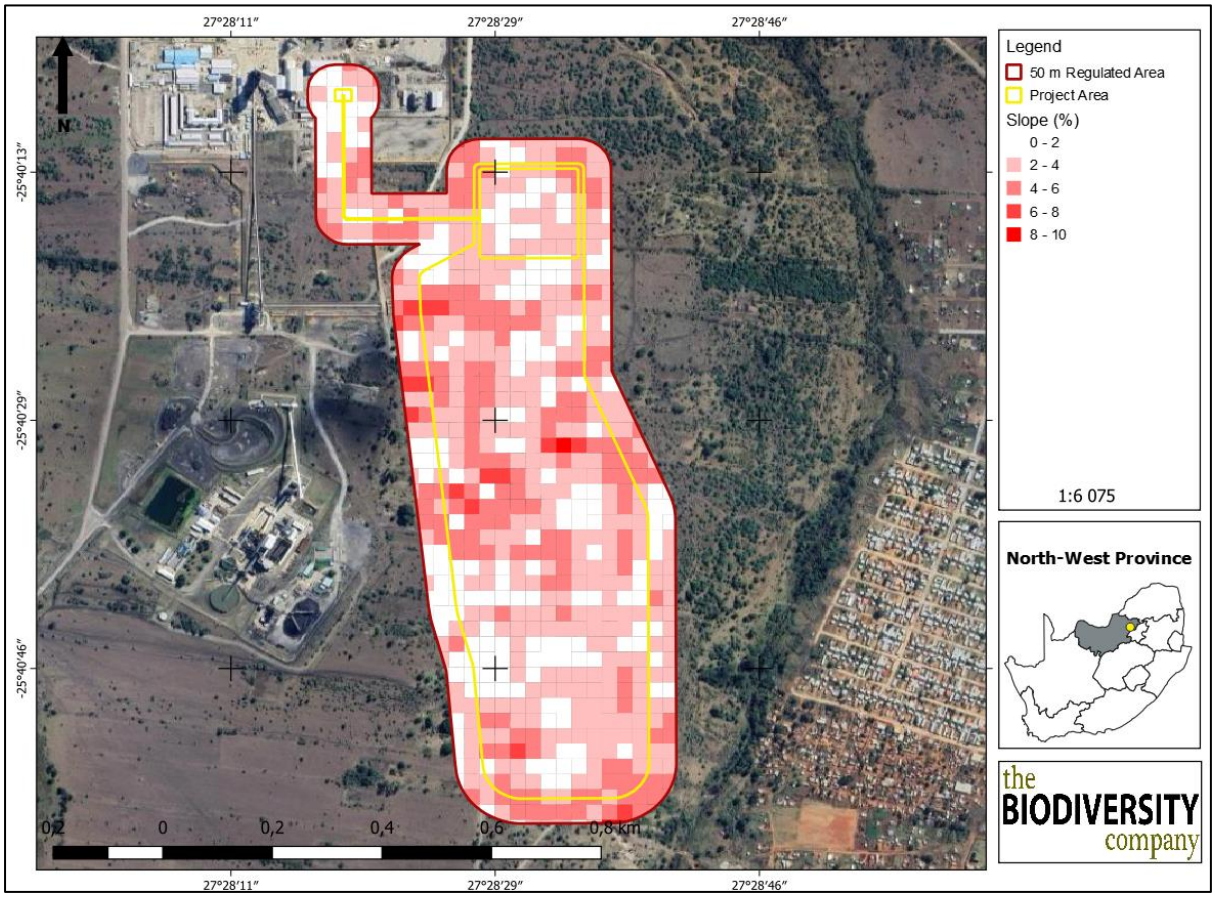



***Figure 4-4 Slope percentage map for the project area***

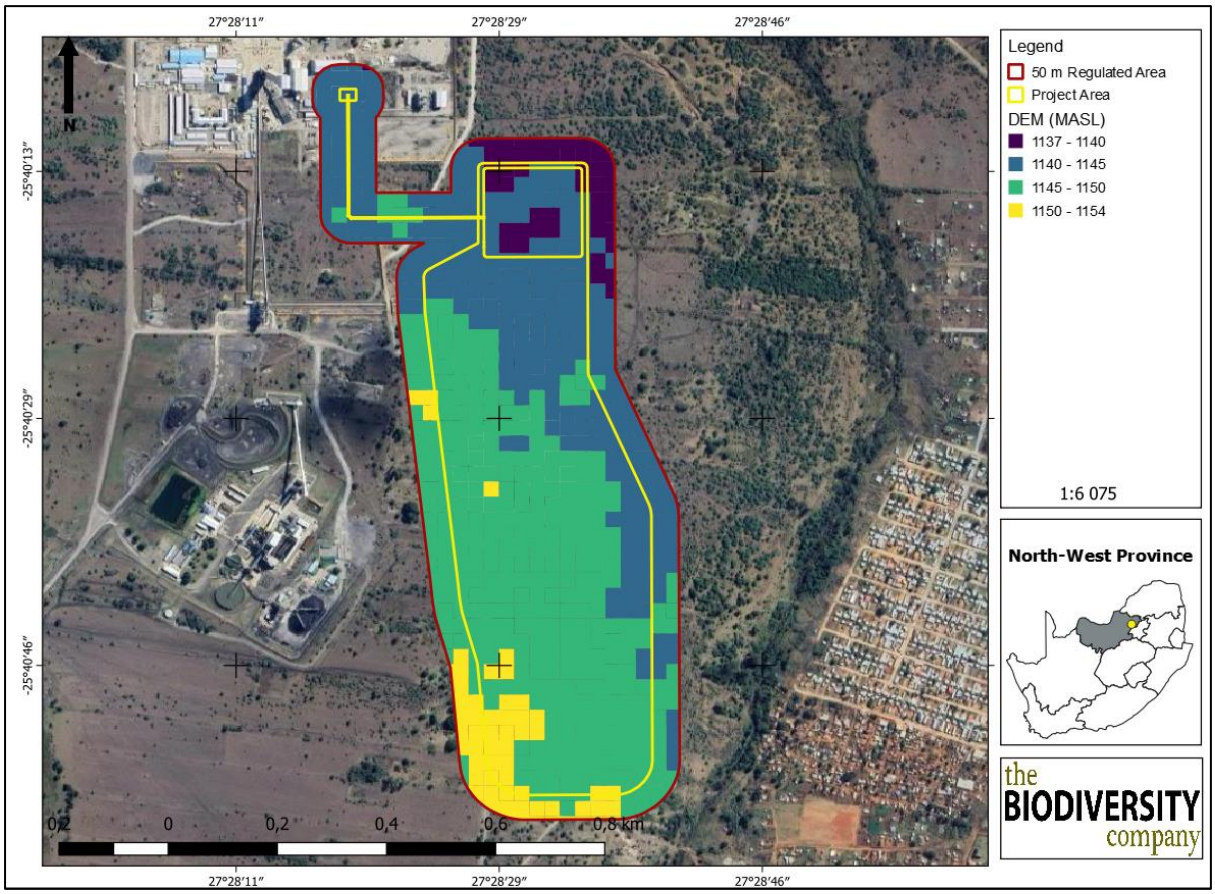



***Figure 4-5 Digital Elevation Model of the project area (Metres Above Sea Level)***

# 5 Results and Discussion

## 5.1 Baseline Findings

The two most sensitive soils forms which were identified in the proposed project area are that of Arcadia and Zondereinde soil forms. The Arcadia soil form consists of a vertic topsoil horizon on top of a lithic horizon below. The Zondereinde soil form has a vertic topsoil with a soft carbonate subsurface horizon with a gley horizon below. Other associated fewer sensitive soils identified in the project area includes the Rensburg, Rustenburg and Wasbank soil forms (see Figure 5-1 to Figure 5-4). The Rustenburg soil form has a vertic topsoil horizon merging into a hard rock substratum. The Rensburg soil form has vertic topsoil on top of a gley horizon. The Wasbank soil form is man-made anthropogenic open excavated or underground transported Technosols. The project area is dominated by vertic soils, which are characterised with high clays, swelling and shrinking (see Figure 5-2). These soils are usually hard to work with for most activities.

The above-mentioned most sensitive soil forms have been determined to have a land capacity class of “III” and “IV” (see Figure 5-5) with a climate capacity level 8 given the Low Mean Annual Precipitation (MAP) and the high Mean Annual Potential Evapotranspiration (MAPE) rates. The combination between the determined land capability class and climate capability results in land potential “L6”. The “L6” land potential level is characterised by very restricted potential due to the severe limitations as a result of the soil, slope, temperature, or rainfall. This area is non-arable, and it is characterised with a “Low to Medium” sensitivity.


***Figure 5-1*** ***Soil forms found within the proposed project area; A&B) Vertic topsoil horizon; C) Wasbank soil form; D) Soft carbonate subsurface horizon; E) Lithic subsurface horizon below vertic topsoil horizon. F) Soft carbonate with a gley horizon below.***

***Figure 5-2 Vertic topsoil swelling and shrinking which causes self-plough or cracking.***

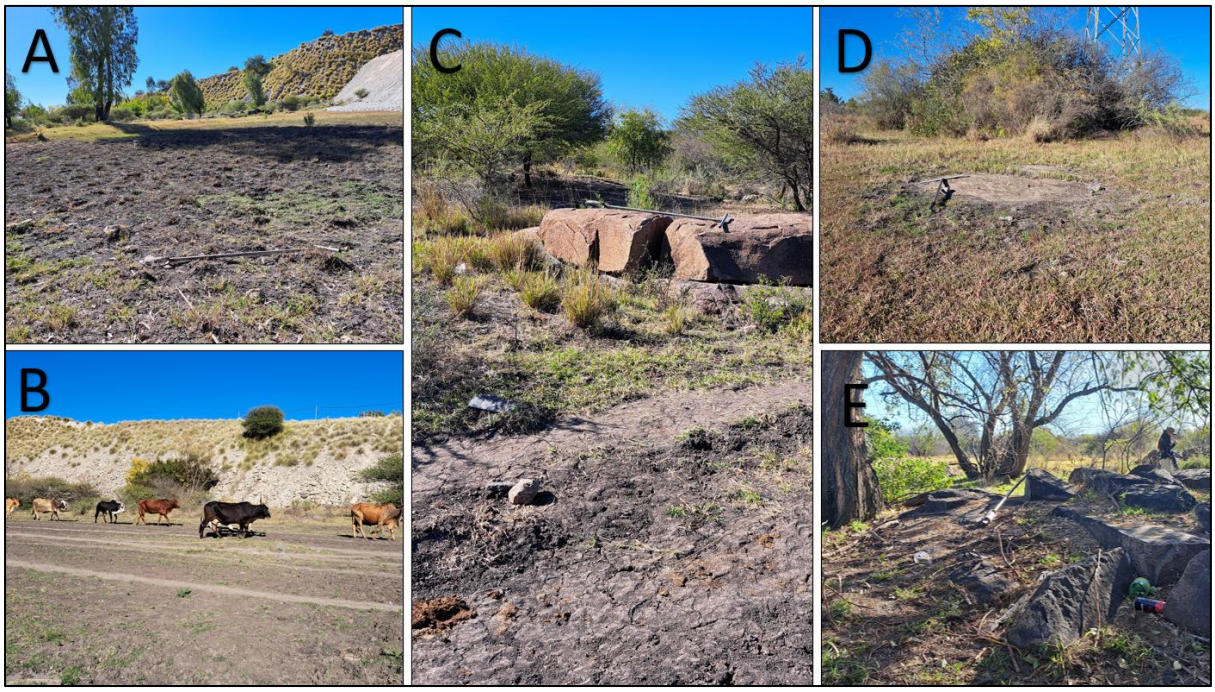



***Figure 5-3 A-D) General landscape of the project area with the identified soil forms.***

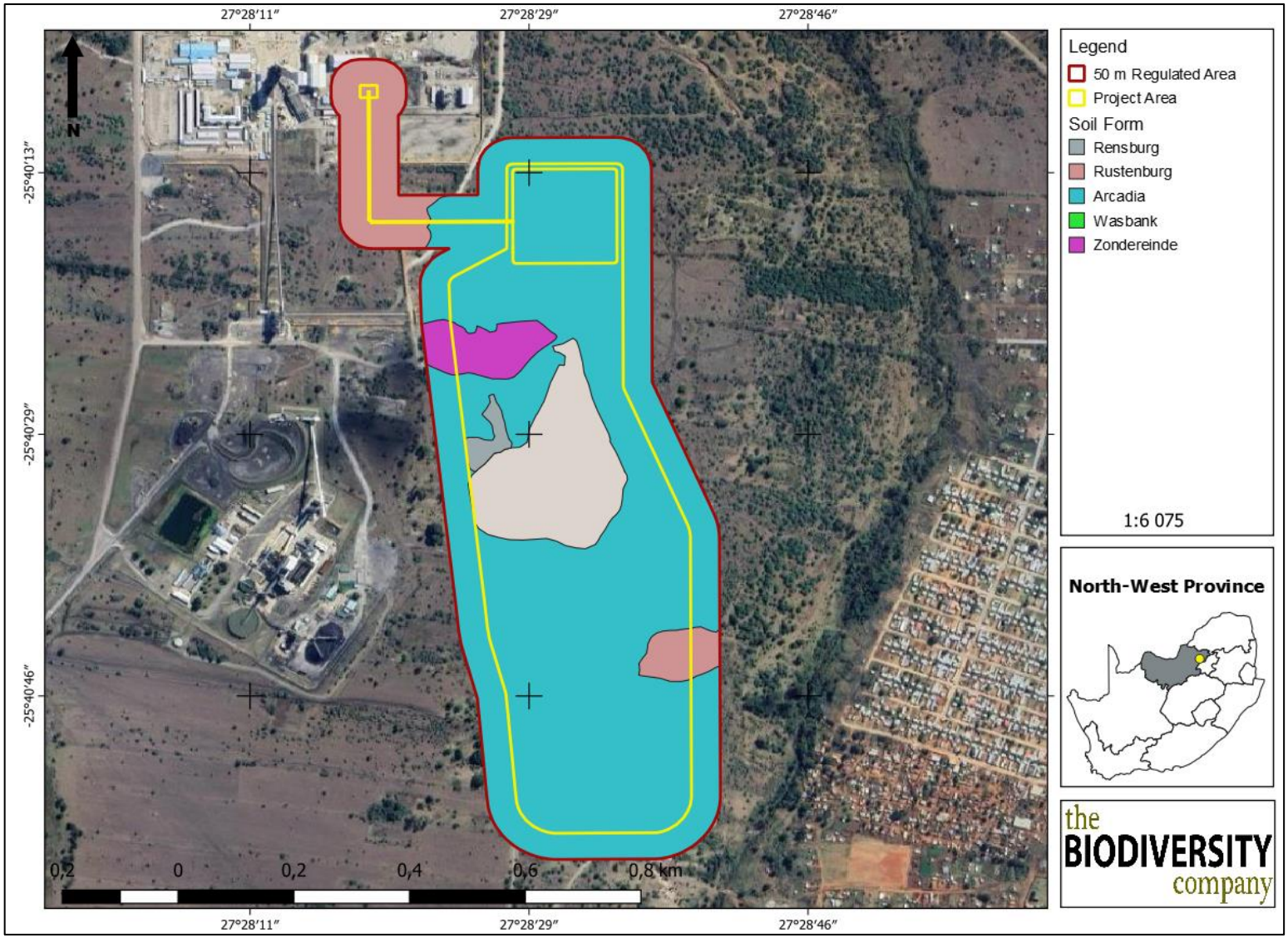



***Figure 5-4 Dominant soil forms distribution identified in the project area.***

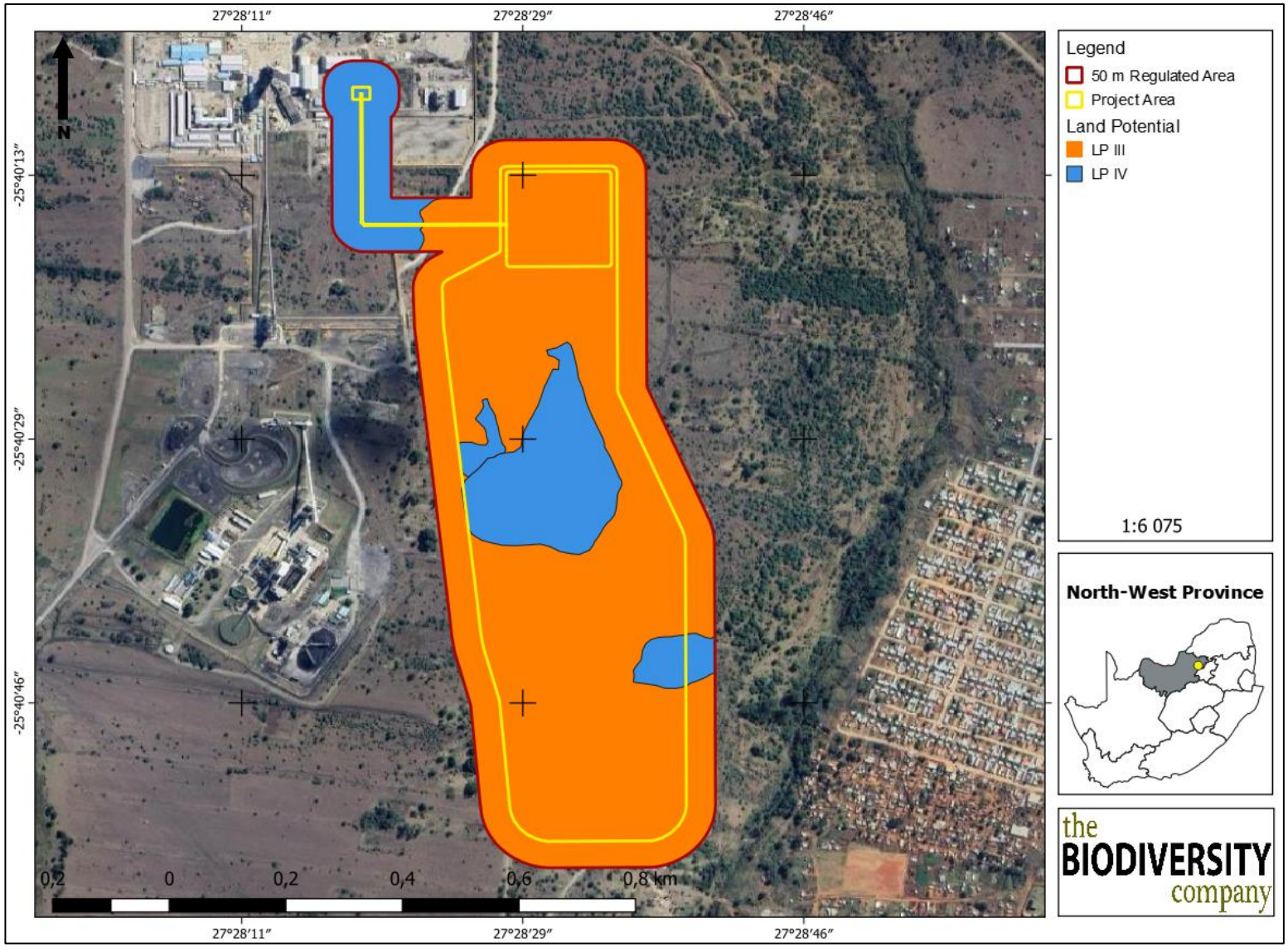



***Figure 5-5 Land Potential of the soil forms identified in the project area.***

### 5.2 Sensitivity Verification

The following land potential level has been determined;

- Land potential level 6 (this land potential is characterised by a very restricted land potential. Severe limitations due to soil, slope, temperatures, or rainfall. Non arable).

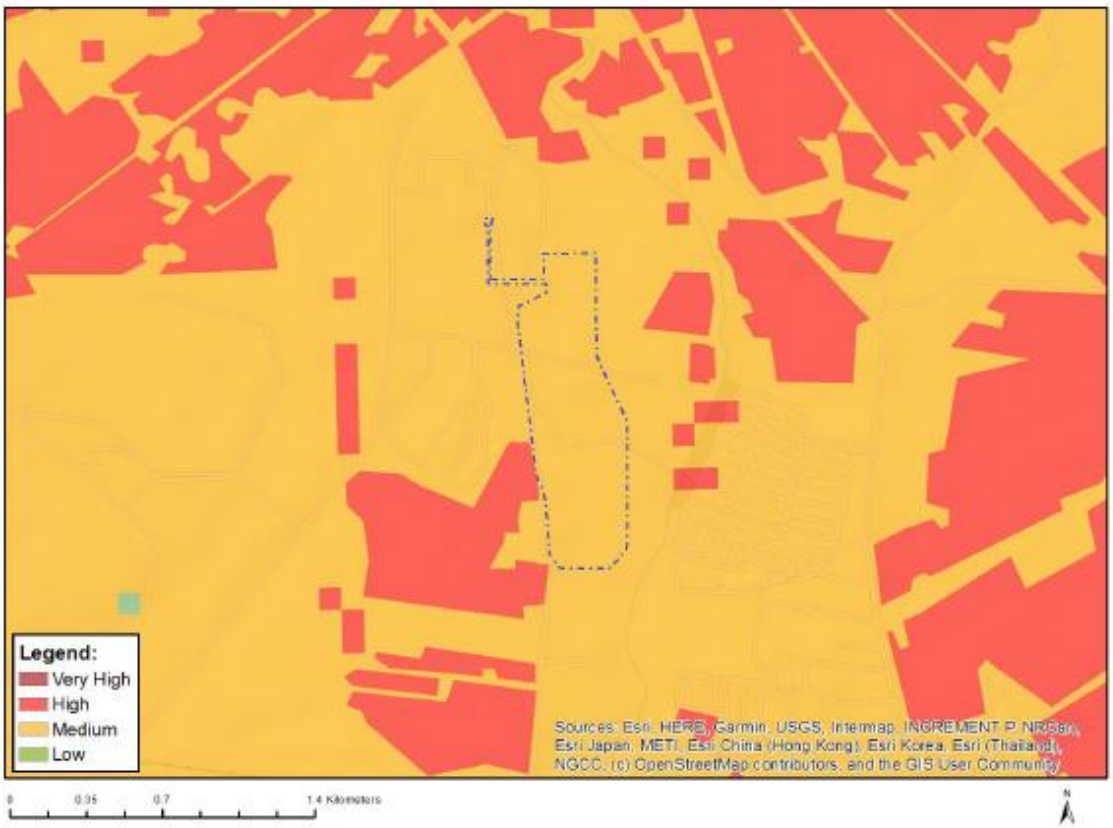
Fifteen land capabilities have been digitised by (DAFF, 2017) across South Africa, of which eight potential land capability classes are located within the proposed footprint area's assessment corridor, including;

- Land Capability 6 to 8 (Low to Moderate Sensitivity).

The baseline findings and the Land Capability sensitivity as per the Department of Agricultural, Forestry and Fisheries (DAFF, 2017) national raster file concur with one another in most areas. The proposed project area is characterised with "Low to Moderate" land capability sensitivity (DFFE screening tool, 2023; Figure 5-6 to Figure 5-7). The verified soil baseline findings disputes the areas which were identified as "Low" sensitivity associated with Wasbank soil forms. These soils are usually characterised with transported excavated material with a significantly limited land potential and capability due to the presence of course parent material from the mining operations. The available harsh climatic conditions also restrict most cropping practices, thus overall, the area can be categorized as "Medium" sensitivity which the specialist also agrees with, based on the site-verified baseline findings, which conforms to the requirements of an agricultural compliance statement only.

In the project area buffer zone (50 m), there are agricultural lands or crop fields identified as high potential according to the DFFE (2023) (see Figure 5-8). However, these areas are now historical crop field areas which are not agriculturally active. Therefore, there is no segregation of active productive agricultural lands or crop fields within the proposed project area.

## MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY




| Very High sensitivity | High sensitivity | Medium sensitivity | Low sensitivity |
|---|---|---|---|
| | X | | |

**Sensitivity Features:**

| Sensitivity | Feature(s) |
|---|---|
| High | Annual Crop Cultivation / Planted Pastures Rotation;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate |
| Medium | Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate |

***Figure 5-6 Map of the relative Agricultural Theme Sensitivity for the proposed project area generated by the Environmental Screening Tool***

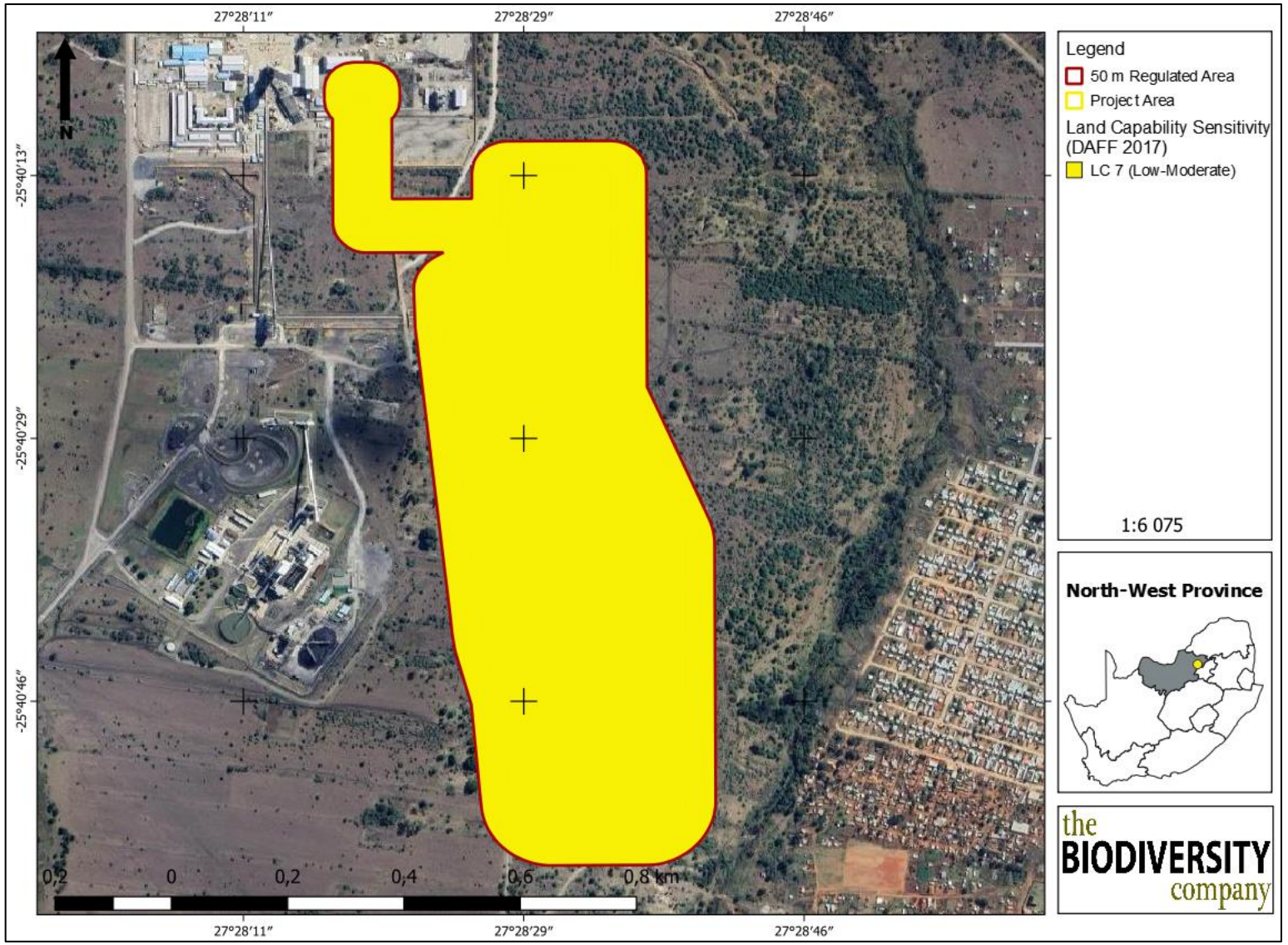



***Figure 5-7 The land capability sensitivity for the proposed project area (DAFF, 2017)***

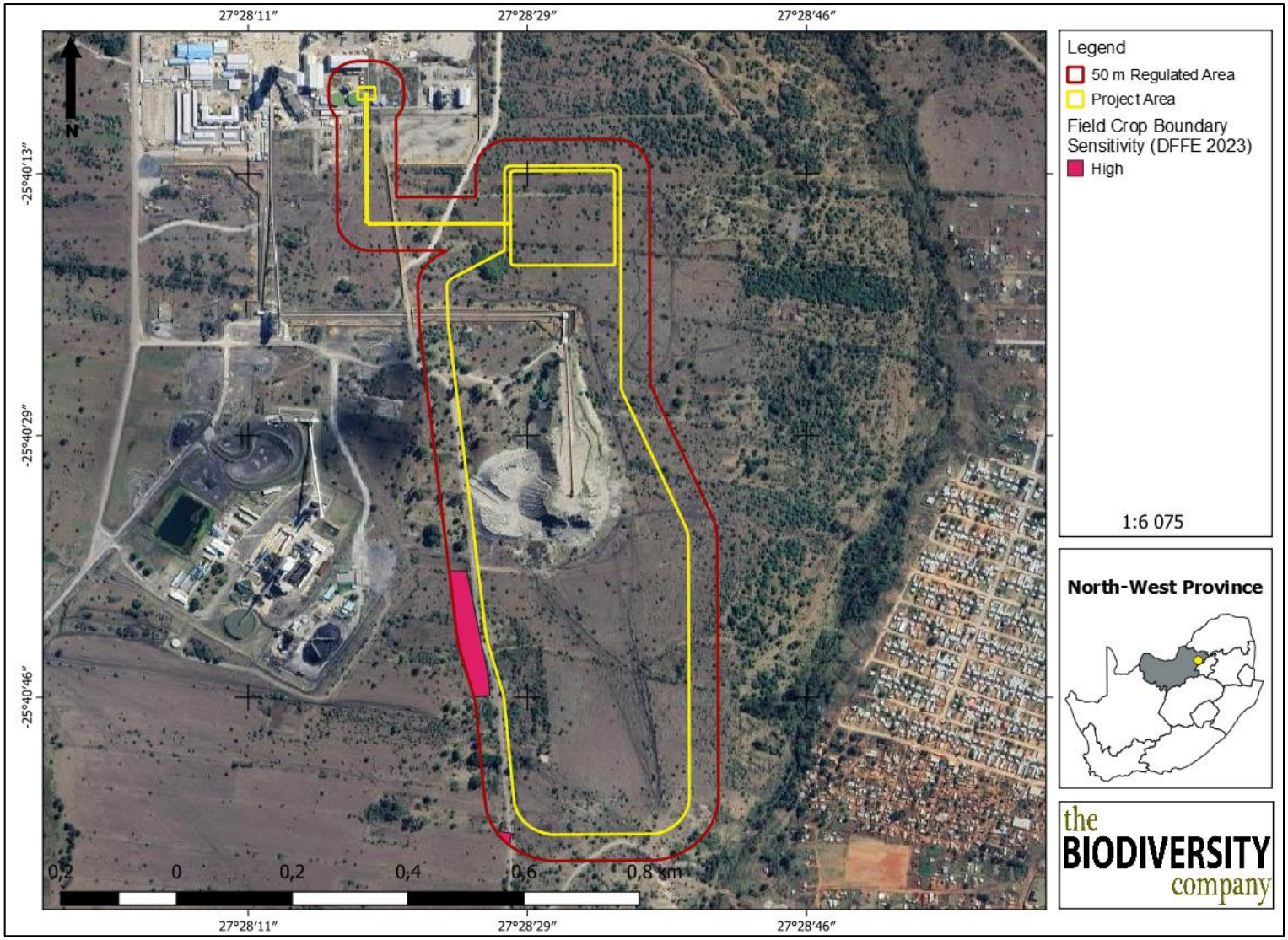



***Figure 5-8 The Crop Boundary sensitivity for the proposed project area (DFFE, 2023)***

# 6 Conclusion

Two dominant soil forms were identified in the proposed project area, the more sensitive forms identified within the assessment area are the Arcadia and Zondereinde soil forms. Other associated soils which were identified within the project area includes, the Rensburg, Rustenburg and Wasbank soil forms. The baseline findings and land capability sensitivity concur with each other, in most areas indicating a “Low to Moderate” land capability sensitivity. The specialist disputes, some areas which were identified with a “Moderate” sensitivity to a revised classification being “Low” sensitivity as these soils are characterized with soils with a restricted potential for cropping activities following the verified soil baseline findings. Overall, the area can be classified as “Medium” following the verified soil baseline findings on site on-site.

Furthermore, the available climate also limits crop production significantly. The climatic conditions are associated with low annual precipitation and high evapotranspiration potential demands of the area, which might not be favourable for most cropping practices.

There is no segregation of active crop fields or land with a high land potential and capability identified within the proposed area. It is the specialist’s opinion that the proposed project will have limited impacts such as soil erosion losses, loss of potential land capability, spillages and soil compaction, on the agricultural production ability of the land, and the proposed project may be favourably considered as have been planned.

# 7 References

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