# FLORA IMPACT ASSESSMENT STUDY FOR THE PROPOSED DEVELOPMENT OF A CRUSHER PLANT ON PORTION 233 OF THE FARM KAFFERSKRAAL 342 JQ, RUSTENBURG LOCAL MUNICIPALITY, NORTH-WEST PROVINCE

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# DOCUMENT CONTROL

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# EXECUTIVE SUMMARY

Makwase Projects (Pty) Ltd is proposing the development of a crusher plant on Portion 233 of the farm Kafferskraal 342 JQ, Rustenburg Local Municipality, North West Province. As part of the Basic Assessment process, SustainDev Services (Pty) Ltd was tasked to undertake a biophysical assessment of the project area proposed site in order to determine the biophysical sensitivity of the site which will be affected by the contemplated Makwase Crusher Plant operations more especially the vegetation component of the local habitat.

The terms of reference was interpreted as follows:

- Report on and map the vegetation groups/units found on the project area. Describe the conservation importance and function of the vegetation within the landscape.
- Provide a map indicating potential habitat along the proposed site for species that are of conservation concern, as well as the inferred vegetation sensitivity thereof.
- List all plant species of conservation concern that are likely to occur on the site.
- Assess the impact that the proposed development could have on the vegetation on the site and provide recommendations to limit or negate these perceived impacts.

The assessment entailed both the desktop research, and the fieldwork in which transect vegetation survey and vegetation classification methods were applied to discern the current ecological integrity of the site.

- During a desktop literature review, a list of local plant species that could potentially occur in the area were documented.
- The desktop study was reinforced by a field vegetation surveys on random transects to determine vegetation classes based on observed habitat transformation, and documented presence/absence of previously reported species using digital photographic methods.
- The site visits were undertaken in April 2017 and again in September 2017. The data collected using the described combination of approaches was analysed and used for reporting.

The study site is situated within the Savanna Biome of South Africa and specifically within the Central Bushveld Bioregion of which comprises several subsidiary vegetation types providing distinguished habitat features of the site as per this assessment:

- Scattered open bushveld
- Habitat transformed
- Wetland habitat

The site is situated within the Marikana Thornveld vegetation type which is nationally listed as a vulnerable ecosystem since the remaining natural habitat is only about 50% of its original extent.

The proposed Makwase Crusher Plant will be located on the heavily transformed vegetation that is of little conservation value and therefore, suitable to the proposed development. Provided that mitigation measures as set out in this report are implemented as a minimum, no objection to the development is raised from a vegetation perspective.

## Contents

# INTRODUCTION

Makwase Projects (Pty) Ltd is proposing the development of a crusher plant on Portion 233 of the farm Kafferskraal 342 JQ, Rustenburg Local Municipality, North West Province. As part of the Basic Assessment process, EcoAgent cc was tasked to undertake a biophysical assessment of the proposed site in order to determine which site will be affected by the contemplated Makwase Crusher Plant operations more especially the vegetation component of the local habitat.

## Terms of reference

The terms of reference was interpreted as follows:

- Report on the vegetation groups/units found around the project area. Describe the conservation importance and function of the vegetation within the landscape.
- List plants of conservation concern and national protected trees that are likely to occur around the project area.
- Provide a map indicating potential habitat along the proposed sites for species that are of conservation concern, as well as the inferred vegetation sensitivity on the project area.
- Assess the impact that the proposed development could have on the vegetation on the project area and provide recommendations to limit or negate these perceived impacts.

## Methodology

The assessment entailed both the desktop research, and the fieldwork in which transect vegetation survey and vegetation classification methods were applied to discern the current ecological integrity of the site. During a desktop literature review, a list of local plant species were documented and then followed the short-listing of plant species of conservation concern that could potentially occur in the area. The desktop study was reinforced by a field vegetation surveys on random transects to determine vegetation classes based on observed habitat transformation, and documented presence/absence of previously reported species using digital photographic methods. Species identification and conservation status of the vegetation were conducted used the keys presented in Mucina and Rutherford 2006; Driver *et al*. 2011. The site visits were undertaken in April 2017 and again in September 2017. The data collected using the described combination of approaches was analysed and used for reporting.

# BACKGROUND TO THE STUDY SITE

## Locality

The proposed project site is located on Portion 233 of the farm Kafferskraal 342 JQ. within the Rustenburg Local Municipality and the Bojanala Platinum District Municipality of the North West Province. The site is situated north of the N4 Highway adjacent to the Buffelpoort/Marikana off-ramp, south of Tharisa mine (Figure 1).

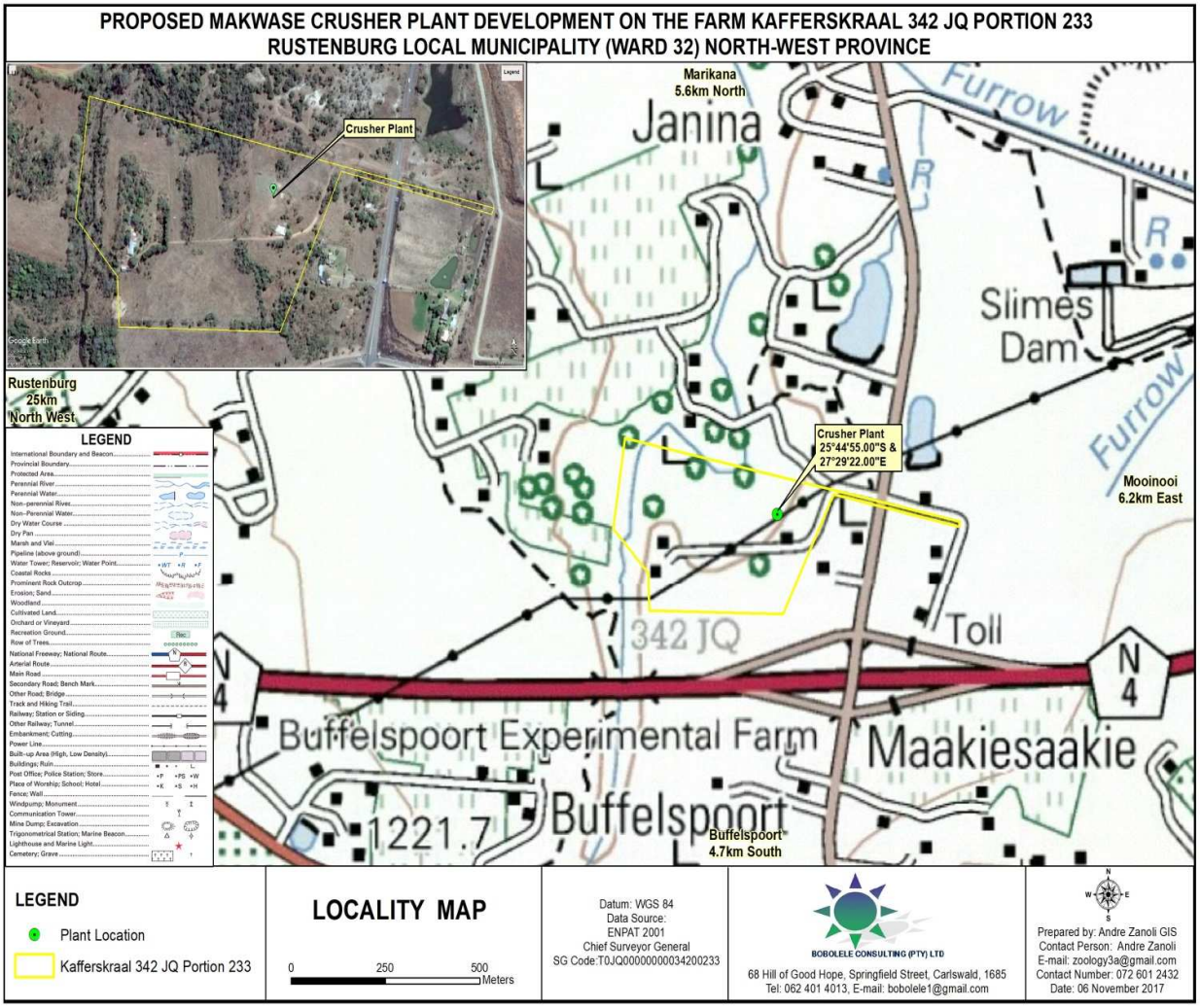



**Figure 1: Locality of the Project Area marked in yellow line**

## Climate: Temperatures and Precipitation

The site falls within Highveld climatic conditions, with hot and wet summers; cold and dry winters (Figure 2). On average, winds blow from the north-west (mainly during the day time) and south east (mainly at night) however seasonal differences are observed. Wind speeds hardly reach speeds higher than 5m/s. Wind direction, speed and atmospheric conditions influence the area of impact and the extent to which pollution can occur. The highest concentrations for low level releases would occur during weak wind speeds and stable (night-time) atmospheric conditions.

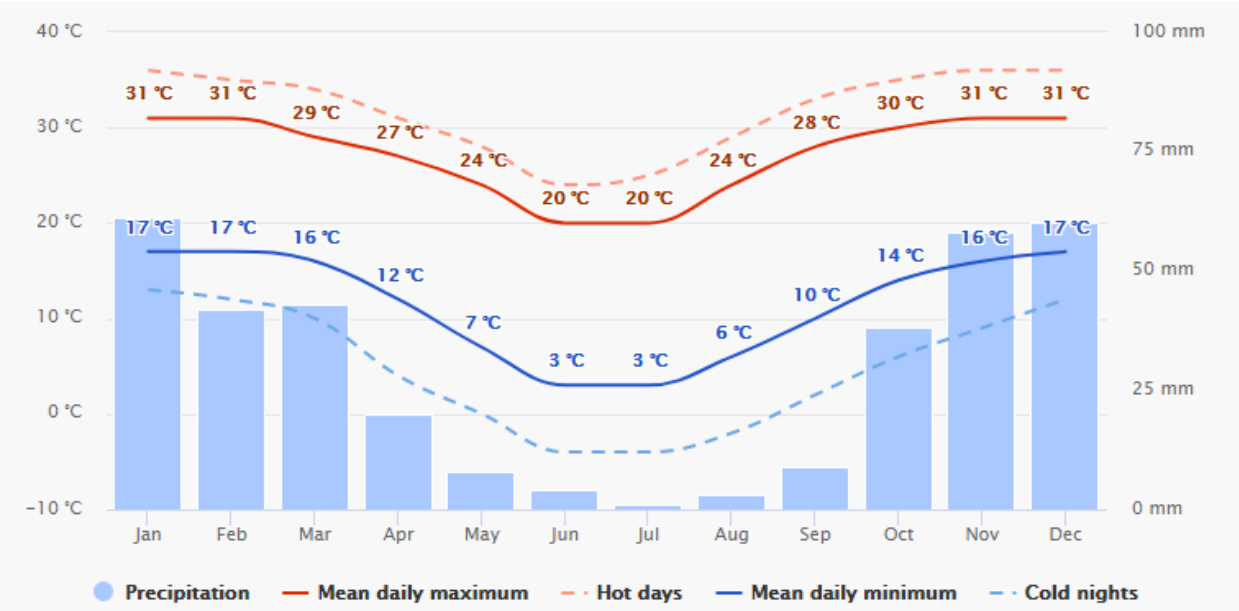



**Figure 2: Average temperatures and precipitation of the site based on the past 30 years of hourly historical weather data (source: https://www.meteoblue.com/en/weather/forecast/modelclimate/)**

## 2.3 Landscape and Hydrology

The site lies on a relatively flat plain with a gentle slope down towards the north. The area has an elevation of approximately 1206 meters above sea level (m.a.s.l.). The natural topography surrounding the project area has been changed by mining activities to the north and N4 highway to the south. The perennial drainage line runs through the project area.

## 2.4 Soil and Land Capability

Most of the area is underlain by mafic intrusive rocks of the Rustenburg Layered Suit of the Bushveld Igneous Complex. The rocks include gabbor, norite pyroxene and anorthosite. The soils comprise mainly vertic melanic clays (Mucina & Rutherford, 2006). As per the national

soils descriptions, the study area consist of strongly structured, cracking soils which is mainly dark coloured and dominated by swelling clays.

The project area is located within an intermediate suitability for arable agriculture where climate permits.The land use in the area is a mixture of farming, low density residential and mining.

## 2.5 Overview of Historic Vegetation

The study site is situated within the Savanna Biome of South Africa and in specific within the Central Bushveld Bioregion. The Savanna biome is the largest biome in southern Africa, occupying over one-third of the surface area of the country (Mucina & Rutherford, 2006). It is characterised by a grassy ground layer and a distinct upper layer of woody plants. Where this upper layer is near the ground the vegetation may be referred to as Shrubveld, where it is dense, as Woodland, and the intermediate stages are commonly known as Bushveld (Mucina & Rutherford, 2006).

Summer rainfalls (see Figure 2), coupled with winter wildfire and regular grazing ensures that the grass layer remains dominant. In addition, the lack of sufficient rainfall prevents the tree canopy from dominating. However, in areas where grazing intensity is high, and wildfire frequencies low, the woody vegetation layer could become increasingly dominant. The Central Bushveld Bioregion (a bioregion is a vegetation organisation level between that of vegetation type and biome) comprises several vegetation types. The proposed site is within the Marikana Thornveld vegetation type. This vegetation type extends from Rustenburg area in the west, through Marikana and Brits to the Pretoria area in the east. Marikana Thornveld vegetation is greatly transformed with up to 50% being transformed by mining, cultivation and urban expansion and are classified as being Vulnerable (Mucina & Rutherford, 2006).

# LEGAL FRAMEWORK

### National Guidelines

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing of threatened or protected ecosystems. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to conserve sites of exceptionally high conservation value. Although the project area falls within the Marikana Thornveld vegetation type which is classified as vulnerable, the Marikana Thornveld ecosystem is divided into 'original extent' and 'remaining extent' by the National List of Threatened Terrestrial Ecosystems for South Africa (2011). According to the National list, the site does not fall within the 'remaining extent' of the Marikana Thornveld ecosystem.

### Provincial Guidelines

The North-West Province published a biodiversity conservation assessment report in 2009, which includes a list of Critical Biodiversity Areas. These areas are terrestrial and aquatic features that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. According to the 2009 list, the project area is located within a terrestrial Critical Biodiversity Area 2. In addition, an aquatic Critical Biodiversity Area 1 runs along the western boundary of the site.

# RESULTS OF THE FIELD ASSESSMENT

The following vegetation/habitat zones were mapped within the project area:

- Scattered open bushveld;
- Habitat transformed; and
- wetland habitat.

**Scattered Open Woodland/Scattered Open Bushveld**

This vegetation assemblage is generally associated with the deep vertic clays or gabbros. It is a short microphyllous woodland with a well-developed graminoid (grass) layer that is interspersed by distinctive bush clumps comprising of many wood species. This habitat unit occurs in less disturbed areas. Table 1 provides a general description and list of commonly occurring species within the scattered open woodlands/open bushveld.

**Table 1. Biophysical Description – Undisturbed Areas**

| | | | |
|---|---|---|---|
| **Status** | Natural & grazed | | |
| **Conservation Priority** | Moderate in its own right; however because the habitat falls within a terrestrial CBA, the remaining bushveld may be considered important in order to reach provincial conservation targets. | | |
| **Soil** | Deep vertic clay | | |
| **Rockiness** | 1% | | |
| **Commonly Occurring Native Plant Species – Undisturbed Areas** | | | |
| **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** |
| *Acacia caffra* | Common Hook-thorn | *Hypoxis hemerocallidea* | Star-flower |
| *Acacia karroo* | Sweet Thorn | *Hypoxis rigidula* | Silver-leaved Star-flower |
| *Acacia nilotica* | Scented Pod | *Ipomoea bachycolpos* | - |
| *Acacia robusta* | Splendid Thorn | *Ipomoea ommaneyi* | Beespatat |
| *Acacia tortilis subsp. heteracantha* | Umbrella Thorn | *Ischaemum afrum* | Turf Grass |
| *Aloe greatheadii* | - | *Jacaranda mimosifolia* | Jacaranda |
| *Aristida bipartita* | Rolling Grass | *Kohautia virgata* | - |
| *Aristida congesta subsp.barbicollis* | Spreading Three-awn | *Lantana camara* | Lantana |
| *Arauajia sericiifera* | White moth vine | *Lantana rugosa* | Wild Grassland Lantana |
| *Asclepias eminens* | Large Turret Flower | *Ledebouria revoluta* | - |
| *Asparagus laricinus* | Cluster-leaved | *Lippia javanica* | Lemon Bush |
| *Bidens bipinnata** | Spanish Black-jack | *Melia azedarach* | Seringa |

| | | | |
|---|---|---|---|
| *Bidens pilosa* | Common Black-jack | *Melinis repens* | Natal grass |
| *Bothriochloa insculpta* | Pinhole Grass | *Monsonia angustifolia* | Pink Monsonia |
| *Celtis africana* | White Stinkwood | *Nidorella resedifolia* - | - |
| *Ceratothea triloba* | Wild foxglove | *Ocimum angustifolium* | - |
| *Chamasyce inaequilatera* | Smooth Creeping | *Olea europaea subsp. africana* | Wild Olive |
| *Chamasyce sp.* | Creeping Milkweed | *Oxalis obliquifolia* | Oblique-leaved Sorrel |
| *Dicanthium annulatum* | Marvel grass | *Panicum maximum* | Guinea Grass |
| *Clematis brachiata* | Traveller's Joy | *Panicum schinzii* | Buffalograss |
| *Commelina africana* | Yellow Commelina | *Pappea capensis* | Jacket-plum |
| *Convolvulus sagittatus* | - | *Paspalum dilatatum* | Dallis grass |
| *Corchorus cf. confuses* | - | *Pogonnarthia squarrosa* | Herringbone Grass |
| *Crabbea hirsuta* | Prickle Head | *Rhus lancea* | Karee tree |
| *Crinum macowanii* | River Lily | *Rhus leptodictya* | Mountain Karee |
| *Cucumis hirsutus* | Wild Cucumber | *Rhus pyroides var. pyroides* | Common Current |
| *Cynodon dactylon* | - | *Rhynchosia caribaea* | - |
| *Cyphostemma sandersonii* | Felted Tree Grape | *Salvia reflexa* | Mintweed |
| *Dicrostachys cinerea* | Sickle-bush | *Salvia repens* | Kruipsalie |
| *Digitaria eriantha* | Common Finger Grass | *Scabiosa columbaria* | Wild Scabiosa |
| *Diospyros lycioides subsp. guerkei* | Bluebush | *Sclerocarya birrea* subsp *caffra* | Marula tree |
| *Dipcadi viride* | - | *Setaria nigrirostris* | - |
| *Ehretia rigida subsp. rigida* | Puzzle Bush | *Sida rhombifolia* | - |
| *Elionurus muticus* | Wire Grass | *Solanum pandiruforme* | Poison Apple |
| *Eragrostis chloromelas* | Curly Leaf | *Sorghum versicolor* | Black-seed Sorghum |
| *Eragrostis curvula* | Weeping Love Grass | *Tagetes minuta* | Khaki-weed |
| *Eragrostis lehmanniana* | Lehmann Love Grass | *Tarchonanthus camphoratus* | Wild Camphor Bush |
| *Eragrostis rigidior* | Curly Leaf | *Tephrosia sp.* | - |
| *Euclea crispa subsp. crispa* | Blue Guarrie | *Themeda triandra* | Red Grass |
| *Euphorbia ingens* | Naboom | *Thesium sp.* | - |
| Felicia muricata | - | *Tragus berteronianus* | Carrot-seed Grass |

| | | | |
|---|---|---|---|
| Fingerhuthia africana | Blousoetgras, Borseltjiegras, Haargras | *Vernonia oligocephala* | - |
| *Galinsoga parviflora** | Gallant Soldier | *Urochloa mosambicensis* | - |
| *Gladiolus antholyzoides* | - | *Zinnia peruviana* | Redstar Zinnia |
| *Gladiolus crassifolius* | Thick-leaved Gladiolus | *Ziziphus mucronata* | Buffalo Thorn |
| *Grewia flava* | Raisin | *Gymnosporia buxifolia* | Common Spike-thorn |
| *Heteropogon contortus* | Spear Grass | *Hibiscus trionum* | Bladder Hibiscus |
| *Hypoxis rigidula* | - | *Homeria pallida* | Yellow Tulip |
| *Hyparrhenia hirta* | Common Thatching | *Hyperthelia dissoluta* | Yellow Thatching Grass |

**Transformed areas**

Typical of old agricultural lands and disturbed areas, this assemblage is in close proximity to human settlement areas. It is a pioneer grassland, with the forb layer represented by many agrestal weed species. Table 2 provides a general description and list of commonly occurring species within the transformed cultivated land and built up areas.

**Table 2. Biophysical Description – Transformed Areas**

| | | | |
|---|---|---|---|
| **Status** | Transformed and cultivated | | |
| **Conservation Priority** | Low | | |
| **Soil** | Deep vertic clay | | |
| **Rockiness** | 0% | | |
| **Commonly Occurring Native Plant Species – Transformed Areas** | | | |
| **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** |
| *Argemone mexicana* | Yellow Mexican Poppy | *Heteropogon contortus* | Steekgrass |
| *Aristida bipartite* | Rolling Grass | *Hibiscus trionum* | Bladder Hibiscus |
| *Aristida congesta subsp. barbicollis* | Spreading Three-awn | *Hyparrhenia hirta* | Common Thatching |
| *Aristida congesta subsp.congesta* | Tassel three-awn | *Hyperthelia dissolute* | Yellow Thatching |
| *Bidens bipinnata* | Spanish Black-jack | *Ischarmum afrum* | Turfgrass |
| *Bidens pilosa* | Common Black-jack | *Melinis repens* | Natal Red Top |
| *Bothriochloa insculpta* | Pinhole Grass | *Nicotiana glauca* | Wild Tobacco |
| *Cenchrus ciliaris* | Foxtail Buffalo Grass | *Nidorella resedifolia* | - |
| *Chamasyce inaequilatera* | Smooth Creeping Milkweed | *Panicum schinzii* | Sweet Grass |

| | | | |
|---|---|---|---|
| *Chamasyce sp.* | Creeping Milkweed | *Pennisetum setaceum* | Fountain Grass |
| *Cleome monophylla* | - | *Pentarrhinum insipidum* | - |
| *Conyza albida* | Tall Fleabane | *Pogonarthria squarrosa* | Herringbone Grass |
| *Conyza bonariensis* | Horseweed | *Salvia reflexa* Mintweed | Mintweed |
| *Cynodon dactylon* | Couch Grass | *Schkuhria pinnata* | Dwarf Marigold |
| *Datura ferox* | Thorn-apple | *Senecio consanguineus* | Starvation Senecio |
| *Datura stramonium* | Common Thorn Apple | *Sesamum triphyllum* | Wild Sesame |
| *Dichanthium annulatum* | Vlei Finger Grass | *Sesbania bispinosa* | Spiny Sesbania |
| *Dicrostachys cinerea* | Sickle-bush | *Sida rhombifolia* | - |
| *Digitaria eriantha* | Common Finger Grass | *Solanum panduriforme* | Bitter Apple |
| *Enneapogon cenchroides* | Nine-awned Grass | *Sorghum cf. halepense* | Johnson Grass |
| *Eragrostis curvula* | Weeping Love Grass | *Sorghum versicolor* | Black-seed |
| *Eragrostis lehmanniana* | Lehmann Love Grass | *Tagetes minuta* | Khaki-weed |
| *Eragrostis chloromelas* | Blue Love Grass | *Themeda triandra* | Red oat grass |
| *Euphorbia geniculata* | Wild Pointsettia | *Tragus berteronianus* | Carrot-seed Grass |
| *Felicia muricta* | Bloubossie | *Urochloa mosambicensis* | Bushveld Signal |
| *Gladiolus sp.* | Gladiolus | *Vernonia oligocephala* | - |
| *Gomphocarpus fruticosus* | Milkweed | *Xanthium strumarium* | Large cocklebur |
| *Grewia flava* | Brandybush | *Zinnia peruviana* | Redstar Zinnia |

**Wetlands: River Systems and Associated Riparian Vegetation**

The wetland units are associated with the drainage lines within the project area. Table 3 provides a general description and list of commonly occurring species along river systems and associated vegetation unit.

**Table 3. Biophysical Description – Watercourses**

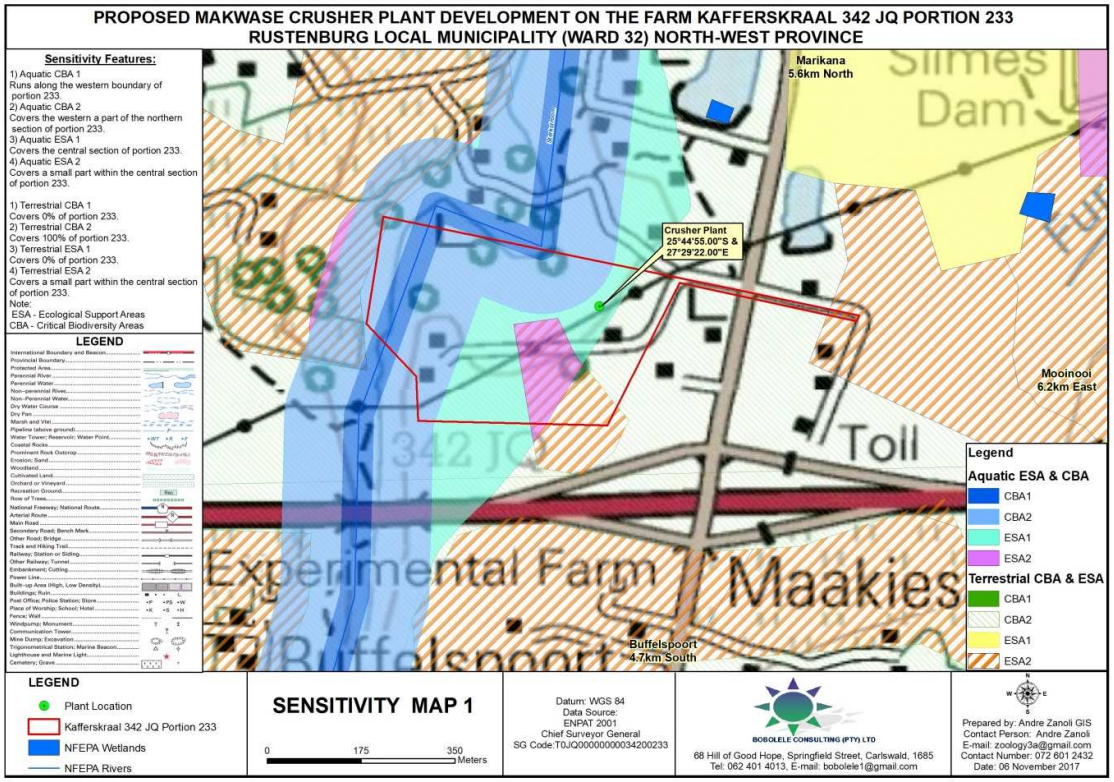
| | | | |
|---|---|---|---|
| **Status** | | Natural | |
| **Conservation Priority** | | High | |
| **Soil** | | Hydromorphic | |
| **Rockiness** | | 0-50% | |
| **Commonly Occurring Native Plant Species – Wetlands** | | | |
| **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** |
| *Acacia karroo* | Sweet Thorn | *Melia azedarach* | Seringa |

| | | | |
|---|---|---|---|
| *Acacia robusta* | Thorn | *Morus alba* | White Mulberry |
| *Agrostis lachnantha* | Bent Grass | *Panicum schinzii* | Sweet Grass |
| *Andropogon schirensis* | Rumiya | *Paspalum urvillei* | Vasey Grass |
| *Bidens bipinnata* | Spanish Black-jack | *Persicaria lapathifolia* | Spotted Knotweed |
| *Bidens pilosa* | Common Black-jack | *Persicaria serrulata* | Snake Root |
| *Bothriochloa bladhii* | Purple Plume Grass | *Phragmites australis* | Common Reed |
| *Bothriochloa insculpta* | Pinhole Grass | *Polygala hottentotta* | - |
| *Carissa bispinosa* | Num-num | *Populus x canescens* | - |
| *Celtis africana* | White Stinkwood | *Ranunculus multifidis* | Common Buttercup |
| *Clematis brachiata* | Traveller's Joy | *Rhus lancea* | Karee |
| *Combretum erythrophyllum* | River Bushwillow | *Rhus pyroides var* | |
| *Cynoglossum cf. hirsutum* | Hound's Tongue | *Rumex crispus* | Curly Dock |
| *Cynodon dactylon* | Couch Grass | *Salvia repens* Kruipsalie | Kruipsalie |
| *Cyperus cf. longus* | - | *Schoenoplectus cf.* | - |
| *Dichanthium annulatum* | Finger Grass | *Schkuhria pinnata* | Bitterbos |
| *Eragrostis plana* | Tough Love Grass | *Searsia lancea* | - |
| *Eragrostis curvula* | Weeping Love Grass | *Searsia pyroides* | - |
| *Eragrostis lehmanniana* | Lehmann Love Grass | *Sesbania bispinosa* | - |
| *Eucalyptus sp* | Gum | *Setaria nigrirostris* | - |
| *Heteropogon contortus* | Spear Grass | *Solanum seaforthianum* | Slender Potato |
| *Hyparrhania dregeana* | Blue Thatching Grass | *Sporobolus africanus* | Ratstail Dropseed |
| *Hyparrhenia hirta* | Common Thatching | *Tagetes minuta* | Khaki-weed |
| *Hyperthelia dissoluta* | Yellow Thatching Grass | *Themeda triandra* | Grass |
| *Imperata cylindrica* | Blady Grass | *Tiphonia rotundifolia* | Red Sunflower |
| *Jacaranda mimosifolia* | Jacaranda | *Typha capensis* | Bulrush |
| *Jamesbrittenia aurantiaca* | - | *Verbena bonariensis* | Tall Verbena |
| *Juncus effusus* | - | *Veronica anagallisaquatica* | - |
| *Lantana camara* | Lantana | *Zinnia peruviana* | Redstar Zinnia |
| *Ledebouria revoluta* | - | *Ziziphus mucronata* | Thorn |

**Ecologically Sensitive Habitats at the Project Area**

A biodiversity sensitivity map (Figure 3) was developed by Bobolele Consulting. Salient points regarding these sensitive areas are summarized below:

- All wetland areas, including the Sterkstroom River classified as Aquatic CBA 1, are regarded as having increased ecological sensitivity due to the contribution of these features to faunal migratory connectivity, wetland eco services provision and the unique habitat provided for fauna and flora. Taking the condition of each group of wetlands into account it was determined that the Sterkstroom River is of high ecological sensitivity.
- The transformed habitat unit has low ecological sensitivity.
- The scattered habitat Bushveld unit has been less impacted than the transformed habitat unit and still hosts a reasonably high level of biodiversity and suitable habitat for fauna and flora. These areas are however fragmented and have been impacted by edge effects from adjacent mining and agriculture.



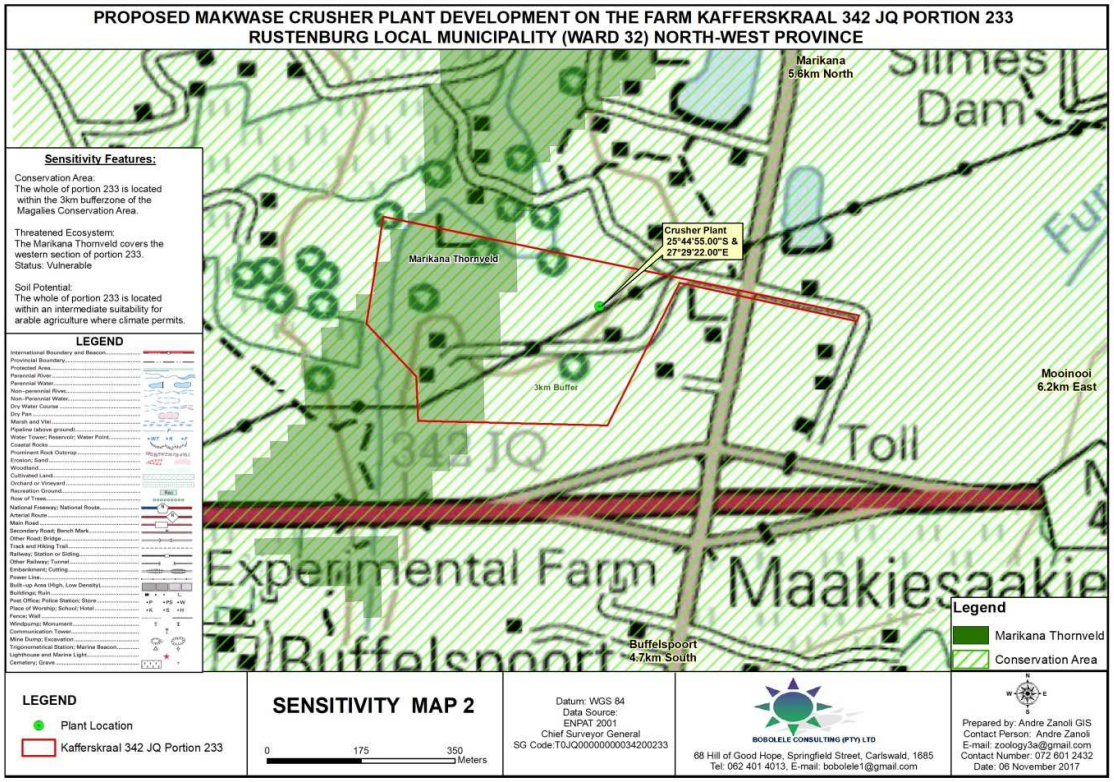



**Figure 3: A biodiversity sensitivity map**

### Red Data Listed Floral and Protected Tree Species

SAS (2014) sourced Red Data species lists from the Pretoria Computer Information Systems (PRECIS) for the relevant map grid references (2527CB, 2527DA and 2527DC). SAS then determined the probability of occurrence of these Red Data species by considering habitat suitability within the project area. This assessment found that there is a low probability of any of these species occurring within the project area as outlined in the table 4 below.

**Table 4. Probability of Red Data Floral Species Occurring Within the Project Area**

| Scientific Name | Probability of occurrence | Motivation |
|---|---|---|
| *Frithia pulchra* | 13% | No suitable habitat |
| *Ilex mitis* | 33% | No suitable habitat |
| *Stenostelma umbelliferrum* | 40% | If present, this species will be located within the wetland habitat |
| *Prunus Africana* | 20% | No suitable habitat |

### Exotic Plant Species

Scattered alien and invasive plant species occur throughout the project area. A list of many of the plant species is provided in Table 5 below.

**Table 5. Exotic/Alien Plant Species Recorded at the Site**

| Species Name | Common Name | Growth Form | Category |
|---|---|---|---|
| *Amaranthus spinosa* | Thorny pigweed | Forb | - |
| *Araujia sericifera* | Moth catcher | Shrub | Category 1 |
| *Argemone Mexicana* | Yellow Mexican Poppy | Forb | Category 1 |
| *Bidens pilosa* | Common Blackjack | Forb | Weed |
| *Datura ferox* | Large Thorn Apple | Forb | Category 1 |
| *Datura stramonium* | mon Thorn Apple | Forb | Category 1 |
| *Brachiaria eruciformis* | Sweet Signal Grass | Grass | Weed |
| *Eucalyptus camaldulensis* | Red river gum | Tree | Category 2 |
| *Euphorbia geniculate* | Wild Pointsettia | Succulent | Weed |
| *Galinsoga parviflora* | Gallant Soldier | Forb | Weed |
| *Gomphrena celosiodes* | Prostrate globe amaranth | Shrub | Weed |
| *Grevellia robusta* | Australian silky oak | Tree | Category 3 |
| *Hibiscus trionum* | Bladder Hibiscus | Forb | Weed |
| *Jacaranda mimosifolia* | Jacaranda | Tree | Category 3 |
| *Lantana camara* | Common Lantana | Shrub | Category 1 |
| *Lepidium bonariense* | Pepperweed | Forb | Weed |
| *Melia azedarach* | Syringa | Tree | Category 3 |
| *Morus alba* | White Mulberry | Tree | Category |
| *Nicotiana glauca* | Wild Tobacco | Shrub | Category 1 |
| *Oxalis obliquifolia* | Oblique - leaved Sorrel | Forb | Weed |
| *Paspalum urvillei* | Vasey Grass | Grass | Weed |
| *Pennisetum setaceum* | Fountain Grass | Grass | Category 1 |
| *Persicaria lapathifolia* | Spotted Knotweed | Forb | Weed |
| *Persicaria serrulata* | Knotweed | Forb | Weed |
| *Physalis angulate* | Wild gooseberry | Shrub | Weed |
| *Populus x canescens* | Grey Poplar | Tree | Category 2 |
| *Pseudognaphallum luteo - album* | Cudweed | Forb | Weed |
| *Phytolacca dioica* | Belhambra | Tree | Category 3 |
| *Rumex crispus* | Curly Dock | Forb | Weed |
| *Salvia reflexa* | Mintweed | Forb | Weed |
| *Schkuhria pinnata* | Dwarf Marigold | Forb | Weed |

| | | | |
|---|---|---|---|
| *Sesbania bispinosa* | Spiny sessbania | Shrub | Weed |
| *Sida rhombifolia* | Arrowleaf Sida | Forb | Weed |
| *Solanum seaforthianum* | Slender Potato Creeper | Forb | Weed |
| *Sorghum halepense* | Aleppo Grass | Grass | Category 2 |
| *Tacoma stans* | Yellow bells | Tree | Category 1 |
| *Tagetes minuta* | Khaki Weed | Forb | Weed |
| *Tipuana tipu* | Tipu tree | Tree | Category 3 |
| *Verbena bonariensis* | Tall Verbena | Forb | Weed |
| *Veronica anagallis - aquatica* | Water Speedwell | Forb | Weed |
| *Xanthium strumarium* | Large cocklebur | Shrub | Category 1 |
| *Zinnia peruviana* | Redstar Zinnia | Forb | Weed |

# IMPACT ASSESSMENT AND MITIGATION

Mankind depends on the natural environment for a large number of ecological services provided for by ecosystems, ecological processes and plant species in general. However, any development activities in natural systems will impact on the surrounding natural environment and usually in a negative way. In order to limit or negate these impacts, the source, extent, duration and intensity of the possible impacts needs to be identified. Once the significance of the impacts is understood, the development could both adequately plan for and mitigate these impacts to a best practise and acceptable level. However, if the impacts are significant, especially in already threatened ecosystems and vegetation units, and no adequate mitigation measures could reduce or avert these impacts, then the development should not be allowed to proceed.

“The mitigation hierarchy is inherently proactive. It illustrates the steps that should be followed to firstly avoid, then minimize, then repair or restore, and finally compensate for or offset the negative effects of any development on biodiversity” (SANBI, 2012). Therefore in areas of high conservation importance, avoidance of the impacts should be considered first. Within the studied area, much of the assumed area to be impacted is of medium to low concern, except for the moist grasslands associated with wetlands/drainage lines areas. Mitigation measures to limit impacts and conserve the ecological function of these areas should thus be included in the Environmental Management Programme (EMPr). From the perspective of minimizing impacts on biodiversity and ecosystem services, on-going rehabilitation and monitoring of the indigenous vegetation during construction offers significant benefits over rehabilitation only after completion of construction (SANBI, 2012). This approach effectively reduces the time during which negative impacts endure and any associated risks.

## Impacts Statement

The proposed site location will be on mostly transformed habitat that is of no conservation value. However, minor impacts may be extended to undisturbed and wetland areas. Existing dirt roads can be utilised to limit impacts, while transformed areas could be utilised as construction camps and storage areas.

## Risk Assessment of Impacts

The risk associated with the possible impacts were assessed based on the risk rating template below and the result of the main impacts are presented below.

**Step 1**: Determine the **PROBABILITY** of the impact by calculating the average between the Frequency of the Aspect, the Availability of a pathway to the receptor and the availability of the receptor

| **FREQUENCY OF ASPECT/UNWANTED EVENT** | Score | **AVAILABILITY OF PATHWAY FROM THE SOURCE TO THE RECEPTOR** | Score | **AVAILABILITY OF RECEPTOR** | Score |
|---|---|---|---|---|---|
| Never known to have happened, but may happen | 1 | A pathway to allow for the impact to occur is never available | 1 | The receptor is never available | 1 |
| Known to happen in industry | 2 | A pathway to allow for the impact to occur is almost never available | 2 | The receptor is almost never available | 2 |
| < once a year | 3 | A pathway to allow for the impact to occur is sometimes available | 3 | The receptor is sometimes available | 3 |
| Once per year to up to once per month | 4 | A pathway to allow for the impact to occur is almost always available | 4 | The receptor is almost always available | 4 |
| Once a month - Continuous | 5 | A pathway to allow for the impact to occur is always available | 5 | The receptor is always available | 5 |

**Step 2**: Determine the **MAGNITUDE** of the impact by calculating the average of the factors above.

| **SOURCE** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Duration of impact** | Score | **Extent** | Score | **Volume / Quantity / Intensity** | Score | **Toxicity / Destruction Effect** | Score | **Reversibility** | Score | **Sensitivity of environmental component** | Score |
| Lasting days to a month | 1 | Effect limited to the site. (metres); | 1 | Very small quantities / volumes / intensity (e.g. < 50L or < 1Ha) | 1 | Non toxic (e.g. water) / Very low potential to create damage or destruction to the environment | 1 | Bio-physical and/or social functions and/or processes will remain naltered. | 1 | Current environmental component(s) are largely disturbed from the natural state. Receptor of low significance / sensitivity | 1 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lasting 1 month to 1 year | 2 | Effect limited to the activity and its immediate surroundings. (tens of metres) | 2 | Small quantities / volumes / intensity (e.g. 50L to 210L or 1Ha to 5Ha) | 2 | Slightly toxic / Harmful (e.g. diluted brine) / Low potential to create damage or destruction to the environment | 2 | Bio-physical and/or social functions and/or processes might be negligibly altered or enhanced / Still reversible | 2 | Current environmental component(s) are moderately disturbed from the natural state. No environmentally sensitive components. | 2 |
| Lasting 1 – 5 years | 3 | Impacts on extended area beyond site boundary (hundreds of metres) | 3 | Moderate quantities / volumes / intensity (e.g. > 210 L < 5000L or 5 – 8Ha) | 3 | Moderately toxic (e.g. slimes) Potential to create damage or destruction to the environment | 3 | Bio-physical and/or social functions and/or processes might be notably altered or enhanced / Partially reversible | 3 | Current environmental component(s) are a mix of disturbed and | 3 |
| Lasting 5 years to Life of Organisation | 4 | Impact on local scale / adjacent sites (km's) | 4 | Very large quantities / volumes / intensity (e.g. 5000 L – 10 000L or 8Ha– 12Ha) | 4 | Toxic (e.g. diesel & Sodium Hydroxide) | 4 | Bio-physical and/or social functions and/or processes might be considerably altered or enhanced / potentially irreversible | 4 | Current environmental component(s) are in a natural state. Environmentally sensitive environment / receptor (endangered species / habitats etc.). | 4 |
| Beyond life of Organisation / Permanent impacts | 5 | Extends widely (nationally or globally) | 5 | Very large quantities / volumes / intensity (e.g. > 10 000 L or > 12Ha) | 5 | Highly toxic (e.g. arsenic or TCE) | 5 | Bio-physical and/or social functions and/or processes might be severely/substantially altered or | 5 | Current environmental component(s) are in a pristine natural state. Highly Sensitive area | 5 |

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| | | | | | | | | enhanced / Irreversible | | | |

**Step 3**: Determine the **SEVERITY** of the impact by plotting the averages that were obtained above for Probability and Magnitude in the table below.

| **ENVIRONMENTAL IMPACT RATING / PRIORITY** | | | | | |
|---|---|---|---|---|---|
| | **MAGNITUDE** | | | | |
| **PROBABILITY** | **1**<br>**Minor** | **2**<br>**Low** | **3**<br>**Medium** | **4**<br>**High** | **5**<br>**Major** |
| **5**<br>**Almost Certain** | Low | Medium | High | High | High |
| **4**<br>**Likely** | Low | Medium | High | High | High |
| **3**<br>**Possible** | Low | Medium | Medium | High | High |
| **2**<br>**Unlikely** | Low | Low | Medium | Medium | High |
| **1**<br>**Rare** | Low | Low | Low | Medium | Medium |

**Risk Assessment – Disturbance / impacts on vegetation within and around watercourses, loss of stabilising vegetation and function thereof**

| Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss | Risk rating (before mitigation) | | | Environmental objective | Degree to which impact can be reversed and the supporting mitigatory action plan | Timeframe | Responsibility | Risk rating (after mitigation) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Probability | Magnitude | Severity | | | | | Probability | Magnitude | Severity |
| **ENVIRONMENTAL COMPONENT:** Flora | | | | | | | | | | |
| **ACTIVITY:** Destruction of the vegetation within and in proximity to the watercourses will impact on its hydrological function. During operational phase of the development, polluted water or sediment reaching the watercourse could have detrimental effects on the vegetation and hydrology. | | | | | | | | | | |
| **PROJECT PHASE APPLICABILITY: Construction and Operation** | | | | | | | | | | |
| *Impact description:* Polluted water or sediment reaching the watercourse during construction and operation will have detrimental effects on the vegetation and hydrology of the watercourse.<br>The downstream Removal of vegetation and subsequent soil erosion could lead to increased sedimentation and turbidity, which could then reduce water storage capacity, smother vegetation, and decrease oxygen concentration.<br>The lack of natural vegetation in and around the watercourses could | 5 | 3.5 | H | Prevent/limit damage to watercourse vegetation during construction and operation | *Degree to which impact can be reversed*: Reversible with human intervention, if immediate action is taken. If degradation is allowed to proceed, the impact may become irreversible.<br><br>Mitigation:<br>*Construction:*<br>-Project engineers should compile a method statement, outlining the construction methodologies. The required mitigation measures to avoid the impacts on the watercourse should be contained within the method statement. The method statement must be approved by the ECO and be available on | Commence during Planning phase | ECO/All contractors and workers /Management | 3 | 2.8 | M |

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| drastically reduce water holding capacity and the subsequent loss of the ecological function of the vegetation as catchment to the watercourse. In addition, pollutants could reach the watercourse and deteriorate the water quality which could impact on the surrounding and downstream vegetation.<br><br>*Extent of impact:* Local<br><br>*Duration of impact:* Lasting during construction phase and a possibility of extending into the operational phase and for the duration thereof | | | | | site for reference purposes.<br>-Make use of existing roads and tracks where feasible, rather than creating new routes through watercourses.<br>-Runoff from roads must be managed to avoid erosion and pollution problems.<br>-Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.<br>-Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.<br>-Prevent polluted water from reaching the watercourses.<br>-An ecologically sound, storm water management plan must be implemented during construction and ensure that the stormwater management of the completed development is adequate to prevent deterioration of the watercourse.<br>-Do not allow stormwater to be canalised.<br>-Prevent contamination of rainwater on the site.<br>-Place and maintain erosion control barriers as appropriate to prevent sedimentation into the watercourse and moist grasslands.<br>-Trucks and equipment should only be washed in dedicated areas and the dirty water is not allowed to discharge into the watercourse or | | | | | |

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| | | | | | surrounding natural vegetation.<br>*Operational phase*<br>-Place and maintain erosion control barriers as appropriate to prevent sedimentation.<br>-Ensure that the vegetation disturbed during construction is rehabilitated with the plant species that naturally occur and monitor rehabilitation for at least three years after construction is complete. If monitoring observed failed rehabilitation or erosion, corrective action should be taken immediately to determine the cause and correct the problem.<br>-Do not disturb soil or vegetation in watercourses unnecessary during operation. Ensure that maintenance work does not take place haphazardly, but according to a fixed plan. | | | | | |

## Risk Assessment – removal or destruction of plants of conservation concern

| Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss | Risk rating (before mitigation) | | | Environmental objective | Degree to which impact can be reversed and the supporting mitigatory action plan | Timeframe | Responsibility | Risk rating (after mitigation) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Probability | Magnitude | Severity | | | | | Probability | Magnitude | Severity |
| **ENVIRONMENTAL COMPONENT:** Flora | | | | | | | | | | |
| **ACTIVITY:** Possible destruction of plants of conservation concern due to construction activity where these plants potentially occur (potentially watercourses). Maintenance and edge effects in the operational phase, could trample on these plants if they are present | | | | | | | | | | |
| **PROJECT PHASE APPLICABILITY: Construction and operation** | | | | | | | | | | |
| *Impact description:* Although no threatened or protected plant species were recorded at the time of the site visits, watercourses in particular provide suitable habitat. Edge effects or pollution may impact on this suitable habitat of the threatened species.<br><br>*Extent of impact:* Local<br><br>*Duration of impact*: Lasting during construction phase and a possibility of extending into the operational phase and for the duration thereof | 3 | 2 | M | Avoid impact on suitable habitat for threatened/ protected species | Mitigation:<br>*Construction phase:*<br>-Construction activities must be restricted to previously disturbed and transformed areas as planned and avoid the suitable habitat of these species.<br>-If any bulbous species are unearthed by construction, these should be identified by an ecologist. If the species are found to be of conservation concern, the North West Department of Rural, Environmental and Agricultural Development should be consulted for a permit to either replant the species or relocate them to suitable habitat. | Construction Phase | Planners and management | 2 | 2 | L |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Operational Phase:*<br>-Maintenance to the crusher plant or associated activities may not trample natural and must be restricted to the previously disturbed footprint of construction | | | | | |

**Risk Assessment – Exposure of the soil to erosion and soil compaction, subsequent sedimentation of proximate watercourses**

| **Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss** | **Risk rating (before mitigation)** | | | **Environmental objective** | **Degree to which impact can be reversed and the supporting mitigatory action plan** | **Timeframe** | **Responsibility** | **Risk rating (after mitigation)** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Probability | Magnitude | Severity | | | | | Probability | Magnitude | Severity |
| **ENVIRONMENTAL COMPONENT:** Flora | | | | | | | | | | |
| **ACTIVITY:** The removal of surface vegetation and movement of heavy machinery could result in soil compaction and erosion. | | | | | | | | | | |
| **PROJECT PHASE APPLICABILITY: Construction and Operational** | | | | | | | | | | |
| *Impact description:*<br>The removal of surface vegetation will expose the soils, which in rainy events | 3 | 2 | M | Prevent soil erosion and soil compaction | Degree to which impact can be reversed: Reversible with human intervention, if immediate action is taken. If degradation is allowed to proceed, the impact may become irreversible<br><br>Mitigation: | Commence at Construction Phase | ECO / All contractors and workers /Management | 2 | 2 | L |

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|---|---|---|---|---|---|---|---|---|---|---|
| could wash down into watercourses, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully. The movement of heavy machinery could result in soil compaction that will modify habitats, destroy vegetation and inhibit re-vegetation. Soil compaction as a result of vehicles and traffic, could lead to a decrease of water infiltration and an increase of water runoff.<br><br>*Extent of impact:* Local | | | | | -Protect all areas susceptible to erosion (especially stockpiled soils and materials such as sand and tar) and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.<br>-Do not allow erosion to develop on a large scale before taking action.<br>□ Make use of existing roads and tracks where feasible, rather than creating new routes through grassland areas.<br>-Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005).<br>-Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.<br>- Colonisation of the disturbed areas by plants species from the surrounding natural vegetation must be monitored to ensure that vegetation cover is sufficient within one growing season. If not, then the areas need to be rehabilitated with a grass seed mix containing species that naturally occur within the study area.<br>-Vehicles may not veer from the dedicated roads.<br>-Once construction is complete, obsolete roads should be obliterated by breaking the surface crust and erecting earth embankments to prevent erosion, while the natural species composition should be re-established.<br>-It is advised that environmental audits be undertaken by an independent party during this construction period, especially in sensitive areas. | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Duration of impact:* Lasting during construction phase and a possibility of extending into the operational phase and for the duration thereof | | | | | | | | | | |

## Risk Assessment – Spread of Alien Invasive Plant Species

| **Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss** | **Risk rating (before mitigation)** | | | **Environmental objective** | **Degree to which impact can be reversed and the supporting mitigatory action plan** | **Timeframe** | **Respons ibility** | **Risk rating (after mitigation)** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Probability | Magnitude | Severity | | | | | Probability | Magnitude | Severity |
| **ENVIRONMENTAL COMPONENT:** Flora | | | | | | | | | | |
| **ACTIVITY:** The seed of alien invasive plant species that occur on and in the vicinity of the construction areas could spread into the disturbed soil. Also, the construction vehicles and equipment were likely used on various other sites and could introduce alien invasive plant seeds or indigenous plants not belonging to this vegetation unit to the construction site. | | | | | | | | | | |
| **PROJECT PHASE APPLICABILITY** | **Construction** | x | | | | | | | | |
| | **Operation** | | | | | | | | | |
| | **Decommissioning** | | | | | | | | | |
| *Impact description:* Spread of alien | 3 | 2.5 | M | Remove alien invasive plant | Degree to which impact can be reversed: | Commence prior to | ECO / All | 2 | 2 | L |

| **Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss** | **Risk rating (before mitigation)** | | | **Environmental objective** | **Degree to which impact can be reversed and the supporting mitigatory action plan** | **Timeframe** | **Respons ibility** | **Risk rating (after mitigation)** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Probability | Magnitude | Severity | | | | | Probability | Magnitude | Severity |
| invasive plant species from the transformed site to the natural vegetation, which will result in the deterioration of the remaining natural vegetation.<br><br>*Extent of impact:*<br>Local<br><br>*Duration of impact*: Lasting during construction phase | | | | species from the site and immediate surrounds and monitor re-emergence | Reversible with human intervention, if immediate action is taken. If degradation is allowed to proceed, the impact may become irreversible<br><br>Mitigation:<br>• Alien invasive species that were identified within the study area should be removed prior to construction. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation.<br><br>• All alien seedlings and saplings must be removed as they | Construction Phase | contract ors and workers /Manag ement | | | |

| Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss | Risk rating (before mitigation) | | | Environmental objective | Degree to which impact can be reversed and the supporting mitigatory action plan | Timeframe | Responsibility | Risk rating (after mitigation) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Probability | Magnitude | Severity | | | | | Probability | Magnitude | Severity |
| | | | | | become evident for the duration of construction.<br>• Manual / mechanical removal is preferred to chemical control.<br>• All construction vehicles and equipment, as well as construction material should be free of soil and plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the study area. | | | | | |

## CONCLUSION

The project area falls within the Marikana Thornveld which is an important vegetation type that requires careful consideration when developing projects. The project area includes a terrestrial Critical Biodiversity Area 2 (CBA2) and Aquatic CBA 1 that runs along the western boundary (North West Department of Agriculture, Conservation, Environment and Rural Development, 2009).

The proposed and preferred site comprised transformed vegetation that is of little conservation value and therefore suitable to the proposed development. Provided that mitigation measures as set out in this report are implemented as a minimum, no objection to preferred site are raised from a vegetation perspective.

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