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Terrestial Biodiversity Impact Assessment Report

A TERRESTIAL BIODIVERSITY IMPACT ASSESSMENT FOR THE PROPOSED INFRASTRUCTURE DEVELOPMENT ON THE BMW SITE THAT FORMS PART OF THE "CHANGE THE FACE OF KIMBERLEY CITY"PROJECT, NORTHERN CAPE PROVINCE

AUGUST 2020

Prepared for: Ndi Geological Consulting Services
Compiled by Dr BJ Henning
Document version 1.0 – Draft

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A TERRESTIAL BIODIVERSITY IMPACT ASSESSMENT FOR THE PROPOSED INFRASTRUCTURE DEVELOPMENT ON THE BMW SITE THAT FORMS PART OF THE "CHANGE THE FACE OF KIMBERLEY CITY"PROJECT, NORTHERN CAPE PROVINCE

August 2020

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Curriculum Vitae

CURRICULUM VITAE

B J Henning

PhD Plant Ecology

PERSONAL DETAILS

Name:	BAREND JOHANNES HENNING
Date of Birth:	1976-09-06
Profession/Specialization:	Senior Ecologist
Years with Firm:	6 years (previously 2006-2012 & since May 2020)
Nationality:	South African
Years' experience:	15 years

QUALIFICATIONS

University attended:	University of Pretoria, Pretoria (1995- 2002) PhD Plant Ecology, MSc (Botany), BSc (Hons.), BSc

COURSES

Advanced Wetland Course (UP CE, 2010)

Wetland Rehabilitation Course (UFS, 2015)

Course on wetland offsets (SANBI)

KEY QUALIFICATIONS AND EXPERIENCE

- Senior Ecologist / Soil Science Specialist for Ages Limpopo since September 2006 to 2012 and again since May 2020 involved in the following aspects:
    - Agricultural potential and land capability studies of soils on farms. (Reference: Mr Johan Botha, AGES Limpopo; 0152911577, Mr Herman Gildenhuys, Exigo; 0127512160;)
    - Spatial Development Frameworks;
    - Strategic Development Area Frameworks for local municipalities

  - Vegetation surveys, sensitivity and zoning analysis of development sites, including eco-estates, mines, residential developments, shopping centres, roads, water supply and other related infrastructure etc (Reference: Mr Johan Botha, AGES Limpopo; 0152911577, Mr Herman Gildenhuys, Exigo; 0127512160;)
  - Faunal analysis and scoping reports (Reference: Mr Johan Botha, AGES Limpopo; 0152911577, Mr Herman Gildenhuys, Exigo; 0127512160)
  - Avifauna studies related to solar plant and power line connection developments;
  - Wetland delineations and functional capacity assessments (completed advanced wetland course of the Continued Education Department, University of Pretoria 2010 as well as Wetland rehabilitation course of the University of the Free State);
  - Wildlife Management Plans and habitat assessment for rare and endangered game species;
  - GIS related functions;

- Senior Ecologist for Exigo (previously AGES Gauteng) November 2012 to April 2020. Involved in all of the abovementioned aspects;:
- Environmental Consultant for Envirodel Wildlife & Ecological Services cc and Dubel Integrated Environmental Services, Polokwane 2004 - 2006. Involved in the following aspects:
  - Wildlife management plans for game farms /reserves throughout the Limpopo Province
  - Environmental impact assessments (vegetation surveys and faunal scoping reports), habitat suitability analysis and report compilation.
  - Coordinating and performing grass monitoring surveys for the Limpopo Tourism and Parks Board
  - Soil potential studies.
- Environmental Consultant for Ficus – pro Environmental Services cc., Modimolle 2004 / 5. Involved mostly in fieldwork, report compilation or impact studies. Reference: Mr. R. Venter (0147173378)

- Subconsultant for AGES (Africa Geo-Environmental Services 2005-2006. Vegetation surveys and sensitivity zoning and analyses. Mr Johan Botha (0836449957)
- Eco-Agent environmental services cc, Pretoria 2002 - 2004. Involved in environmental impact studies. Prof G. J. Bredenkamp (0825767046), University of Pretoria.
- Enviroguard environmental services cc, Heidelberg 2002 - 2004. Involved in environmental impact studies. Prof L. R Brown (0825767046).
- GIS related aspects for all the above-mentioned aspects on projects

POSITION AND DUTIES

Employed as Senior Ecological Specialist. Main duties and responsibilities include:

- Compilation of project proposals;
- Conducting specialist assessments
    - Ecological assessments
    - Soils and Land use potential studies;
    - Wetland assessments;
    - Wetland rehabilitation plans;
    - Ecological & wetland monitoring;
    - Biodiversity Action & Management Plans;
    - Agricultural assessments;
    - Avifauna assessments;
    - Wildlife Management Plans and assessments.
    - Rehabilitation Strategy & Implementation Programmes (RSIPs)
- Liaison with clients;
- GIS and map compilation;
- Project admin and management;
- Integration and interaction with the environmental consultants;
- Travelling;
- Any ad hoc duties that may be given by immediate manager.

Declaration

I, DR BJ Henning declare that -

- I act as the independent specialist;
- I will perform the work relating to the project in an objective manner, even if this results in views and findings that are not favourable to the project proponent;
- 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 project, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998; the Act), regulations and any guidelines that have relevance to the activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will consider, to the extent possible, the matters listed in Regulation 18 of the NEMA EIA Regulations;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the project proponent 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 project; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority or project proponent;
- All the particulars furnished by me in this document are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the Act.

_____

SIGNATURE OF SPECIALIST

AUGUST 2020

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NOTATIONS AND TERMS

Biota: living things; plants, animals, bacteria

Bottomland: the lowlands along streams and rivers, on alluvial (river deposited) soil.

Connectivity: in this context, referring to either the upstream-downstream or lateral (between the channel and the adjacent floodplain) connectivity of a drainage line. Upstream-downstream connectivity is an important consideration for the movement of sediment as well as migratory aquatic biota. Lateral connectivity is important for the floodplain species dependent on the wetting and nutrients associated with overbank flooding

Endorheic: closed drainage e.g. a pan.

Floristic: of flora (plants).

Floodplain: wetland inundated when a river overtops its banks during flood events resulting in the wetland soils being saturated for extended periods of time.

Gley: soil material that has developed under anaerobic conditions because of prolonged saturation with water. Grey and sometimes blue or green colours predominate but **mottles** (yellow, red, brown and black) may be present and indicate localised areas of better aeration.

Groundwater: subsurface water in the zone in which permeable rocks, and often the overlying soil, are saturated under pressure equal to or greater than atmospheric.

Horizon: see soil horizons.

Hydrophyte: any plant that grows in water or on a substratum that is at least periodically deficient in oxygen because of soil saturation or flooding; plants typically found in wet habitats.

Hydro-geomorphic: refers to the water source and geology forms.

Hydrology is defined in this context as the distribution and movement of water through a wetland and its soils.

Geomorphology is defined in this context as the distribution and retention patterns of sediment within the wetland.

Infilling: dumping of soil or solid waste onto the wetland surface. Infilling generally has a very high and permanent impact on wetland functioning and is like drainage in that the upper soil layers are rendered less wet, usually so much so that the area no longer functions as a wetland.

Mottles: soils with variegated colour patters are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.

Organic soil material: soil material with a high abundance of un-decomposed plant material and humus.

Palustrine (wetland): all non-tidal wetlands dominated by persistent emergent plants (e.g. reeds) emergent mosses or lichens, or shrubs or trees (see Cowardin *et al.*, 1979).

Perched water table: the upper limit of a zone of saturation in soil, separated by a relatively impermeable unsaturated zone from the main body of groundwater.

Permanently wet soil: soil which is flooded or waterlogged to the soil surface throughout the year, in

most years.

Riparian: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as **riparian wetlands**. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

Roughness coefficient: an index of the roughness of a surface; a reflection of the frictional resistance offered by the surface to water flow.

Runoff: total water yield from a catchment including surface and subsurface flow.

Seasonally wet soil: soil which is flooded or waterlogged to the soil surface for extended periods (>1 month) during the wet season but is predominantly dry during the dry season.

Sedges: grass-like plants belonging to the family *Cyperaceae*, sometimes referred to as nutgrasses. Papyrus is a member of this family.

Soil drainage classes: describe the soil moisture conditions as determined by the capacity of the soil and the site for removing excess water. The classes range from very well drained, where excess water is removed very quickly, to very poorly drained, where excess water is removed very slowly. Wetlands include all soils in the very poorly drained and poorly drained classes, and some soils in the somewhat poorly drained class. These three classes are roughly equivalent to the permanent, seasonal and temporary classes

Soil horizons: layers of soil that have uniform characteristics and have developed through pedogenic processes; they are bound by air, hard rock or other horizons (i.e. soil material that has different characteristics).

Soil profile: the vertically sectioned sample through the soil mantle, usually consisting of two or three horizons (Soil Classification Working Group, 1991).

Soil saturation: the soil is considered saturated if the water table or **capillary fringe** reaches the soil surface (Soil Survey Staff, 1992).

Temporarily wet soil: the soil close to the soil surface (i.e. within 50 cm) is wet for periods > 2 weeks during the wet season in most years. However, it is seldom flooded or saturated at the surface for longer than a month.

Terrain unit classes: areas of the land surface with homogenous form and slope. Terrain may be seen as being made up of all or some of the following units: crest (1), scarp (2), midslope (3), footslope (4) and valley bottom (5).

Transpiration: the transfer of water from plants into the atmosphere as water vapour

Unchanneled valley bottom: linear fluvial, net depositional valley bottom surfaces which do not have a channel. The valley floor is a depositional environment composed of fluvial or colluvial deposited sediment. These systems tend to be found in the upper catchment areas.

Vegetation is defined in this context as the vegetation structural and compositional state.

Water regime: when and for how long the soil is flooded or saturated.

Water Quality largely self-explanatory and reflecting the changes in quality as a consequence of

changes in land use or as a direct result of activities within the wetland itself that could lead to changes in the quality of the water flowing through and within the wetland

Waterlogged: soil or land saturated with water long enough for anaerobic conditions to develop.

Wetland: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

Wetland catchment: the area up-slope of the wetland from which water flows into the wetland and including the wetland itself.

Wetland delineation: The determination and marking of the boundary of a wetland on a map.

LIST OF ABBREVIATIONS

Abbreviation	Description
CARA	Conservation of Agricultural Resources Act
CSIR	Council for Scientific and Industrial Research
CR	Critically Endangered
EN	Endangered
DD	Data Deficient
DAFF	Department of Agriculture, Forestry and Fisheries
DENC	Department of Environmental Affairs and Nature Conservation
DME	Department of Minerals and Energy Affairs
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPR	Environmental Management Programme Report
ENPAT	Environmental Potential Atlas
GIS	Geographic Information Systems
GPS	Geographical Positioning System
LC	Least Concern
LR	Lower Risk
MAE	Mean Annual Evaporation
MAE	Mean Annual Evaporation
MAMSL	Meter Above Mean Sea Level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
N	Nitrogen
NC	Northern Cape
NEMA	National Environmental Management Act
NFA	National Forest Act
NWA	National Water Act
NWCS	National Wetland Classification System
P	Phosphorus
PQ4	Priority Quaternary Catchment
QDS	Quarter Degree Square
RDL	Red Data List
SANBI	South African National Biodiversity Institute
VU	Vulnerable
WHO	World Health Organisation
WWF	World Wide Fund for Nature

1 ASSIGNMENT

AGES Limpopo (Pty) Ltd was appointed by Ndi Geological Consulting Services to conduct a terrestrial biodiversity impact assessment for the proposed development situated on the BMW site for the proposed project known as “Change the Face of Kimberley City” in the Northern Cape Province.

According to the national web-based environmental screening tool in terms of National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998), the site has a Medium and Low sensitivity from a terrestrial sensitivity perspective. A pre-screening site visit was therefore conducted to determine if a detailed terrestrial biodiversity assessment or a compliance statement would be sufficient. After the site visit the following was concluded:

- A detailed terrestrial biodiversity assessment should be conducted for the site.

This report will include a detailed impact assessment of the proposed development on the biodiversity. This assessment is essential as it will contribute to meeting the requirements of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) in compliance with Gazette No. 43310 Government Notice R320.

The assignment is interpreted as follows: Compile an ecological study on the flora (vegetation units), fauna and general ecology of the site and determine the potential impacts of the proposed development on the fauna and flora of the area as well propose mitigation measures. The study will be done according to guidelines and criteria set by the Northern Cape (NC) Department of Environmental Affairs and Nature Conservation (DENC) for biodiversity studies. To compile this, the following had to be done:

1.1 INFORMATION SOURCES

- All relevant topographical maps, aerial photographs and information (previous studies and environmental databases) related to the ecological components in the study area;
- Requirements regarding the fauna and flora survey as requested by NC DENC;
- Legislation pertaining to the fauna and flora study as relevant;
- Red data species list from the South African National Biodiversity Institute (SANBI).
- Information on plant and animal species recorded for the various Quarter Degree Squares was extracted from the SABIF/SIBIS database hosted by SANBI and the faunal databases hosted by the Animal Demography Unit (ADU). This includes is a considerably larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has not been well sampled in the past.
- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Critical Biodiversity Areas were obtained from the various coverages produced by the

Northern Cape Conservation Plan (2014).

1.2 REGULATIONS GOVERNING THIS REPORT

1.2.1 National Environmental Management Act, 1998 (Act No. 107 of 1998) - Gazette No. 43310 Government Notice R. 320

This report was prepared in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Gazette No. 43310 Government Notice R. 320. Specialist reports includes a list of requirements to be included in a specialist report for an agricultural agr0-ecosystem assessment:

1. A specialist report or a report prepared in terms of these regulations must contain:
    a. Details of
        i. The specialist who prepared the report; and
        ii. The expertise of that specialist to compile a specialist report, including a curriculum vitae;
    b. A declaration that the specialist is independent in a form as may be specified by the competent authority;
    c. An indication of the scope of, and purpose for which, the report was prepared;
    d. The date and season of the site investigation and the relevance of the season to the outcome of the assessment;
    e. A description of the methodology adopted in preparing the report or carrying out the specialized process;
    f. The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;
    g. An identification of any areas to be avoided, including buffers;
    h. A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;
    i. A description of any assumptions made and any uncertainties or gaps in knowledge;
    j. A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
    k. any mitigation measures for inclusion in the EMPr;
    l. any conditions for inclusion in the environmental authorisation;

m. any monitoring requirements for inclusion in the EMPr or environmental authorisation

n. a reasoned opinion –

i. As to whether the proposed activity or portions thereof should be authorised and

ii. If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr and where applicable, the closure plan;

o. A description of any consultation process that was undertaken during the course of preparing the specialist report;

p. A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and

q. Any other information requested by the competent authority.

This Act also embraces all three fields of environmental concern namely: resource conservation and exploitation; pollution control and waste management; and land-use planning and development. The environmental management principles include the duty of care for wetlands and special attention is given to management and planning procedures.

1.2.2 Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA)

This Act regulates the utilization and protection of wetlands, soil conservation and all matters relating thereto; control and prevention of veld fires, control of weeds and invader plants, the prevention of water pollution resulting from farming practices and losses in biodiversity.

1.2.3 National Environmental Management Biodiversity Act (Act 10 0f 2004) (NEMBA)

The following aspects of the NEMBA (2004) are important to consider in the compilation of an ecological report. It:

- Lists ecosystems that are threatened or in need of national protection;
- Links to Integrated Environmental Management processes;
- Must be considered in EMPs and IDPs;
- The Minister may make regulations to reduce the threats to listed ecosystems.

1.2.4 The National Forest Act (Act 84 of 1998) (NFA)

In terms of section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree; or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any

product derived from a protected tree, except under a licence or exemption granted by the Minister of Agriculture, Forestry and Fisheries.

1.2.5 Northern Cape Nature Conservation Act (2009)

The Northern Cape Nature Conservation Act, No. 9 of 2009 deals with the following:

- To provide for the sustainable utilisation and protection of biodiversity within the provinces;
- To provide for professional hunting;
- To provide for the preservation of caves and cave formations;
- To provide for the establishment of zoos and similar institutions;
- To provide for the appointment of nature conservators;
- To provide for the issuing of permits and other authorisations;
- To provide for offences and penalties for contravention of the Act;
- To implement the provisions of the Act; and to provide for matters connected therewith.

1.3 TERMS OF REFERENCE

1.3.1 Objectives

1. The primary aim of this project is to investigate options for enhancing and / or maintaining biodiversity to mitigate the impact of the development and related infrastructure with the overall objective of preventing further loss of biodiversity. The end product would be a tool for promoting and lobbying for the recognition of the importance of species habitat and habitat conservation. Options available to maintain the current level of floral diversity include:
    a. Protection of native vegetation restored elsewhere in return for unavoidable clearing;
    b. Minimisation of habitat fragmentation;
    c. Minimisation of any threats to the native flora and fauna and their habitats during the construction and operational phases of the developments and;
    d. Rehabilitation to establish plant communities / landscaping that will provide future habitat values.
2. To produce a clear and agreed species and habitat priorities for conservation actions. This includes the following:
    i. Determine the ecological impacts and actions the developments will have on the biodiversity on a species and habitat level;
    ii. Conduct a risk analyses of the impacts identified to determine the

significance of the impacts on the fauna and flora of the study area;

iii. Protection and enhancement of vegetation / habitats of high conservation value;

iv. The retention of a substantial amount of native vegetation / habitat of adequate size and configuration to promote the conservation of the existing flora communities;

v. The retention and / or creation of vegetation links, wildlife corridors and vegetation buffers wherever possible, subject to the appropriate bush fire risk management; and

vi. The protection of water quality in the locality so as not to threaten native aquatic flora that rely on the watercourse for survival.

3. Provide recommendations on the ecological mitigation measures to be implemented by the developer and the way forward.

1.3.2 Scope

1. Conduct a field study to determine the state of the vegetation on site:
    i. After studying the aerial photograph determine the previous state of the vegetation compared to the current state of the vegetation on site;
    ii. Conduct a site visit and list the plant species (trees, shrubs, grasses, succulents and other herbaceous species of special interest) present for plant communities still present after construction;
    iii. Identify potential red data plant species, possible encroacher species, medicinal plants of value and exotic plant species.
2. Determine the ecological impact the development will have on the fauna and flora of the site and conduct an impact rating assessment
3. Fauna scoping
    a. List the potential fauna (mammal species, red data birds, reptiles, amphibians, invertebrates) present linked to the specific potential habitats that occur as identified in the vegetation survey.
    b. Analyse the data and identify potential red data fauna species, as well as other endemic or protected species of importance.
    c. Indicate species mitigation measures and management measures to be implemented to prevent any negative impacts on the fauna of the area.
4. General
    a. Identify and describe ecologically sensitive areas. Create a sensitivity map to indicate specific sensitive areas based on various environmental parameters such as natural vegetation in a good condition, rockiness, slopes, flood lines etc.

b. Identify problem areas in need of special treatment or management, e.g. bush encroachment, erosion, degraded areas, reclamation areas.
c. Make recommendations, impact ratings and risk assessments for each specific impact.

1.3.3 Limitations and assumptions

- To obtain a comprehensive understanding of the dynamics of communities and the status of endemic, rare or threatened species in an area, ecological studies should ideally be replicated over several seasons and over a few years. However, due to project time constraints such long-term studies are not feasible;
- Most threatened plant species are extremely seasonal and only flower during specific periods of the year,
- Most threatened faunal species are extremely secretive and difficult to survey even during thorough field surveys conducted over several seasons;
- The site has some limitations in terms of criminal activities and therefore not every area was surveyed in detail. Dense vegetation stands were avoided due to potentially being a safety risk.

Thus, even though it might be assumed that survey findings are representative of the ecosystem of the site for the development activities, it should be stated that the possibility exists that individual plants species might have been missed due to the nature of the terrain and size of the study area. Therefore, maintaining due cognisance of the integrity and accuracy of the ecological survey, it should be stated that the ecological resources identified during the study do not necessarily represent all the ecological resources present on the property.

2 METHODS

2.1 VEGETATION SURVEY

Two basic methods were used during the vegetation survey:

- Line transects were walked on the site surveyed to record the plant species present. Rare and threatened plant species and any botanically sensitive sites or habitats were searched for in the various vegetation units.
- The Braun-Blanquet survey technique to describe plant communities as ecological units was also used for this study. It allows for the mapping of vegetation and the comparison of the data with similar studies in the area.

The site surveys were conducted on the 27th of July 2020. The relevance of the season (winter months) had no impact on the outcome of the assessment, considering that the development footprint will be placed on the degraded areas that occurs throughout most of the site. The vegetation was in a moderate condition and most species could be identified, although some species might have been missed because of the dense vegetation cover in some areas, although this represented alien invasive tree stands. No further surveys were necessary for the project area.

2.1.1 Data recorded:

Plant names used in this report are in accordance with Arnold & De Wet (1993), except for a few newly revised species. A list of all plant species present, including trees, shrubs, grasses, forbs, geophytes and succulents were compiled. All identifiable plant species were listed. Notes were additionally made of any other features that might have an ecological influence as well as potential fauna habitat that might occur.

2.1.2 Red data species

A species list of the red data species previously recorded in the vicinity of the development was obtained from the South African Biodiversity Institute (SANBI), South Africa as classified by the IUCN red data list categories.

2.1.3 Protected trees

A species list of the protected tree species was obtained from the Department of Forestry. These trees are listed by the NFA (Act 84 of 1998) as protected.

2.1.4 Protected plants

A list of protected and specially protected plants was obtained from the NC Nature Conservation Act (2009).

2.1.5 Data processing

A classification of vegetation data was done to identify, describe and map vegetation types.

The descriptions of the vegetation units include the tree, shrub and herbaceous layers.

Conservation priority of each vegetation unit was assessed by evaluating the plant species composition in terms of the present knowledge of the vegetation of the Northern Cape Province, as well as the Kimberley Thornveld vegetation type.

The following four conservation priority categories were used for each vegetation unit:

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

2.2 FAUNA SURVEY

The fauna survey was conducted as follows:

- A site survey was done to identify potential habitats after identifying the vegetation units. Fauna observed on site or any specific indication of species was noted as confirmed in the species lists.
- A scoping survey was then conducted by comparing the habitat types identified with the preferred habitats of species occurring in the area.

2.2.1 Data recorded:

A list of all species of fauna and their status as observed on the site or that could potentially occur on the site. Notes were made of any specific sensitive or specialized habitats that occur on the site.

2.2.2 Red data species lists

A species list of the red data species of the different faunal classes was obtained from the following references:

- Red Data Book of the Mammals of South Africa (Friedman & Daly, 2004)
- The Atlas of the Southern African Birds - digital data on quarter degree grid data (Avian Demography Unit, University of Cape Town)
- Atlas and red data book of the frogs of South Africa, Lesotho and Swaziland (Minter et al. 2004)
- South African Red Data Book – Reptiles and Amphibians. National Scientific

Programmes Report no. 151;

2.2.3 Data processing

A comparison of the habitats (vegetation units) occurring on the property was made to the preferred habitats of the faunal species. In addition to species observed on the site, lists of the potential mammal, bird, reptile, amphibian and insect species were compiled and mitigating measures recommended if needed.

2.3 IMPACT RATING ASSESSMENT MATRIX

An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need.

The significance of the impacts will be determined through a synthesis of the criteria below (Plomp, 2004):

Probability. This describes the likelihood of the impact occurring:

- Improbable: The possibility of the impact occurring is very low, due to the circumstances, design or experience.
- Probable: There is a probability that the impact will occur to the extent that provision must be made, therefore.
- Highly Probable: It is most likely that the impact will occur at some stage of the development.
- Definite: The impact will take place regardless of any prevention plans, and there can only be relied on mitigation actions or contingency plans to contain the effect.

Duration. The lifetime of the impact

- Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
- Medium term: The impact will last up to the end of the phases, where after it will be negated.
- Long term: The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
- Permanent: Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Scale. The physical and spatial size of the impact

- Local: The impacted area extends only as far as the activity, e.g. footprint.

- Site: The impact could affect the whole, or a measurable portion of the above-mentioned properties.
- Regional: The impact could affect the area including the neighbouring areas.

Magnitude/ Severity. Does the impact destroy the environment or alter its function.

- Low: The impact alters the affected environment in such a way that natural processes are not affected.
- Medium: The affected environment is altered, but functions and processes continue in a modified way.
- High: Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Significance. This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.

- Negligible: The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
- Low: The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
- Moderate: The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
- High: The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights will be assigned to each attribute:

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude/Severity	Low	2

Aspect	Description	Weight
	Medium	6
	High	8
Significance	**Sum (Duration, Scale, Magnitude) x Probability**	
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

The significance of each activity will be rated without mitigation measures and with mitigation measures for the development.

The mitigation effect of each impact will be indicated without and with mitigation measures as follows:

- Can be reversed;
- Can be avoided, managed or mitigated;
- May cause irreplaceable loss of resources.

2.4 SENSITIVITY ASSESSMENT

The ecological sensitivity of any piece of land is based on its inherent ecosystem service and overall preservation of biodiversity.

2.4.1 Ecological function

The ecological function relates to the degree of ecological connectivity between systems within a landscape matrix. Therefore, systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive and will be those contributing to ecosystem service (e.g. wetlands) or overall preservation of biodiversity.

2.4.2 Conservation importance

Conservation importance relates to species diversity, endemism (unique species or unique processes) and the high occurrence of threatened and protected species or ecosystems protected by legislation.

2.4.3 Sensitivity scale

- High – sensitive ecosystem with either low inherent resistance or low resilience towards disturbance factors or highly dynamic systems considered being important for the maintenance of ecosystem integrity. Most of these systems represent ecosystems with high connectivity with other important ecological systems or with high species diversity and usually provide suitable habitat for a few threatened or rare species. These areas should be protected;
- Medium – These are slightly modified systems which occur along gradients of

disturbances of low-medium intensity with some degree of connectivity with other ecological systems or ecosystems with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species;

- Low – Degraded and highly disturbed / transformed systems with little ecological function and which are generally very poor in species diversity.

2.5 EIA SCREENING TOOL

The significance of a site or natural feature may only become apparent when it is evaluated in terms of a broader biodiversity context. Put differently, local impacts on biodiversity may seem unimportant, but can become highly significant when interpreted beyond the immediate boundaries of a site. Even if a locality has a history of disturbance such as alien infestation, cultivation or recurrent fires, and it does not host any plant or animal species of special concern, it may nevertheless be significant for biodiversity conservation when viewed from a landscape or even national perspective.

According to the national web-based environmental screening tool in terms of section 24(5)(h) of the NEMA, 1998 (Act No 107 of 1998) and regulation 16(1)(b)(v) of the EIA regulations, 2014, as amended**, no red listed species occur on the development footprint area**.

3 STUDY AREA

3.1 LOCATION AND DESCRIPTION OF ACTIVITY

Kimberley Rehabilitation and Development (KRD) wishes to develop various infrastructure, mining (mining permit application) and industrial developments to change the face of Kimberley City, Sol Plaatje Municipality, Northern Cape Province (Figure 1).

The project will contribute to the city and the province in terms of infrastructure and socio-economic development, especially the estimated 1 500 direct and indirect job opportunities. KRD has done extensive calculations, investigations and consultations in the compilation of the project plan and its various components and its integration into a single integrated business model. The information and calculations all indicated the feasibility of the project, if implemented as an integrated model. This project cannot succeed if the various individual activities do not contribute to the execution of the project plan.

Figure 1 summarizes the scope of the project entitled “Changing the Face of a City” which Kimberley Rehabilitation and Development is packaging for implementation:

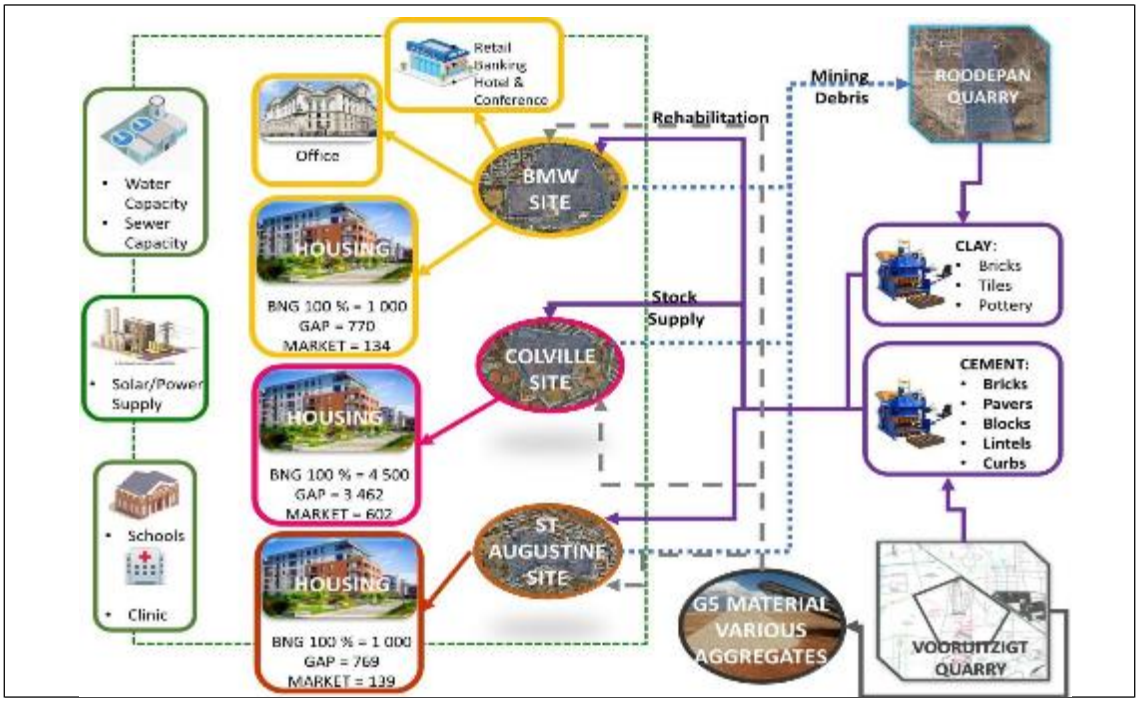

Figure 1. PROJECT SYNOPSIS

It is understood that the mining debris will be removed from the three sites (BMW, St. Augustine and Colville) to the Roodepan Quarry, which is vacant and has been unattended for the last ± 80 years. At the quarry the debris will be reworked to extract the clay content, which will be used for the manufacturing of clay bricks. The clay bricks together with the cement bricks manufactured at the Vooruitzigt Quarry will be used for the development of the three development sites. The unused material will be used to fill the quarry in accordance with an approved environmental management plan.

Subject to the outcome of the required research the Table 1 provide an indicative development rationale amounting to approximately 12,369 housing opportunities.

This study focused specifically on the potential impact of the infrastructure development on the BMW site highlighted below in Table 1:

Table 1: INDICATIVE DEVELOPMENT RATIONALE

Development Rationale							Land Use Application						
Site	Area (m²)	Site Name	Building Footprint (%)	Coverage (000m²)	Height (Storeys)	Bulk (000m²)	Commercial (000m²)	Housing Configuration					
								Type	BNG100%	GAP Housing		Market	Total
								Size (m²)	60	60	65	85	95	
								Bas-ket (%)	50	20	20	5	5	100%
								Units						
1	20	BMW (A)	20	40	3	120			1000	400	369	71	63	1908
1	20	BMW (B)	20	40	2	80	80		0	0	0	0	0	0
2	45	Colville	40	180	3	540			4500	1800	1662	318	284	8563
3	10	St Augustine	40	40	3	120			1000	400	369	71	68	1903
						TOTAL	80		6500	2500	2400	459	411	12369

As the BMW site contain mining debris, it will be necessary to rehabilitate the site in accordance with the outcome of a geotechnical assessment and a purpose designed environmental rehabilitation plan. Provisionally it is envisaged that approximately the top 1.5m will have to be dug out and backfilled with G5 compacted to 90 ModAshato. The full range of gravel will be obtained from the quarry to be developed on Portion 1 of the farm Vooruitzigt No 81. KRD has submitted the necessary applications to DMR for the establishment of the Roodepan and Vooruitzigt quarries.

The BMW site is located to the west of the “Big Hole” and to the north of the N8 in Kimberley between Waterloo and Anderson Road (Figure 3).

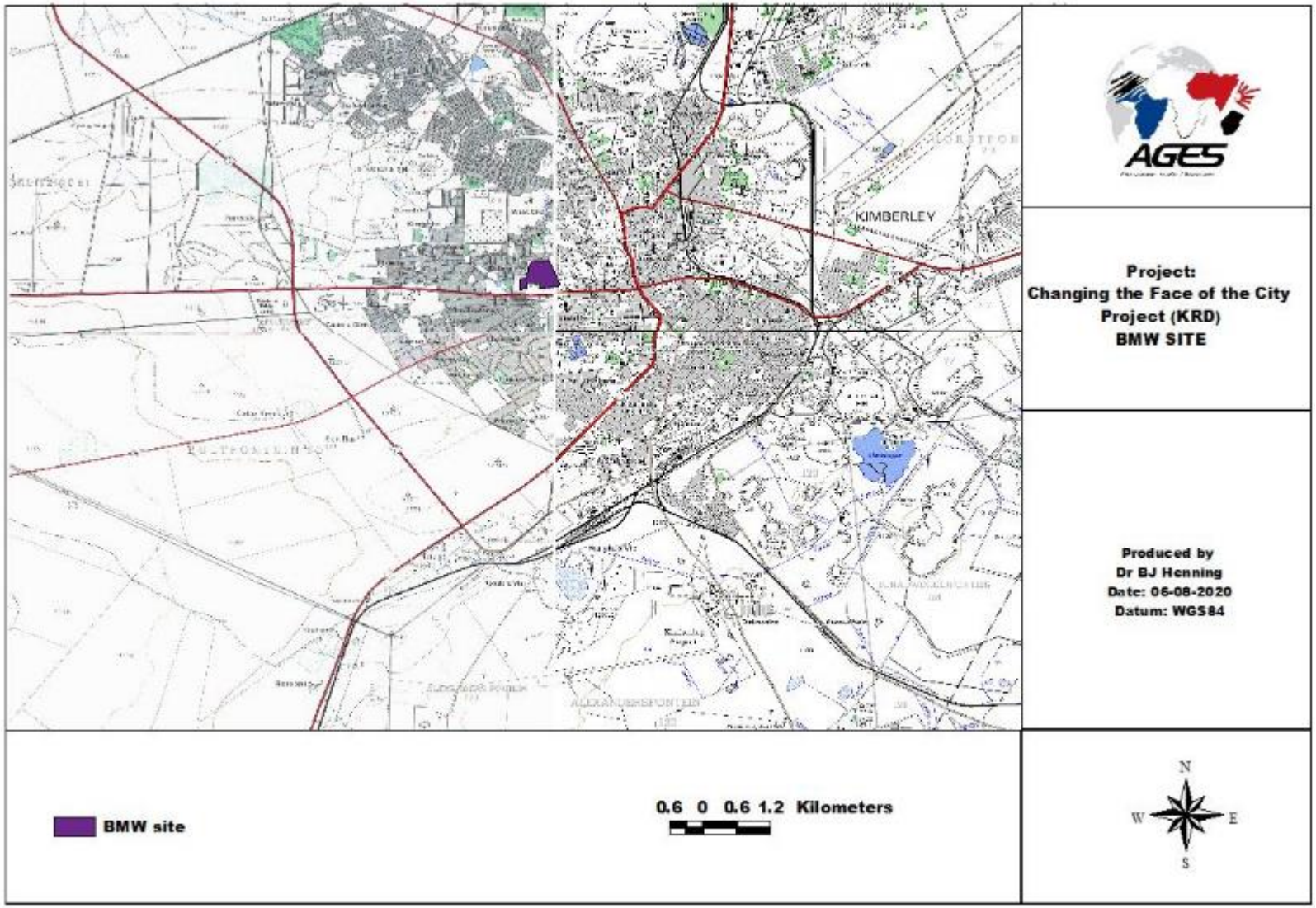

Figure 2. Regional location Map of the project area

Figure 3. Aerial Map of the project area

3.2 CLIMATE

Climate in the broad sense is a major determinant of the geographical distribution of species and vegetation types. However, on a smaller scale, the microclimate, which is greatly influenced by local topography, is also important. Within areas, the local conditions of temperature, light, humidity and moisture vary greatly and it is these factors which play an important role in the production and survival of plants (Tainton, 1981).

In terrestrial environments, limitations related to water availability are always important to plants and plant communities. The spatial and temporal distribution of rainfall is very complex and has great effects on the productivity, distribution and life forms of the major terrestrial biomes (Barbour et al. 1987). The climate around Kimberley is essentially a continental one - the weather provides hot wet summers (December to February) and mild dry winters (June to August). It is not unusual for winter night-time temperatures to drop below freezing.

Kimberley normally receives about 283mm of rain per year, with most rainfall occurring mainly during summer. The chart below shows the average rainfall values for Kimberley per month. It receives the lowest rainfall in October and the highest (59mm) in March.

The monthly distribution of average daily maximum temperatures (Figure 3) shows that the average midday temperatures for Kimberley range from 18°C in June to 33°C in January. The region is the coldest during July when the mercury drops to 0.3°C on average during the night.

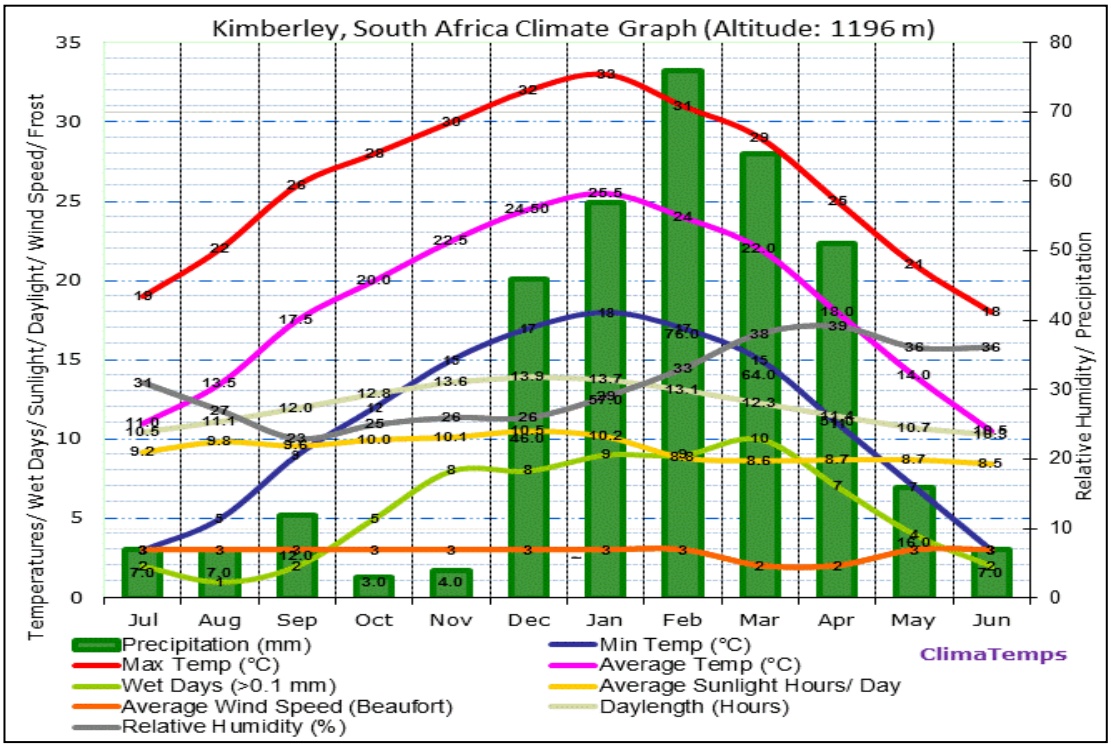

Figure 4. Climate graph for Kimberley area

3.3 GEOLOGY AND SOIL TYPES

Geology is directly related to soil types and plant communities that may occur in a specific area (Van Rooyen & Theron, 1996). The geology area is underlain by rocks of the Karoo Supergroup. The Karoo sequence in the Kimberly area comprises sedimentary succession of the Dwyka, Ecca and Beaufort Groups. The Dwyka consists of Tillite, sandstone, mudstone and shale. The Dwyka Formation is found at the base of the Karoo Sequence. In the central of the Karoo it was deposited in a comparatively shallow basin with a rather even floor, so that the rocks in this area are practically horizontally bedded and not very thick.

A Land type unit is a unique combination of soil pattern, terrain and macroclimate, the classification of which is used to determine the potential agricultural value of soils in an area. The land type units represented within the project areas include the Ae45 land type (Land Type Survey Staff, 1987) (ENPAT, 2000). The land type, geology and associated soil type is presented in Table 2 below as classified by the Environmental Potential Atlas, South Africa (ENPAT, 2000).

Table 2. Land types, geology and dominant soil types of the proposed development site

Landtype	Soils	Geology
Ae45	Red-yellow apedal, freely drained soils; red, high base status, > 300 mm deep (no dunes)	Tillite (Dwyka Formation), shale and mudstone (Ecca Group) covered partially by surface limestone and red wind-blown sand. Dolerite intrusions also occur.

The soils in a regional context are reddish, moderately shallow, sandy, and often overlay layers of calcrete of varying depths and thickness. The soils are typically weakly structured with low organic content. These soils drain freely which results in a soil surface susceptible to erosion, especially wind erosion when the vegetation cover is sparse and gulley erosion in areas where stormwater can concentrate.

3.4 TOPOGRAPHY

When assessing the ecology of an area, it is important to know in which eco-region it is located. The project area forms part of the Southern Kalahari Eco-region. The topography of the Properties is generally by slightly undulating to flat plains. The Properties are defined as a Plain at a Medium Level (ENPAT 2000). The topography of the area is influenced by the underlying geology of the area, as well as the climatic conditions and is characterised. The study area is located at an altitude of 1200 MAMSL.

3.5 DRAINAGE

The drainage areas of South Africa are also referred to as the primary catchments and constitute the catchment areas of all the major rivers in the country. These drainage regions

comprise areas of which the topography is such that all water deposited in the catchments will, except for evaporation and retention in the system, eventually end up in the main river flowing from that same catchment. Primary river catchments such as the Orange, Vaal and Limpopo catchments are subdivided into contributing secondary catchments. They are, in turn, subdivided into even smaller tertiary catchments, which are finally subdivided into quaternary catchments, the smallest catchment units used in the management and planning of water resources at a national level.

The sites fall within the Lower Vaal water management area which is in the quaternary drainage region C52L of the DWAF. The Vaal River lies further to the north and the Modder River further south of the study area.

No natural watercourses traverse the BMW infrastructure site in the town of Kimberley and thus it was necessary for a number of storm water furrows/ channels to be constructed in the past to allow interception of runoff thereby allowing drainage of the region and containment of water for re-use.

The project area is drained mainly by surface run-off (i.e.: sheetwash) with surface water flowing into the pans and drainage channels that bisect the larger Kimberley area. The storm water collects along roads and footpaths cutting through the area, to drain into the regional man-made canals and channels. It must be noted that surface flow generally only occurs in the period directly after precipitation events or a wet rainy season, and that these channels / canals may exhibit a large base-flow component with groundwater flow occurring within the sandy sediments lining its channel.

3.6 LAND USE AND EXISTING INFRASTRUCTURE

The land-use of the proposed development site is vacant land and mainly used as a pass-through by the local community. Wood harvesting, littering and illegal dumping occur on the site. The major land use of the study area as classified by the Environmental Potential Atlas of South Africa (2000) is vacant land.

4 RESULTS

4.1 VEGETATION

4.1.1 Biomes

The development site lies within the Savanna biome which is the largest biome in Southern Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. Fire and grazing also keep the grassy layer dominant. The most recent classification of the area by Mucina & Rutherford shows that the site is classified as Kimberley Thornveld.

4.1.2 Vegetation types

The terrain morphology is slightly undulating plains, although the natural topography has been changed by the old mining dumps that occur on site. The indigenous flora of area is mostly represented by the Kimberley Thornveld (Mucina & Rutherford, 2006) which occurs on slightly irregular plains with well-developed tree layer dominated by tree species such as *Vachellia erioloba, V. tortilis, V. karroo* and *Boscia albitrunca* and well developed shrub layer with occasional dense stands of *Tarchonanthus camphoratus* and *Senegalia mellifera*. The grass layer is often open with much uncovered soil, although erosion is very low. This vegetation type has a Least Threatened conservation status with 18% transformed mostly through cultivation, while only 2% conserved.

4.1.3 Vegetation units

Vegetation units were identified during the ecological surveys according to plant species composition, previous land-use, soil types and topography. The state of the vegetation of the proposed development site varies from completely modified to moderately degraded woodland. The study area is used as a pass-through by the local community.

The vegetation map indicates the location of the plant communities in the larger project area (Figure 3). The vegetation communities identified on the proposed development site during the ecological surveys are classified as physiographic physiognomic units, where physiognomic refers to the outer appearance of the vegetation, and physiographic refers to the position of the plant communities in the landscape. The physiographic-physiognomic units will be referred to as vegetation units in the following sections. These vegetation units are classified according to the land-use and soil differences that had the most definitive influence on the vegetation units. Each unit is described in terms of its characteristics. A species list for the area was identified during the field surveys and photographs are included. The aim of the study was to determine the suitability of the area from an ecological perspective for the proposed development activities.

After the initial ecological surveys of the study area, the analysis of the data resulted in the identification of 5 major vegetation units on the proposed development site. The plant species for the QDS as listed by the South African National Biodiversity Institute (SANBI) Plants of Southern Africa (POSA) database is included in Appendix A, while the detailed species list for each vegetation unit is

included in Appendix B. The following vegetation units were documented on site:

- Degraded *Vachellia tortilis – Prosopis woodland (Photograph 1);*
- *Prosopis glandulosa* woodland
    - Open woodland (Photograph 2)
    - Thickets / degraded areas (old mining dumps) (Photograph 3)
- Degraded grassland / bare ground (Photograph 4);
- Drainage features
    - Stormwater canal (Photograph 5);

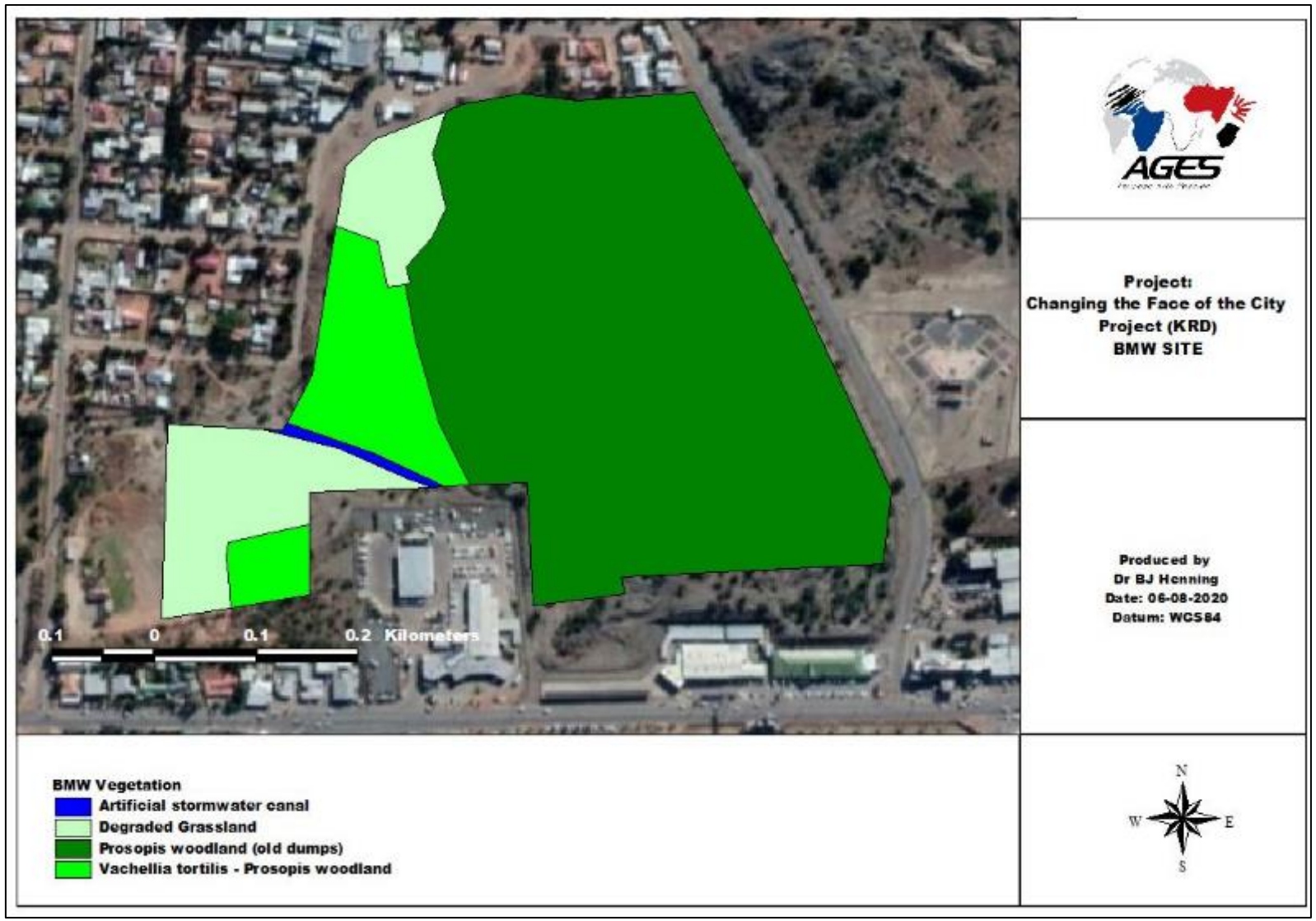

Figure 5. Vegetation Unit Map of the proposed development area

4.1.3.1 *Vachellia tortilis – Prosopis* woodland

This vegetation unit occurs to the north of the stormwater canal in the western section of the site on red apedal soils of the Hutton soil form. The woody layer is characterised by the dominance of the indigenous *Vachellia tortilis* and the alien invasive *Prosopis glandulosa* (Photograph 1). The woodland is typical of the Kimberley Thornveld vegetation type on plains and can be considered as the only natural vegetation unit occurring on the BMW site. Herbaceous species within the understorey included grass species such as *Enneapogon cenchroides, Enneapogon desvauxii, Cenchrus ciliaris, Eragrostis echinochloidea, Aristida congesta, Fingerhutia africana* and *Themeda triandra.* The following are recommended for this vegetation unit:

- The vegetation unit has a Medium-low Sensitivity and unlimited development can be supported within the footprint area.

Photograph 1. *Vachellia tortilis – Prosopis* woodland in the project area

4.1.3.2 *Prosopis glandulosa* woodland

This vegetation unit represent the *Prosopis* invaded areas on the old mining dumps of the BMW site. Two specific variations of this vegetation unit occur namely a more open unit This vegetation unit represent the *Prosopis* invaded areas on the old mining dumps of the BMW site. Two specific variations of this vegetation unit occur namely a more open unit where *Prosopis* have invaded (Photograph 2) and a variation where the *Prosopis* trees form dense stands or thickets (Photograph 3). The Mesquite tree (*Prosopis glandulosa*) is synonymous

with dry arid areas in especially the Karoo and the Northern Cape. The tree is loved by livestock for its sweet seed pods which is sometimes also used among residents for its medicinal purposes. It has since become the second most widespread invasive tree species in South Africa. Prosopis trees are extravagant users of readily available ground-water and dense stands could seriously affect the hydrology of the ecosystems they invade. Dense stands compete with and replace indigenous woody and grassland species. Dense stands produce few pods and thus replace natural pasturage without providing pods in return. Dense stands are virtually impenetrable, restricting the movement of domestic and wild animals and causing injuries. These species and hybrids have been listed as invasive species in terms of the Alien and Invasive Species Regulations (AIS), National Environmental Management: Biodiversity Act (Act No 10 of 2004). They were listed as category 3 species in the Northern Cape recently and the Kimberley area have a serious problem with *Prosopi*s invasion. The development will ensure that the *Prosopis* stands are controlled, although a specific approach would be needed to prevent spreading to neighbouring areas.

(Photograph 2) and a variation where the *Prosopis* trees form dense stands or thickets (Photograph 3). The Mesquite tree (*Prosopis glandulosa*) is synonymous with dry arid areas in especially the Karoo and the Northern Cape. The tree is loved by livestock for its sweet seed pods which is sometimes also used among residents for its medicinal purposes. It has since become the second most widespread invasive tree species in South Africa. Prosopis trees are extravagant users of readily available ground-water and dense stands could seriously affect the hydrology of the ecosystems they invade. Dense stands compete with and replace indigenous woody and grassland species. Dense stands produce few pods and thus replace natural pasturage without providing pods in return. Dense stands are virtually impenetrable, restricting the movement of domestic and wild animals and causing injuries. These species and hybrids have been listed as invasive species in terms of the Alien and Invasive Species Regulations (AIS), National Environmental Management: Biodiversity Act (Act No 10 of 2004). They were listed as category 3 species in the Northern Cape recently and the Kimberley area have a serious problem with *Prosopi*s invasion. The development will ensure that the *Prosopis* stands are controlled, although a specific approach would be needed to prevent spreading to neighbouring areas.

The following are recommended for this vegetation unit:

- The vegetation unit has a Low Sensitivity and unlimited development can be supported within the footprint area;
- The old mining dumps area should be rehabilitated after the mining debris have been removed to the Roodepan site for clay brick manufacturing.

Photograph 2. Open *Prosopis* woodland in the project area

Photograph 3. Dense *Prosopis* stands on old mining dumps in the project area

4.1.3.3 Degraded grassland

This vegetation unit occurs along the edges of the old mining dumps in the central and western section of the site and represent secondary grassland (Photograph 4). Most of the areas were previously degraded for mining related activities. Although secondary grasslands may superficially look like primary grasslands, they differ markedly with respect to species composition, vegetation structure, ecological functioning and the ecosystem services they deliver. These grasslands are still in an early successional state, although somewhat older (older than 5 years) with several grass species like *Enneapogon scoparius, Aristida junciformis, Aristida congesta s. congesta* and *Eragrostis echinchloidea*. The herbaceous layer is characterised by dense stands (density 60-70%) of climax grasses of medium height (0.6-1.2m).

The following are recommended for this vegetation unit:

- The vegetation unit has a Low Sensitivity and unlimited development can be supported within the footprint area;

Photograph 4. Degraded grassland on an old rehabilitated area within the project area

4.1.3.4 Drainage features: Stormwater canal

The stormwater canals have been artificially created for stormwater in the project area and represent shallow (0.5-1m) channels (Photograph 5). The canals are classified as channels. A channel is classified by Sanbi (2009) as an open conduit with clearly defined margins that (i) continuously or periodically contains flowing water, or (ii) forms a connecting link between two water bodies. Dominant water sources include concentrated surface flow from upstream channels and tributaries, diffuse surface flow or interflow, and/or groundwater flow. Water moves through the system as concentrated flow and usually exits as such but can exit as diffuse surface flow because of a sudden change in gradient. Unidirectional channel-contained horizontal flow characterises the hydrodynamic nature of these units. Channels generally refer to rivers or streams (including those that have been canalised) that are subject to concentrated flow on a continuous basis or periodically during flooding, as opposed to being characterised by diffuse flow. As a result of the erosive forces associated with concentrated flow, channels characteristically have relatively obvious active channel banks. The canals are mostly characterised by various hygrophilous grasses, reeds and bulrushes (*Typha capensis*). The following are recommended for the canal:

- The canal has a Medium-low Sensitivity due to still performing a function in terms of the hydrology of the larger area. The canal can be backfilled and rehabilitated as part of the site, although it can also be kept for stormwater management of the site.

Photograph 5.Artificial stormwater canal in the project area

4.2 FLORA: SPECIES LEVEL ASSESSMENT

South Africa has been recognized as having remarkable plant diversity with high levels of endemism. The major threats to plants in the study area are urban expansion, non-sustainable harvesting, collecting, overgrazing/browsing, mining and agriculture. The objective of this section was to compile a list of plant species for which there is conservation concern. This included threatened, rare, declining, protected and endemic species.

4.2.1 Species of conservation concern

Species of conservation concern are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient – Insufficient Information (DDD). It should also be noted that not all species listed as protected are threatened or vice versa.

A list of SCC plant species previously recorded in the study area in which the proposed development is planned was obtained from the Plants of Southern Africa (POSA) database of SANBI. Figure 6 indicates the classification system used by Sanbi for SCC:

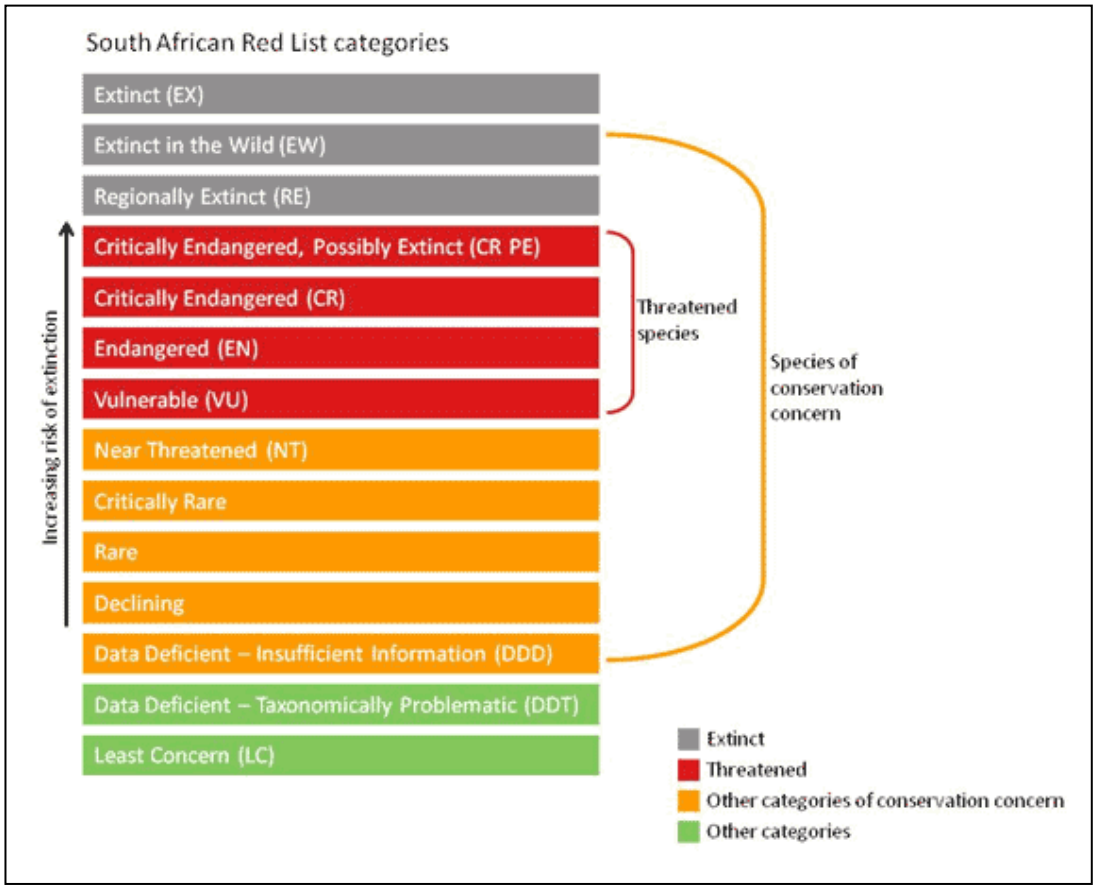

Figure 6. South African red list categories indicating the categories to be used for Species of Conservation Concern

A list of red data plant species previously recorded in the study area in which the proposed development is planned was obtained from the Plants of Southern Africa (POSA) database of SANBI. There are various categories for Red Data Book species, such as 'Endangered', 'Vulnerable', 'Rare' and 'Near threatened' as listed in the Red Data List of Southern African Plants (Hilton-Taylor 1996). The following red data species was listed for the project area (Table 3).

Table 3. Red data species documented during the surveys

Species Name	*Conservation Status*
Gallenia pallens	Data Deficient

After a detailed survey was conducted during July 2020, none of the red listed plants was found on site:

4.2.2 Protected tree species (NFA)

The National Forest Act (no.84 of 1998: National Forest Act, 1998) provides a list of tree species that are considered important in a South African perspective because of scarcity, high utilization, common value, etc. In terms of the National Forest Act of 1998, these tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under license granted by DWAF (or a delegated authority). Obtaining relevant permits are therefore required prior to any impact on these individuals. Taking cognizance of the data obtained from the field surveys no listed protected tree species was documented on site.

4.2.3 Protected Plants (NC DENC)

Plant species are also protected according to the Northern Cape Department of Environment of Nature Conservation (DENC). According to this Act, no person may pick, import, export, transport, possess, cultivate or trade in a specimen of a specially protected or protected plant species. The Appendices to the Act provide an extensive list of species that are protected, comprising a significant component of the flora expected to occur on site. Communication with Provincial authorities indicates that a permit is required for all these species, if they are expected to be affected by the proposed project. After a detailed survey was conducted during July 2020, no protected plant species was found on site:

4.2.4 Invasive alien species and exotic weeds

Invasive alien plants pose a direct threat not only to South Africa's biological diversity, but

also to water security, the ecological functioning of natural systems and the productive use of land. They intensify the impact of fires and floods and increase soil erosion. Of the estimated 9000 plants introduced to this country, 198 are currently classified as being invasive. It is estimated that these plants cover about 10% of the country and the problem is growing at an exponential rate.

The Alien and Invasive Species Regulations (GNR 599 of 2014) are stipulated as part of the National Environmental Management: Biodiversity Act (10/2004). The regulation listed a total of 559 alien species as invasive and further 560 species are listed as prohibited and may not be introduced into South Africa. Below is a brief explanation of the four categories of Invasive Alien Plants as per the regulation.

- Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Cat 3 plants to exist in riparian zones.

The following alien invasives and exotic plant species were recorded on site during the surveys as stipulated in the Alien and Invasive Species Regulations (GNR 599 of 2014) (Table 6):

Table 4. Declared weeds and invader plants of the study area

Species	Common name	NEMBA status
Agave sisalana	Sisal	2
Argemone ochroleuca	Mexican poppy	1b
Atriplex nummularia	Old man salt bush	2
Cirsium vulgare	Scotch thistle, spear thistle	1b

Species	Common name	NEMBA status
Datura stramonium	Common thorn apple	1b
Flaveria bidentis	Smelters bush	1b
Melia azedarach	Seringa tree	3 (in urban areas)
Nicotiana glauca	Tobacco tree	1b
Opuntia ficus-indica; Opuntia stricta	Prickly pear	1b
Prosopis glandulosa	Mesquite trees	3
Ricinus communis	Castor oil plant	2
Salsola kali	Common saltwort / tumbleweed	1b
Tipuana tipu	Tipu tree	3
Xanthium strumarium	Large cocklebur	1b

According to the amended regulations (No. R280) of March 2001 of the Conservation of Agricultural Resources Act 1983 (Act no. 43 of 1983), it is the legal duty of the land user/landowner to control invasive alien plants occurring on the land under their control. The State has the right to clear invasive plants at the landowner's expense if the landowner refuses to remove invasive plants. Goals for addressing the problem of Invasive Alien Species (IAS) in the project area in the project area should include:

- Prevention: Keeping an IAS from being introduced onto the ecosystem. Ideally, this usually means keeping alien plants from entering the development sites;
- Early detection: Locating IAS before they have a chance to establish and spread. This usually requires effective, site-based inventory and monitoring programmes;
- Eradication: Killing the entire population of IAS. Typically, this can only be accomplished when the organisms are detected early;
- Control: The process of long-term management of the IAS population size and distribution when eradication is no longer feasible:
    - Institute strict control over materials brought onto site, which should be inspected for potential invasive invertebrate species and steps taken to eradicate these before transport to the site. Routinely fumigate or spray all materials with appropriate low-residual insecticides prior to transport to or in a quarantine area on site. The contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the construction phase. Alien invasive tree species such as black wattle and blue gum should be eradicated;
    - Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be

controlled in the manner prescribed for that category by the Conservation of Agricultural Resources Act or in terms of Working for Water guidelines;

- Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish;
- Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds;
- Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented;
- A plan should be developed for control of noxious weeds and invasive plants that could occur because of new surface disturbance activities at the site. The plan should address monitoring, weed identification, the way weeds spread, and methods for treating infestations. Require the use of certified weed-free mulching. Prohibit the use of fill materials from areas with known invasive vegetation problems. The spread of invasive non-native plants should be avoided by keeping vehicles and equipment clean and reseeding disturbed areas with native plants. Scientists and field workers use a range of methods to control invasive alien plants. These include:
    - Mechanical methods - felling, removing or burning invading alien plants;
    - Chemical methods - using environmentally safe herbicides;
    - Integrated control - combinations of the above three approaches. Often an integrated approach is required to prevent enormous impacts.

4.3 FAUNA

4.3.1 Overview

A healthy environment is inhabited by animals that vary from micro-organisms to the birds and mammals. The species composition and diversity are often parameters taken into consideration when determining the state of the environment. A comprehensive survey of all animals is a time consuming task that will take a long time and several specialists to conduct. The alternative approach to such a study is to do a desktop study from existing databases and conduct a site visit to verify the habitat requirements and condition of the habitat.

4.3.2 Fauna Habitats

The number of mammal species supported by a plant community depends on several factors like the primary production, seasonal availability of resources, floral heterogeneity, diversity of plant structure, nature of the substratum and previous history (Delany, 1982). Each mammal species has a niche, which can be regarded as the sum of all ecological requirements of a species namely food, space, shelter and physical conditions. Mills & Hes (1997) stated that the distribution and abundance of animal species does not rigorously follow that of plant communities or biomes. Instead, mammal species seem to have certain preferences for a specific habitat type (Skinner & Smithers, 1990). Several authors have shown this preference of mammals to certain habitats through analysis (Beardall et al. 1984; Ben-Shahar, 1991; Dekker et al. 1996).

A survey was conducted during July 2020 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups (birds, mammals, reptiles, amphibians) occurring in the quarter degree grid. The area represents mixed woodland vegetation components with a diverse vegetation structure and height class. A detailed species list for the fauna of the area is included in Appendix C, D and E.

The regional fauna has not been as extensively studied and is not known to exhibit many unique features. The area has been settled for many centuries, and the fauna is usually considered impoverished due to overgrazing and other man-induced impacts. There are two main faunal habitat types present on the site that might be impacted on by the proposed project namely degraded grassland and mixed woodland (alien invasive and indigenous).

4.3.3 Common fauna documented and potentially occurring in the project area

As a result of anthropogenic disturbance in the larger area and the limitations created by game fences, only the most tolerant generalists of the larger vertebrates still occur in the project area outside the nature reserves. Examples are grey duiker, steenbok and vervet monkey. The more sensitive habitat-specialist species like honey badger, brown hyena and caracal have retreated into areas of lower disturbance such as the surrounding woodland outside Kimberley city.

4.3.3.1 Mammals

Large mammals that occurred historically at the site, are absent from the area, owing to anthropogenic impacts in recent centuries. This loss of large species means that the mammal diversity at the site is far from its original natural state not only in terms of species richness but also with regards to functional roles in the ecosystem.

The use of trapping techniques was not deemed necessary due to the degraded state of the natural environment, although the development of the infrastructure area will not have a significant impact on any small mammal species that may occur within the study area due to the surrounding areas representing built-up land.

Mammals are sensitive to disturbances and habitat destruction and degradation and as such the anticipated species diversity of the study area would be low. Settlement areas have negated the possibility of encountering any medium to large mammals. The presence of dogs as well as poaching activities (snares observed on site), poses a threat to the presence of mammals on sites. The mammals are mostly represented by generalised species such as rodents and scrub hares that will move through the area while foraging. The proximity of the informal settlements does however place constant pressure on these mammal populations and many of these populations will eventually disappear from the area completely. Most mammal species are highly mobile and will move away during construction. The connectivity[1] of the project site is low.

4.3.3.2 Birds (avifauna)

The project area represents woodland and degraded grassland avifauna habitats. Microphyllous woodland usually supports much higher bird numbers compared to the broadleaved woodlands. The area represents microphyllous woodland and supports many smaller bird species such as Ashy Tit, Pied Babbler, Kalahari Robin, Burntnecked Eremomela, Desert Barred Warbler, Marico Flycatcher, PriritBatis, Crimsonbreasted Shrike, Longtailed Shrike, Threestreaked Tchagra, Great Sparrow, Whitebrowed Sparrowweaver, Scalyfeathered Finch, Violeteared Waxbill and Blackcheeked Waxbill.

Degraded grasslands sometimes cover extensive areas and have become an artificial habitat that attracts a wide range of generalist species. These grasslands represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the grasses are often eaten themselves by birds, or attract insects which are in turn eaten by birds.

4.3.3.3 Herpetofauna (Reptiles and Amphibians)

Typical species associated with arid and semi-arid habitat types occur in the study area. Venomous species such as the puff adder and cape cobra are expected to occur in the larger study area, although the location within Kimberley City makes the probability of these snakes occurring on site virtually zero. The general habitat type for reptiles consists of open woodland and grassland with limited available habitat for diurnally active and sit-and-wait predators, such as terrestrial skinks and other reptiles.

The amphibians appear to be poorly represented on site since no standing or perennial water sources are located on site. The stormwater canal might hold water for limited times of the year that could attract a few locally occurring frog or toad species. No threatened species occur in the area.

1 C**onnectivity (habitat connectivity)** - Allowing for the conservation or maintenance of continuous or connected habitats, to preserve movements and exchanges associated with the habitat.

4.3.4 Red data fauna

Some red data fauna does potentially occur in the vicinity of the proposed developments, although it has a very low to almost zero probability of occurring on the site. Table 5 below lists potential red data species occurring in the study area.

Table 5. Red data fauna species potentially occurring in the study area

English Name	Conservation Status	Probability of occurrence on site
BIRDS		
Bustard, Kori	Near threatened	Very low
Bustard, Ludwig's	Endangered	Very low
Courser, Burchell's	Vulnerable	Medium
Courser, Double-banded	Near threatened	Medium
Crane, Blue	Near threatened	Very low
Duck, Maccoa	Near threatened	Very low
Eagle, Martial	Endangered	Very low
Eagle, Tawny	Endangered	Very low
Eagle, Verreauxs'	Vulnerable	Very low
Falcon, Lanner	Vulnerable	Very low
Flamingo, Greater	Near threatened	Very low
Flamingo, Lesser	Near threatened	Very low
Korhaan, Southern Black	Vulnerable	Low
Painted-snipe, Greater	Vulnerable	Very low
Pipit, African Rock	Near threatened	Low
Roller, European	Near threatened	Medium
Secretarybird	Vulnerable	Very low
Stork, Abdim's	Near threatened	Very low
Stork, Saddle-billed	Endangered	Very low
Stork, Yellow-billed	Endangered	Very low
Vulture, Lappet-faced	Endangered	Very low
Vulture, White-backed	Endangered	Very low
MAMMALS		
Bushveld Gerbil	Data Deficient	Medium
African Striped Weasel	Data deficient	Very low
Southern African Hedgehog	Near Threatened	Very low
African Straw-colored Fruit Bat	Near Threatened (IUCN ver 3.1)	Very low
Roan Antelope	Vulnerable	Zero – restricted to game reserves
Sable antelope	Vulnerable	Zero – restricted to game reserves

The following impacts might occur during the development phase on the fauna populations of the area:

- Destruction/permanent loss of individuals of rare, endangered, endemic and/or protected species through habitat loss or fragmentation;
- Disturbance of remnant terrestrial wild mammal, avian, amphibian and insect fauna would probably occur through physical habitat destruction, noise, traffic and movement of people;

- Potential increase in feral animals and impact on indigenous fauna e.g. cats, rats;
- Illegal hunting or disturbance.

The following general observations with regards to the project area can be made. Recommendations and mitigating measures need to be implemented to ensure the survival of these species other fauna habitats and feeding grounds:

- Red data and other mammal species have a very low probability of occurring in the area. Probability of occurrence was determined depending on the state of the habitats. The areas where low diversity of fauna can be expected (degraded habitats) is because of the following:
    - The already degraded land as well as other anthropogenic influences in the area that stretches along roads and around infrastructure will cause fauna to migrate from the area to more natural areas with fewer disturbances;
    - The habitat of many of the red data species would be in the Kamfers Dam or rocky outcrops outside the development footprints. These areas will be preserved as corridors for fauna;
- If one considers the habitat descriptions of the red data species, some of them are limited in range or threatened as a direct result of habitat loss in the southern African sub-region, although other species with large home ranges are not directly threatened by habitat loss. The impact of development on the red data species would therefore be less than predicted;
- The development would not have a significant impact on the above mentioned red data fauna since adequate natural habitat/vegetation would be available on the larger Southern Kalahari landscape. The mitigation measures stipulated with the impacts provides for the preservation of the sensitive habitats in the area;

The general faunal biodiversity is not expected to be adversely influenced on a measurable scale by the development of the infrastructure or rehabilitation actions proposed for the sites, especially through already impacted zones. No unique or restricted faunal habitat types occur on the BMW site.

4.3.4.1 EIA screening tool listed species

No listed species occur in the EIA screening tool.

5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT ON THE FLORA

The impact of the proposed infrastructure developments on the BMW site will be on degraded areas.

The following section deals with the impacts and specific mitigation measures needed for the proposed developments from a biodiversity point of view:

5.1 DIRECT HABITAT DESTRUCTION

5.1.1 Description of impact:

The construction of the infrastructure will result in loss of and damage to degraded habitats. Rehabilitation of some of these areas would be possible and should be adhered to as described in Section 6 of this report. Most habitat destruction will be caused during the construction of the infrastructure.

The impact of the habitat destruction will be on the flora and fauna of the study area in the following ways:

- The construction will lead to the loss of individual plants such as grasses, forbs, trees and shrubs that will be cleared on the footprint area. This will mostly occur during the construction phase;
- Loss of threatened, near-threatened and endemic taxa: The anticipated loss of some of the natural habitats that support endemic species will result in the local displacement of endemic listed flora;
- Due to habitat loss and construction activities animals will migrate from the construction area and animal numbers will decrease;
- Changes in the community structure: It is expected that the faunal species composition will shift, due to an anticipated loss in habitat surface area. In addition, it is predicted that more generalist species (and a loss of functional guilds) will dominate the study area. Attempts to rehabilitate will attract taxa with unspecialised and generalist life-histories. It is predicted that such taxa will persist for many years before conditions become suitable for succession to progress.

5.1.2 Mitigation measures:

- The removal of plant species should only occur on the footprint area of the development and not over the larger area;
- Conduct flora species search and rescue efforts before ground clearing begins to reduce negative impacts on species of concern;
- Remove and relocate any plants of botanical or ecological significance as indicated by the ecologist or Environmental Control Officer (ECO);
- Vegetation to be removed as it becomes necessary;

- Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area;
- Monitoring should be implemented during the construction phase of the development to ensure that minimal impact is caused to the flora of the area;
- The ECO should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The ECO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation;
- Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications;
- Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during pipeline construction;
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors (refer to Appendix C) occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist.

5.2 HABITAT FRAGMENTATION

5.2.1 Description of impact:

The construction of buildings, fences and roads will inevitably result in natural movement patterns being disrupted and, to a varying degree depending on how different species react to these barriers will result in the fragmentation of natural populations. The development will have a low impact in fragmenting the habitats on the property.

5.2.2 Mitigation measures:

- All possible efforts must be made to ensure as little disturbance as possible to the habitats during construction;
- Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place;
- Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas.

5.3 INCREASED SOIL EROSION AND SEDIMENTATION

5.3.1 Description of impact:

The soils in the project area vary from shallow gravelly soils to deeper red apedal sandy loam soils on the undulating plains. The construction activities associated with the developments may result in widespread soil disturbance and is usually associated with accelerated soil erosion. Soil, sediments and associated contaminants are transported into water bodies such as pans and streams in the larger area, resulting in the loss or alteration of habitats for aquatic organisms, as well as changes in water quality. Soil erosion also promotes a variety of terrestrial ecological changes associated with disturbed areas, including the establishment of alien invasive plant species, altered plant community species composition and loss of habitat for indigenous flora.

5.3.2 Mitigation measures:

The following mitigation measures should be implemented to prevent erosion along sensitive soils, wetlands and drainage channels during the construction and operational phase of the infrastructure development:

- Cover disturbed soils as completely as possible, using vegetation or other materials;
- Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices.
- Sediment trapping, erosion and stormwater control should be addressed by a hydrological engineer in a detailed stormwater management plan;
- All aspects related to dust and air quality should be addressed by an air quality specialist in a specialist report;
- Protect sloping areas that are 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;
- Repair all erosion damage as soon as possible to allow for sufficient rehabilitation growth;
- Gravel roads must be well drained to limit soil erosion;
- Minimize clearance of vegetation. Retain natural trees, shrubbery, and grass species wherever possible;
- Implement a rehabilitation plan for the site, especially the old mining dumps and areas where depressions have formed on site;
- Cover disturbed soils as completely as possible, using vegetation or other materials.

5.4 SOIL AND WATER POLLUTION

5.4.1 Description of impact:

Construction work for the proposed infrastructure will always carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. The pollution could have a detrimental impact locally on plant communities or specific species or populations. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface or ground water, leading to potential medium/long-term impacts on flora. During the constructional phase heavy machinery and vehicles as well as sewage and domestic waste from workers would be the main contributors to potential pollution problems.

5.4.2 Mitigation measures:

- Appropriate sanitary facilities must be provided during construction and all waste removed to an appropriate waste facility.
- Any excess or waste material or chemicals should be removed from the site and discarded in an environmentally friendly way. The ECO should enforce this rule rigorously;
- Hazardous chemicals to be stored on an impervious surface protected from rainfall and storm water run-off;
- Spill kits should be on-hand to deal with spills immediately;
- All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays that will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier.

5.5 HABITAT DEGRADATION DUE TO DUST

5.5.1 Description of impact:

The environmental impacts of wind-borne dust, gases and particulates from the construction activities associated with the proposed development will have an impact on the vegetation of the area when dust settles on plant material reducing the amount of light reaching the chlorophyll in the leaves, thereby reducing photosynthesis, which in turn reduces plant productivity, growth and recruitment. The following activities will typically cause air pollution at the proposedinfrastructure development site:

- Land clearing operations and scraping;
- Materials handling operations (truck loading & unloading, tipping, stockpiling);
- Vehicle entrainment on paved and unpaved roads;
- Windblown dust-fugitive emissions (stockpiles).

One of the primary impacts associated with development activities on the biophysical environment is

linked to emission of dusts and fumes from the transportation system. Dust pollution will impact the most severe during the construction phase on the flora of the surrounding areas. Construction vehicles and equipment are the major contributors to the impact on air quality. Dust is generated during site clearance for the construction of infrastructure. Diesel exhaust gasses and other hydrocarbon emissions all add to the deterioration in air quality during this phase. Vehicles travelling at high speeds on dirt roads significantly aggravate the problem.

Dust deposited on the ground may cause changes in soil chemistry (chemical effects) and may over the long-term result in changes in plant chemistry, species composition and community structure. Sensitivities to dust deposition of the various plant species present in the area are not known. It is therefore difficult to predict which species may be susceptible. Dust in the area will be greatly increased in the dry season due to the nature of the soil in the area.

Poor air quality results in deterioration of visibility and aesthetic landscape quality of the region, particularly in winter due to atmospheric inversions.

5.5.2 Mitigation measures:

- A speed limit should be enforced on dirt roads (preferably 30km/h) during construction.
- Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.

5.6 SPREAD AND ESTABLISHMENT OF ALIEN INVASIVE SPECIES

5.6.1 Description of impact:

The construction of the infrastructure almost certainly carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project.

5.6.2 Mitigation measures:

- Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the CARA or in terms of Working for Water guidelines. The control of these species

should even begin prior to the construction phase considering that small populations of these species was observed during the field surveys;

- Institute strict control over materials brought onto site, which should be inspected for seeds of noxious plants and steps taken to eradicate these before transport to the site. Routinely fumigate or spray all materials with appropriate low-residual herbicides prior to transport to or in a quarantine area on site. The contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the construction phase. Alien invasive tree species listed by the CARA regulations should be eradicated;
- Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish;
- A plan should be developed for control of noxious weeds and invasive plants that could occur because of new surface disturbance activities at the site. The plan should address monitoring, weed identification, the way weeds spread, and methods for treating infestations. Require the use of certified weed-free mulching. Prohibit the use of fill materials from areas with known invasive vegetation problems. The spread of invasive nonnative plants should be avoided by keeping vehicles and equipment clean and reseeding disturbed areas with native plants;
- Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Once detected, an eradication/control programme should be implemented to ensure that the species' do not spread to surrounding natural ecosystems.

5.7 NEGATIVE EFFECT OF HUMAN ACTIVITIES

5.7.1 Description of impact:

An increase in human activity on the site and surrounding areas is anticipated. The risk of wood harvesting, poaching and fires is increased which could have a definite impact on the flora and fauna of the larger area. If staff compounds are erected for construction workers, the risk of pollution because of litter and inadequate sanitation and the introduction of invasive flora are increased. The presence of many construction workers or regular workers during the construction phase on site over a protracted period will result in a greatly increased risk of uncontrolled fires arising from cooking fires, improperly disposed cigarettes etc.

5.7.2 Mitigation measures:

- Staff should not be accommodated on site. No temporary accommodation must be erected on the site. Adequate rubbish bins and sanitation facilities should be provided to construction workers;
- The ECO should regularly inspect the site, including storage facilities and compounds. A monitoring programme should also be implemented around these areas to detect alien invasive species early, before they become established and, in the case of weeds, before

the release of seeds;

- Maintain proper firebreaks around entire development footprint.
- Educate construction workers regarding fire risks and the occurrence of important resources in the area and the importance of protection;
- Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas.
- Construction activities must be restricted to working hours Monday to Saturday, unless otherwise approved by the appropriate competent person in consultation with the affected residents.
- Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g. courtship, nesting) seasons. In addition, control pets to avoid harassment and disturbance of wildlife.
- Campfires at construction sites must be strictly controlled to ensure that no veld fires are caused.

5.8 ROAD MORTALITY

5.8.1 Description of impact:

Large numbers of fauna are killed daily on roads. They are either being crushed under the tyres of vehicles in the case of crawling species, or by colliding with the vehicle itself in the case of avifauna or flying invertebrates. The impact is intensified at night, especially for flying insects, as result of their attraction to the lights of vehicles.

5.8.2 Mitigation measures:

- More fauna is normally killed the faster vehicles travel. A speed limit should be enforced (speed on site max 30 km/hour; Outside of the site 60 km/h. In Rain max 20 km/h). It can be considered to install speed bumps in sections where the speed limit tends to be disobeyed. (Speed limits will also lessen the probability of road accidents and their negative consequences).
- Travelling at night should be avoided or limited as much as possible. No travelling at night should be allowed without approval by site manager;
- Lights should be positioned 5m from the roads or paved areas.

5.9 IMPACT ASSESSMENT MATRIX

Table 6 indicate the impacts described above and specific ratings of significance the impact will potentially have on the major ecosystems during the proposed development activities:

Table 6. Impact assessment Matrix for the proposed development

Nr	Activity	Impact	Without or With Mitigation	Nature (Negative or Positive Impact)	Probability		Duration		Scale		Magnitude/ Severity		Significance		Mitigation Measures	Mitigation Effect
					Magnitude	Score	Magnitude	Score	Magnitude	Score	Magnitude	Score	Score	Magnitude		
Terrestrial Biodiversity Impact Assessment																
Construction Phase																
1	Clearing of vegetation for construction of infrastructure, access roads etc.	Habitat destruction & Fragmentation	**WOM**	Negative	Definite	5	Permanent	5	Local	1	Medium	6	60	Moderate	Refer to Sections 5.1.2 and 5.2.2	May cause irreplaceable loss of resources
			WM	Negative	Definite	5	Permanent	5	Local	1	Low	2	40	Low		
2	Topsoil & subsoil stripping, exposure of soils to wind and rain during construction causing erosion and sedimentation in wetlands	Soil erosion and sedimentation	**WOM**	Negative	Definite	5	Permanent	5	Regional	3	High	8	80	High	Refer to section 5.3.2	Can be reversed
			WM	Negative	Highly Probable	4	Medium term	3	Site	2	Medium	6	44	Moderate		
3	Exposure of soils to rainfall and wind during construction	Dust pollution	**WOM**	Negative	Definite	5	Medium term	3	Site	2	Medium	6	55	Moderate	Refer to section 5.4.2	Can be reversed
			WM	Negative	Highly Probable	5	Medium term	3	Site		Low	2	25	Low		
4	Heavy machinery and vehicle movement on site	Spillages of harmful substances	**WOM**	Negative	Highly Probable	4	Long term	4	Regional	3	Medium	6	52	Moderate	Refer to section 5.5.2	Can be avoided, managed or mitigated
			WM	Negative	Probable	2	Long term	4	Site	2	Low	2	16	Negligible		
5	Continued movement of personnel and vehicles on and off the site during the construction phase, as well as occasional delivery of materials required for maintenance	Spreading of alien invasive species	**WOM**	Negative	Highly Probable	4	Permanent	5	Site	2	Medium	6	52	Moderate	Refer to section 5.6.2	Can be reversed
			WM	Negative	Probable	2	Medium term	3	Site	2	Low	2	14	Negligible		
6	Construction of infrastructure, access roads etc.	Negative effect of human activties on fauna and flora	**WOM**	Negative	Highly Probable	4	Medium term	3	Site	2	Medium	6	44	Moderate	Refer to section 5.7.2	Can be avoided, managed or mitigated
			WM	Negative	Probable	2	Medium term	3	Site	2	Low	2	14	Negligible		
7	Continued movement of vehicles on and off the site during the construction phase, as well as occasional delivery of materials required for maintenance	Road mortalities of fauna	**WOM**	Negative	Highly Probable	4	Medium term	3	Site	2	Medium	6	44	Moderate	Refer to section 5.8.2	Can be avoided, managed or mitigated
			WM	Negative	Highly Probable	4	Medium term	3	Site	2	Low	2	28	Low		

6 REHABILITATION PRINCINPLES TO BE IMPLEMENTED FOR THE BMW SITE

The following main steps can be followed to rehabilitate the BMW site, especially the old mining dumps and the stormwater canal:

1. Level the area,
2. Cover with topsoil,
3. Erosion Control;
4. Alien and invader plant species rehabilitation;
5. Rehabilitation of stormwater canals;
6. Compaction rehabilitation measures;
7. Erosion and stormwater management objectives.

6.1 LEVELLING

Denuded areas or elevated areas should be levelled. Levelling should ensure that surface water does not pond, and should also decrease the chance of erosion, decrease the flow velocity and the subsequent potential for sedimentation and vegetation loss. Additional levelling requirements:

- Spoil piles may be levelled using a dozer operation or a truck and shovel operation;
- Progressive in fill of ramps and placing of waste rock can be considered where practically feasible. A capping of topsoil must be deployed over waste rock to fill the ramp prior to topsoil placement and seeding;
- Spoils are compacted during the shaping of the spoil piles.

6.1.1 Levelling Control Procedure

Areas levelled:

- The Rehabilitation Section must notify the Survey Section in advance and indicate which areas they intend to level;
- The responsible Surveyor must stake out the control pegs. Production Rehabilitation Section must adhere to these pegs to level to the approved levelling designs;
- The Survey Section will present a plan of the area indicating any differences between the actual contours and the levelling design contours to the Production Rehabilitation Section;
- Once all the role-players are satisfied that the levelling was done within the set parameters,

- A Survey Month End Report must be completed and signed by all stake holders involved during the monthly levelling and topsoiling meeting (including contractors).

6.2 COVER WITH TOPSOIL

After levelled areas have been inspected and approved by the Superintendent, topsoil may be replaced. The way topsoil and stockpiles are created and maintained is important with regards to the implementation of a successful rehabilitation process. Soil management practices must be adhered to reduce soil loss and to encourage rehabilitation post-construction. The two most important aspects to consider when removing topsoil are the depth of soil to be removed and the conditions of storage.

The topsoil layer (0-50 cm) is important as it contains nutrients, organic material, seed, and communities of micro-organisms, fungi and soil fauna. The biologically active upper layer of soil is fundamental in the development of soils and the sustainability of the entire ecosystem.

The correct handling of topsoil is vital in conserving the seed bank and nutrients which occur within this layer thereby ensuring successful rehabilitation.

- Topsoil must only be used for rehabilitation purposes and not for any other use example i.e. construction of roads;
- Previously excavated areas on the site should be backfilled with suitable fill material, top soiled, levelled to resemble the surrounding topography and slopes and scarified for re-vegetation/re-seeding;
- On steeper slopes rehabilitation measures may include systems such as soil terracing, berm creation, grass blocks, fascine work, gabion basket work, reno-mattresses, retaining block mechanisms, sand bags, boulder and rock placement, stone pitching, and grading;

6.3 EROSION CONTROL

The soil on the site has a sandy nature and the permeation factor is High and therefore the surface runoff is decreased. Nevertheless, some mitigation is necessary to prevent possible erosion. The following management measures are proposed for the rehabilitation process:

- Visual inspection of all exposed surfaces should be conducted for signs of erosion. If erosion channels are discovered, the environmental manager will compile and implement a plan to determine the cause of erosion, reducing erosion in the identified areas and preventing future erosion. Inspection of soil depth if erosion has taken place over a constant period is necessary. If the depth has deteriorated to less than 15cm it must be rectified;
- Erosion can be repaired or minimised using gabions, reno-mattresses and planting of

indigenous grasses;

- Erosion control mechanisms must be established as soon as possible. Further financial provision should be continued over the subsequent years to allow for maintenance of the gabions, reno mattresses, and associated structures;
- A stormwater management plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion. Financial provision for closure will include the estimated costs for erosion control post-mining;
- If compaction occurs, rectification can be done by application and mixing of manure, vegetation mulch or any other organic material into the area. Use of well cured manure is preferable as it will not be associated with the nitrogen negative period associated with organic material that is not composted;

6.4 ALIEN AND INVADER PLANT SPECIES REHABILITATION

Goals for addressing the problem of Invasive Alien Species (IAS) on the site should include:

- Prevention: Keeping an IAS from being introduced onto the ecosystem. Ideally, this usually means keeping alien plants from entering the site;
- Early detection: Locating IAS before they have a chance to establish and spread. This usually requires effective, site-based inventory and monitoring programmes;
- Eradication: Killing the entire population of IAS. Typically, this can only be accomplished when the organisms are detected early;
- Control: The process of long-term management of the IAS' population size and distribution when eradication is no longer feasible.

The following basic principles apply to the control of AIS on the BMW site during the rehabilitation process:

- The Contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the concurrent rehabilitation phase. Alien invasive tree species should be eradicated;
- Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion;
- Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented;

- Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish;
- Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds;

During the rehabilitation of the site, the eradication and control of alien invasive species should be an on-going action. An alien eradication plan should be implemented.

6.5 REHABILITATION OF STORMWATER CANALS

The stormwater canals on site should also be vegetated with indigenous grass and forb species to encourage better water quality. Once all construction has ceased on site, the canals will need to be re-profiled to ensure the unobstructed flow of surface water through the channel. The banks of the canals will require contouring to reduce the risk of soil erosion. The site will then need to be treated with fertilizer, compost and topsoil, followed by the planting of indigenous vegetation. Grass canals should be developed to carry the stormwater on site (Figure 7):

- The grass canals (swales) should be designed according to engineering specifications. According to the MBWCP (2006), the following five steps are typically required for design:
    - Determine the likely treatment performance of the conceptual design, and specify associated plant species and planting densities;
    - Determine the design flows and resultant dimensions of the swale(s), cognisant of site constraints;
    - Estimate and optimise the design inflow of the system, verifying the design with scour velocity and treatment performance checks;
    - Size the overflow area(s) making allowance for roads; and
    - Draft a maintenance plan.

The proposed canals for the site should be a dry swale (canal as indicated in Figure 7). The canal should be designed to contain the entire volume of water that passes through.

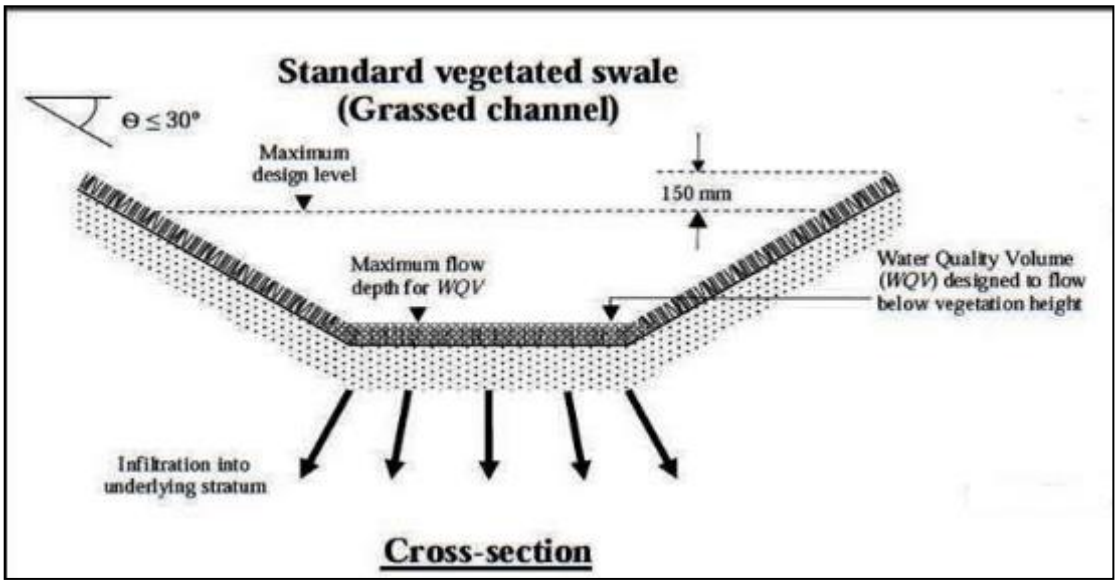

Figure 7. Cross section through proposed stormwater grass canals as part of the project

The following rehabilitation and management actions should be implemented for drainage canals on the site:

- Erosion should be prevented and controlled at all cost to prevent the wash-away of valuable topsoil and sedimentation of streams. Water runoff from the site and surrounding area should be controlled as far as possible to prevent adverse effects;
- Drainage should be consistent with land use and natural drainage patterns should be re-established where appropriate. Existing drainage will be re-established wherever possible through the re-instatement of existing contours;
- The quality of water leaving the site should be such as to cause no significant deterioration of water quality to the downstream beneficial use(s) or water quality objectives of the receiving waters;
- Surface water runoff will be monitored as required until relinquishment. It is noted that the nature of the soils in the operational areas means that these areas will drain very quickly, particularly during the dry season. Surface water sampling programs will necessarily focus upon opportunistic surface sampling after periods of heavy rainfall; and
- Production of polluted water should be minimized and trends should indicate improvement.

In addition to the rehabilitation actions, the following principles should be applied for the maintenance of the water control structures as relevant during the operational phase of the site:

- Maintain the designed freeboard and alignment of contour walls. Re-align contour walls where subsidence has taken place or clear the contour furrow where it has been blocked. Maintain the capacity of all water control structures e.g. contour furrows behind contour walls by regularly cutting grass and removing it from flow area;
- Remove all trees and shrubs from water control structures, e.g. both the flow area of contour furrows;
- Inspect the waterways for obstacles before the rain season and after storm events. Remove all obstacles that can obstruct the flow of water;
- Ensure the discharge of free draining water control structures to avoid the accumulation of water;
- Keep the water control structures on access roads intact and maintain capacity by removing silted material. Reinstate the wall height where it had been damaged by traffic;
- Long term phasing out of contour maintenance can be implemented when an acceptable veldt condition is reached and after a recommendation by a specialist; and
- Monitor the trampling of open standing water sources on rehabilitated areas to determine damage to the cover layer.

The following cannot be allowed:

- Do not allow excessive traffic on the gabion or grassed waterways and over contour walls;
- Do not allow trees and shrubs to get established on or near reinforced (gabions and concrete) waterways; and
- Do not alter the design requirements of any waterway after rehabilitation by adding surface run-off from other areas to the waterway without redesigning the structure.

6.6 COMPACTION REHABILITATION MEASURES

Soil compaction is often an effect of high traffic areas on development sites. It can become a major problem and can be recognised by:

- Excess surface moisture and slow drying soils due to deeper compaction preventing the percolation of water through the soil profile;
- Water runoff due to surface compaction preventing penetration and absorption (ponding of water), especially on banks and sloping surfaces;
- Large clear or sparsely covered areas devoid of a good vegetative cover due to hardened topsoil layers.

Rip and/or scarify all disturbed areas, including roads that are no longer in use (preferably before the rainy season). Do not rip and/or scarify areas under wet conditions, as the soil will not loosen.

6.7 EROSION AND STORMWATER MANAGEMENT OBJECTIVES

Water has the gift to sustain life, but also the potential to maim, damage and destroy if not managed correctly. Erosion is unfortunately often associated with development as areas become disturbed or as stormwater runoff is concentrated at outlets. In order avoid these problems, options such as stabilisation, energy dissipation and the design of stormwater management systems, which do not concentrate flows, are recommended. A few structures incorporated into stormwater design play a role in the dissipation of energy required to prevent erosion at outlet and inlet points, and at various points in different conveyance structures.

Remedial actions must be established to ensure that potential erosion on site is addressed with an erosion control strategy towards rehabilitation. It is important to take note of the following generic points regarding erosion risks in the study area:

- Soil loss will be greater during wetter periods. However, the provision of erosion control measures through the drier months of the year is equally as important;
- Soil loss from the site is proportionally related to the time the soils are exposed, prior to rehabilitation. The time from commencement of rehabilitation activities to finalization thereof should be limited. Rehabilitation efforts should commence as soon as practical;
- Construction staging and progressive/concurrent rehabilitation is important;
- The extent of the disturbance that will take place will influence the risk and consequences of erosion on the site;
- Avoid over-wetting, saturation and unnecessary run-off during dust control activities

and irrigation;

Nevertheless, some mitigation is necessary to prevent possible erosion on site. The following management measures are proposed for the rehabilitation process:

- Re-profiling of the banks of disturbed drainage areas to a maximum gradient of 1:3 to ensure bank stability;
- Reinforce banks and drainage features where necessary with gabions, energy dissipaters reno mattresses and geotextiles. This is especially relevant for the stormwater outlet area;
- A stormwater plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion during the operational phase of the development;
- If compaction occurs, rectification can be done by application and mixing of manure, vegetation mulch or any other organic material into the area. Use of well cured manure is preferable as it will not be associated with the nitrogen negative period associated with organic material that is not composted;

These guidelines require greater cognisance to be taken of natural hydrological patterns and systems in the development of stormwater management systems and that the potential negative impacts highlighted above are reduced as far as is practically possible.

Stormwater management objectives should include the following:

- Minimise the Threat of Flooding: This remains a key objective of any stormwater management system. However, the challenge when contemplating design of stormwater management systems is to consider the following:
    - To mimic pre-development responses to storms
    - To reduce the volume of runoff by promoting infiltration
    - To reduce the peak flows and increase the time-to-peak through detaining the runoff and releasing it at a gradual rate
    - Where necessary, to construct means to contain flood waters and safely convey them out of the urban area

It should be noted that the “receiving water body” is not necessarily the system into which stormwater is discharged directly but can also be a natural system located further downstream in the catchment. Every endeavour should be made to achieve the following as far as possible:

- Maintain natural flow regimes and seasonality
- Prevent deterioration in water quality

- Prevent erosion or sedimentation of natural wetlands or rivers

The need to design appropriate stormwater management systems for new developments should be seen as an opportunity to preserve or, if possible, improve natural freshwater ecosystems that have suffered degradation as a result of past activities, and in some cases, to create additional freshwater habitats that will contribute to the availability of appropriate, high quality river and wetland habitat that mimics the natural condition.

Promote Multi-Functional Use of Stormwater Management Systems: Resources such as land and water are becoming increasingly scarce and multiple uses of these must be strived for. Stormwater systems provide a wide range of opportunities for multi-functionality.

- Development of Sustainable Environments: Developers should think beyond their short-term involvement with the project and consider the sustainability of the stormwater management system that is to be implemented. All relevant factors that will impact on future operation and maintenance should be considered. Maintenance requirements should be minimised as far as possible to maximise the available local authority funding, personnel and equipment. Responsibilities for maintenance must be resolved with the relevant local authority department at an early stage of the design. The possibility of developing public/private partnerships should be explored with local authorities (e.g. division of funding of capital versus maintenance costs between public and private sectors). Environmental policies such as promoting the use of locally indigenous vegetation in planting programmes will also reduce the long-term maintenance requirements of the development.

7 SENSITIVITY ANALYSIS AND CONSERVATION ANALYSIS TOOLS

There are several assessments for South Africa as a whole, as well as on provincial levels that allow for detailed conservation planning as well as meeting biodiversity targets for the country's variety of ecosystems. These guides are essential to consult for development projects and will form an important part of the sensitivity analysis. Areas earmarked for conservation in the future, or that are essential to meet biodiversity and conservation targets should not be developed and have a high sensitivity as they are necessary for overall functioning. In addition, sensitivity analysis in the field based in much finer scale data can be used to ground truth the larger scale assessments and put it into a more localised context.

7.1 CRITICAL BIODIVERSITY & ECOLOGICAL SUPPORT AREAS OF THE PROJECT AREA

The purpose of the Northern Cape Conservation Plan is to develop the spatial component of a bioregional plan (i.e. map of Critical Biodiversity Areas (CBA) and associated land-use guidelines).

The Northern Cape Conservation Plan categories for the project area are presented in Figure 7. The following can be concluded regarding developments:

- The proposed BMW infrastructure development site is in a highly degraded state and should not be classified into any of the categories indicated on the map below (Figure 9).

Economically Active Population

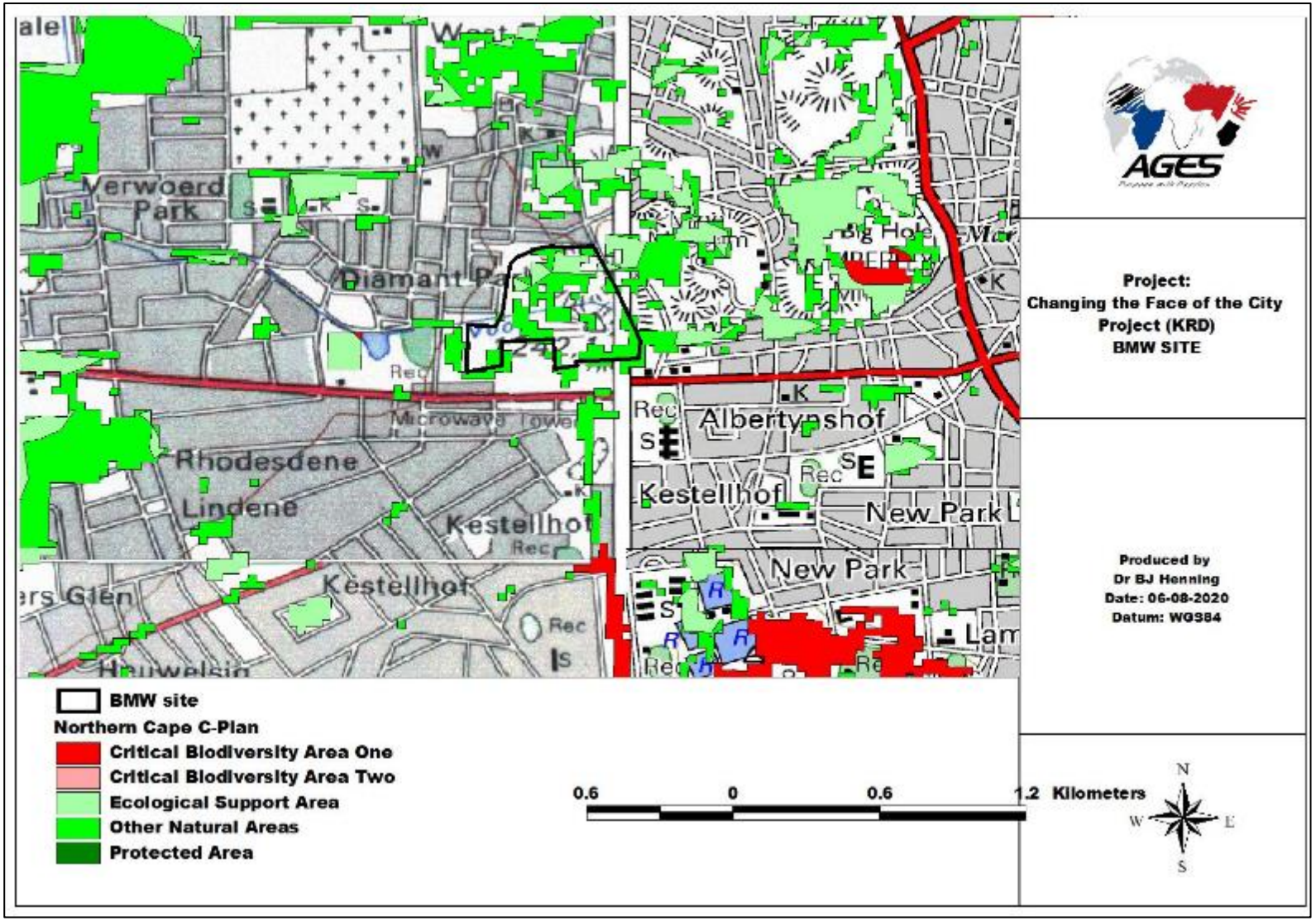

Figure 8. Northern Cape C-Plan Map for the project area

7.2 PROTECTED AREAS NETWORK AND NATIONAL PROTECTED AREAS EXPANSION STRATEGY (NPAES)

Officially protected areas, either provincially or nationally that occur close to a project site could have consequences as far as impacts on these areas are concerned. For the proposed Development site and associated infrastructure however, the Vaalbos National Park is located west of the study area, although the closest point of the reserve to the site is 30km to the northwest.

The NPAES are areas designated for future incorporation into existing protected areas (both National and informal protected areas). These areas are large, mostly intact areas required to meet biodiversity targets, and suitable for protection. They may not necessarily be proclaimed as protected areas in the future and are a broad scale planning tool allowing for better development and conservation planning. No NPAES occur in proximity of the development site, with the closest being the NPAES linked to the Mokala National Park that is situated to the southwest of the project area.

7.3 MPORTANT BIRD AREAS

An Important Bird Area (IBA) is an area recognized as being globally important habitat for the conservation of bird populations. Currently there are about 10,000 IBAs worldwide. At present, South Africa has 124 IBA's, covering over 14 million hectares of habitat for our threatened, endemic and congregatory birds. Yet only million hectares of the total land surface covered by our IBA's legally protected. The BirdLife SA IBA programme continues a programme of stewardship which will ultimately achieve formal protection (Birdlife, 2013).

Two IBAs is located within proximity to the project area, namely Kamferspan slightly northeast, north and east and Dronfield further northeast and east of the project areas (Figure 9).

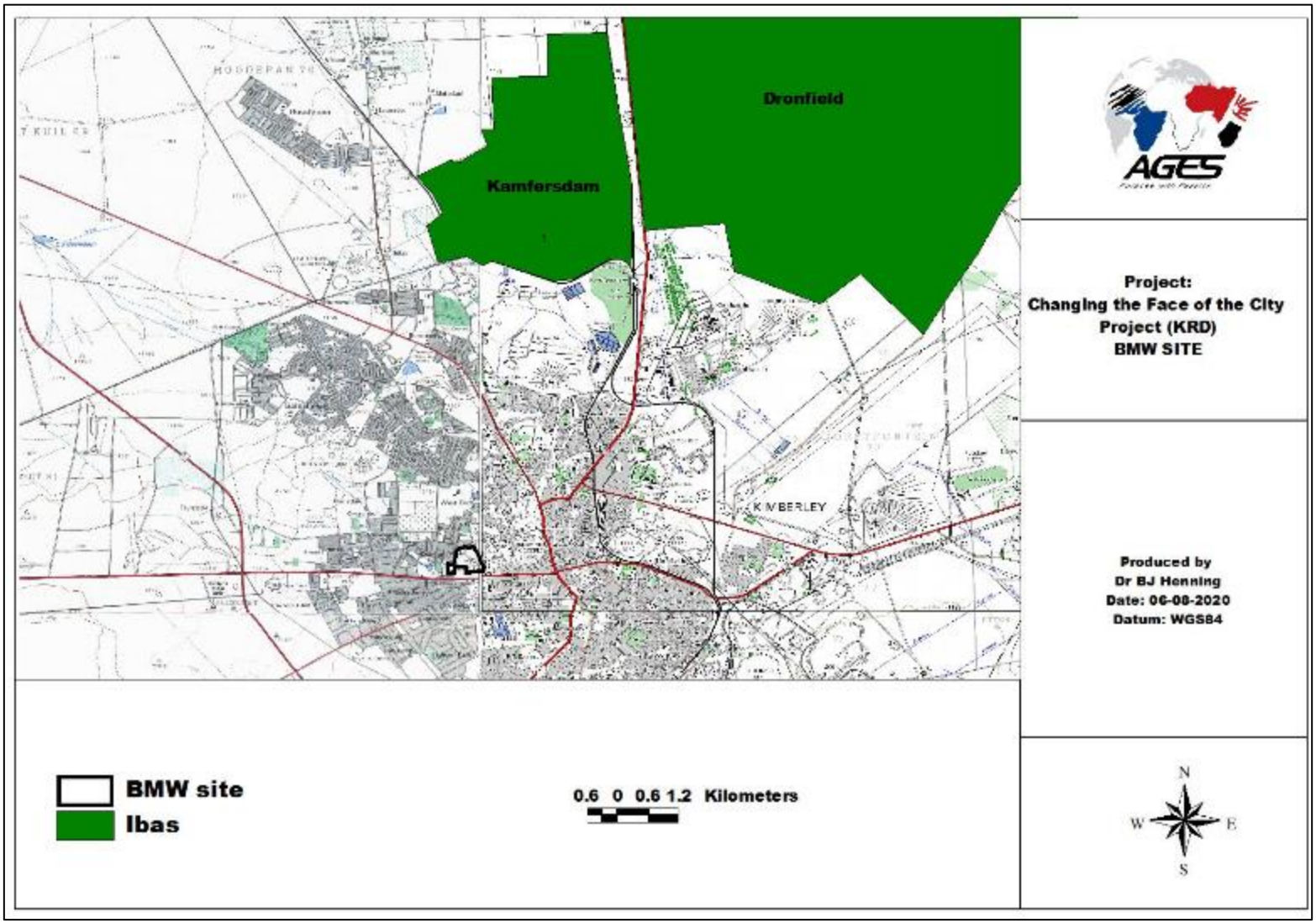

Figure 9. IBAs near the project area (Birdlife SA)

7.4 NATIONALLY THREATENED ECOSYSTEMS

The list of national Threatened Ecosystems has been gazetted (NEM: BA: National list of ecosystems that are threatened and in need of protection) and result in several implications in terms of development within these areas. Four basic principles were established for the identification of threatened ecosystems. These include:

- The approach must be explicit and repeatable;
- The approach must be target driven and systematic, especially for threatened ecosystems;
- The approach must follow the same logic as the IUCN approach to listing threatened species, whereby a number of criteria are developed, and an ecosystem is listed based on its highest ranking criterion; and
- The identification of ecosystems to be listed must be based on scientifically credible, practical and simple criteria, which must translate into spatially explicit identification of ecosystems.

Areas were delineated based on as fine a scale as possible and are defined by one of several assessments: These areas are essential for conservation of the country's ecosystems as well as meeting conservation targets. No listed ecosystem occurs in proximity of the project area. The Vaal-Vet Sandy Grassland vegetation type is located 50 km east of the site.

7.5 NFEPA STATUS OF RIVERS CLOSE TO THE SITE AND IMPACTS ON SUBCATCHMENTS

NFEPA maps provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or 'FEPAs'. NFEPA maps were developed using the principles of systematic biodiversity planning, also known as systematic conservation planning (Margules and Pressey 2000). Systematic biodiversity planning is a well-established field of science in which South Africa is considered a world leader (Balmford 2003). The NFEPA maps and supporting information form part of a comprehensive approach to sustainable and equitable development of South Africa's scarce water resources. For integrated water resources planning, NFEPA provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act (Act 36 of 1998). NFEPA products are therefore directly applicable to the National Water Act, feeding into Catchment Management Strategies, water resource classification, reserve determination, and the setting and monitoring of resource quality objectives. NFEPA products are also directly relevant to the National Environmental Management: Biodiversity Act (Act 10 of 2004), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act. NFEPA products support the implementation of the National Environmental Management: Protected Areas Act (Act 57 of 2003) by informing the expansion of the protected area network.

No National Freshwater Ecosystem Priority Area occur within close proximity of the site and the subcatchment will not be impacted to the extent that it will negatively impact the Vaal River or Kamfers Pan that occurs to the north and east of the site.

7.6 ECOLOGICAL SENSITIVITY CLASSES

Following the ecological surveys, the classification of the study area into different sensitivity classes and development zones was based on information collected at various levels on different environmental characteristics. Factors which determined sensitivity classes were as follows:

- Presence, density and potential impact of development on rare, endemic and protected plant species;
- Conservation status of vegetation units;
- Soil types, soil depth and soil clay content;
- Previous land-use;
- State of the vegetation in general as indicated by indicator species.

Below included is the sensitivity map for the proposed infrastructure development, (Figure 10). Only criteria applicable to the specific vegetation units were used to determine the sensitivity of the specific unit.

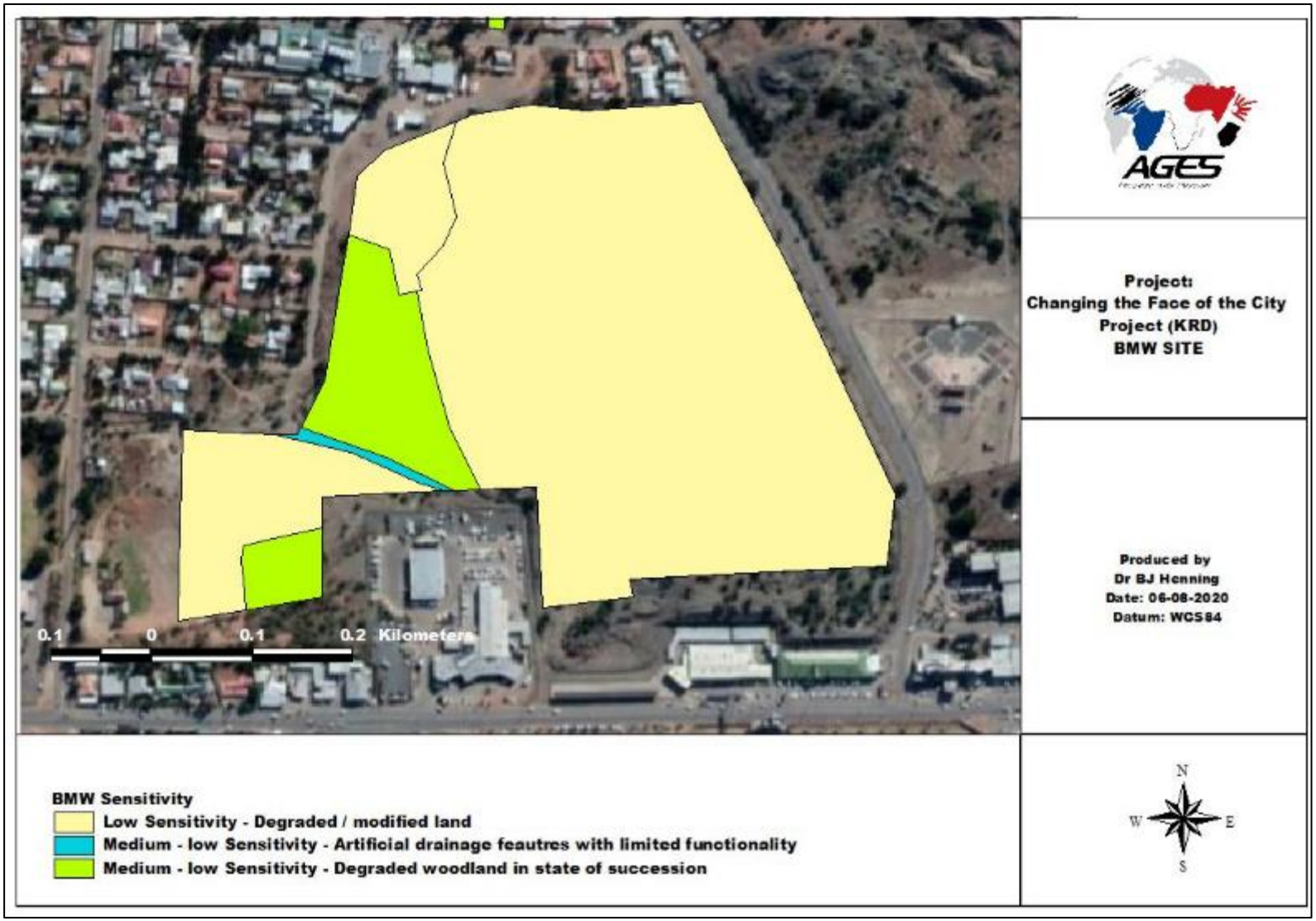

Figure 10. Sensitivity Map of the project area

8 DISCUSSION

Following the investigation and potential ecological impact of the proposed infrastructure development on the fauna and flora vegetation of the area, some conclusions can be made:

All aspects of the environment, especially living organisms, are vulnerable to disturbance of their habitat. The proposed development activities will modify the vegetation and faunal habitats of the development site to a certain extent varying according to the habitats on the site, although in general the vegetation on site where the development footprint is planned are classified as degraded.

Detailed ecological (fauna habitat & flora) surveys were conducted during July 2020 to verify the ecological sensitivity, floristic components and vegetation of the site at ground level. A sensitivity analyses was conducted for the vegetation units to identify the most suitable site for the development.

The area under application is in the City of Kimberley as indicated in Figure 1. The area has been highly disturbed by previous overgrazing, dumping, littering, wood harvesting and old mining dumps. Most development has an impact on the environment. In this case the project area within which the development footprint is planned will be cleared, therefore directly impacting on the environment. A sensitivity analyses was conducted to identify the specific sensitive areas where management measures should be implemented. The following was concluded from the analyses:

- Small pockets of natural vegetation with dense alien vegetation occur in the area and has a Medium-Low Sensitivity. Unlimited development of these areas can be supported;
- Considering the degraded state of the BMW site the area can be developed as Low Sensitivity areas without any limitations, other than rehabilitation of the old mining dumps. These areas are the most suitable for the development of infrastructure since these areas represent medium-low or low sensitivity land on which impacts will be minimal;

Several potential impacts were identified and assessed. A few of these were assessed as having potentially medium or high significance, including the following:

- Destruction or disturbance to sensitive ecosystems leading to reduction in the overall extent of a particular habitat;
- Increased soil erosion;
- Impairment of the movement and/or migration of animal species resulting in genetic and/or ecological impacts;

- Destruction/permanent loss of individuals of rare, endangered, endemic and/or protected species;
- Establishment and spread of declared weeds and alien invader plants;
- Air pollution through dusts and fumes from construction vehicles (construction phase;
- Fauna mortalities on the road during construction and operational phases of the development.

Mitigation measures are provided that would reduce these impacts from a higher to a lower significance. Furthermore, the proposed layout plan of the development should be consistent with the sensitivity map and recommendations stipulated in this report, and the impact on the sensitive habitats on site should be kept to a minimum.

9 CONCLUSION

All aspects of the environment, especially living organisms, are vulnerable to disturbance of their habitat. If we can bring about a more integrated approach to living within our ecosystems, we are much more likely to save the fundamental structure of biodiversity. Positive contributions can be made even on a small scale such as within the proposed BMW infrastructure development that forms part of the project “Changing the Face of the City” in Kimberley City. All stakeholders, such as business, government and environmental groups need to be involved to the impacts associated with the development from causing a significant loss.

The proposed development should mainly focus on rehabilitation of the site and management of stormwater on site during and after construction. This is needed to minimize impacts on the surrounding ecosystems occurring in the area. Negative impacts can be minimised by strict enforcement and compliance with an Environmental Management Plan which considers the recommendations for managing impacts detailed above.

Provided that the proposed development and layout plans is consistent with the sensitivity map and take all the mitigation measures into consideration stipulated in this report, the planned development can be supported.

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APPENDIX A. PLANT SPECIES IN QDS

Family	Genus	Sp1	IUCN
Poaceae	*Cymbopogon*	*pospischilii*	NE
Malvaceae	*Hermannia*	*bryoniifolia*	LC
Fabaceae	*Vachellia*	*erioloba*	LC
Poaceae	*Anthephora*	*pubescens*	LC
Poaceae	*Sporobolus*	*albicans*	LC
Amaryllidaceae	*Haemanthus*	*humilis*	LC
Amaranthaceae	*Salsola*	*henriciae*	LC
Fabaceae	*Crotalaria*	*griquensis*	LC
Lamiaceae	*Stachys*	*spathulata*	LC
Malvaceae	*Malva*	*sylvestris*	
Rubiaceae	*Nenax*	*microphylla*	LC
Asteraceae	*Pteronia*	*sordida*	LC
Euphorbiaceae	*Euphorbia*	*serpens*	NE
Asphodelaceae	*Aloe*	*grandidentata*	LC
Fabaceae	*Prosopis*	*glandulosa*	NE
Asteraceae	*Ursinia*	*nana*	LC
Solanaceae	*Solanum*	*catombelense*	LC
Malvaceae	*Hibiscus*	*pusillus*	LC
Fabaceae	*Indigofera*	*alternans*	
Poaceae	*Eragrostis*	*curvula*	LC
Asteraceae	*Tagetes*	*minuta*	
Iridaceae	*Lapeirousia*	*plicata*	
Lamiaceae	*Leonotis*	*pentadentata*	LC
Aizoaceae	*Galenia*	*exigua*	LC
Boraginaceae	*Heliotropium*	*nelsonii*	LC
Scrophulariaceae	*Selago*	*centralis*	LC
Cucurbitaceae	*Cucumis*	*heptadactylus*	LC
Solanaceae	*Lycium*	*cinereum*	LC
Poaceae	*Oropetium*	*capense*	LC
Acanthaceae	*Barleria*	*irritans*	LC
Solanaceae	*Lycium*	*hirsutum*	LC
Poaceae	*Digitaria*	*sanguinalis*	NE
Asteraceae	*Felicia*	*muricata*	LC
Malvaceae	*Hermannia*	*jacobeifolia*	LC
Salicaceae	*Salix*	*mucronata*	LC
Fabaceae	*Parkinsonia*	*aculeata*	NE
Apocynaceae	*Raphionacme*	*velutina*	LC
Asteraceae	*Pteronia*	*glauca*	LC
Asteraceae	*Schkuhria*	*pinnata*	
Nyctaginaceae	*Commicarpus*	*pentandrus*	LC
Asteraceae	*Hirpicium*	*echinus*	LC
Limeaceae	*Limeum*	*sulcatum*	LC
Poaceae	*Sporobolus*	*ludwigii*	LC

Family	Genus	Sp1	IUCN
Asteraceae	*Hertia*	*pallens*	LC
Apocynaceae	*Raphionacme*	*hirsuta*	LC
Poaceae	*Digitaria*	*sp.*	
Poaceae	*Sporobolus*	*ioclados*	LC
Vitaceae	*Cyphostemma*	*hereroense*	LC
Scrophulariaceae	*Jamesbrittenia*	*albiflora*	LC
Asteraceae	*Chrysocoma*	*ciliata*	LC
Poaceae	*Aristida*	*congesta*	LC
Zygophyllaceae	*Roepera*	*incrustata*	
Asteraceae	*Senecio*	*consanguineus*	LC
Poaceae	*Eragrostis*	*tef*	NE
Fabaceae	*Senegalia*	*mellifera*	LC
Hyacinthaceae	*Drimia*	*intricata*	LC
Amaranthaceae	*Salsola*	*tuberculata*	LC
Asteraceae	*Ifloga*	*glomerata*	LC
Boraginaceae	*Ehretia*	*rigida*	LC
Malvaceae	*Sida*	*chrysantha*	LC
Vahliaceae	*Vahlia*	*capensis*	LC
Cyperaceae	*Afroscirpoides*	*dioeca*	
Aizoaceae	*Mesembryanthemum*	*granulicaule*	
Cyperaceae	*Cyperus*	*decurvatus*	LC
Cleomaceae	*Cleome*	*rubella*	LC
Amaranthaceae	*Salsola*	*kalaharica*	LC
Polygonaceae	*Rumex*	*lanceolatus*	LC
Asteraceae	*Amellus*	*tridactylus*	LC
Asteraceae	*Pentzia*	*lanata*	LC
Poaceae	*Eragrostis*	*sp.*	
Poaceae	*Aristida*	*congesta*	LC
Iridaceae	*Moraea*	*pallida*	LC
Poaceae	*Phalaris*	*minor*	NE
Asteraceae	*Felicia*	*fascicularis*	LC
Phyllanthaceae	*Phyllanthus*	*parvulus*	LC
Poaceae	*Stipagrostis*	*uniplumis*	LC
Malvaceae	*Hermannia*	*cernua*	LC
Dipsacaceae	*Scabiosa*	*columbaria*	LC
Cyperaceae	*Bulbostylis*	*hispidula*	LC
Poaceae	*Sporobolus*	*tenellus*	LC
Amaranthaceae	*Salsola*	*aphylla*	LC
Fabaceae	*Vachellia*	*tortilis*	LC
Convolvulaceae	*Convolvulus*	*dregeanus*	LC
Poaceae	*Sporobolus*	*rangei*	LC
Poaceae	*Setaria*	*verticillata*	LC
Scrophulariaceae	*Aptosimum*	*elongatum*	LC
Anacardiaceae	*Searsia*	*pyroides*	LC

Family	Genus	Sp1	IUCN
Apocynaceae	*Pentarrhinum*	*insipidum*	LC
Brassicaceae	*Heliophila*	*suavissima*	LC
Euphorbiaceae	*Euphorbia*	*spartaria*	LC
Ebenaceae	*Diospyros*	*austro-africana*	LC
Solanaceae	*Solanum*	*capense*	LC
Phyllanthaceae	*Phyllanthus*	*maderaspatensis*	LC
Scrophulariaceae	*Aptosimum*	*indivisum*	LC
Verbenaceae	*Lantana*	*rugosa*	LC
Brassicaceae	*Lepidium*	*africanum*	LC
Amaranthaceae	*Suaeda*	*fruticosa*	LC
Cyperaceae	*Cyperus*	*usitatus*	LC
Poaceae	*Enneapogon*	*cenchroides*	LC
Asteraceae	*Felicia*	*muricata*	LC
Euphorbiaceae	*Euphorbia*	*inaequilatera*	LC
Amaranthaceae	*Atriplex*	*cinerea*	
Malvaceae	*Radyera*	*urens*	LC
Euphorbiaceae	*Euphorbia*	*crassipes*	LC
Lamiaceae	*Salvia*	*stenophylla*	
Amaranthaceae	*Chenopodium*	*glaucum*	
Menispermaceae	*Antizoma*	*angustifolia*	LC
Fabaceae	*Sesbania*	*punicea*	NE
Molluginaceae	*Hypertelis*	*cerviana*	
Asphodelaceae	*Trachyandra*	*saltii*	LC
Asphodelaceae	*Gonialoe*	*variegata*	LC
Asteraceae	*Dicoma*	*capensis*	LC
Convolvulaceae	*Convolvulus*	*ocellatus*	LC
Poaceae	*Panicum*	*impeditum*	LC
Poaceae	*Pogonarthria*	*squarrosa*	LC
Pedaliaceae	*Harpagophytum*	*procumbens*	NE
Cyperaceae	*Kyllinga*	*alba*	LC
Fabaceae	*Prosopis*	*glandulosa*	NE
Poaceae	*Eragrostis*	*nindensis*	LC
Poaceae	*Stipagrostis*	*ciliata*	LC
Oxalidaceae	*Oxalis*	*pes-caprae*	LC
Boraginaceae	*Trichodesma*	*angustifolium*	LC
Malvaceae	*Abutilon*	*austro-africanum*	LC
Fabaceae	*Vachellia*	*hebeclada*	LC
Asteraceae	*Eriocephalus*	*karooicus*	LC
Malvaceae	*Hibiscus*	*marlothianus*	LC
Asteraceae	*Helichrysum*	*caespititium*	LC
Hyacinthaceae	*Albuca*	*prasina*	
Poaceae	*Themeda*	*triandra*	LC
Asteraceae	*Helichrysum*	*cerastioides*	LC
Solanaceae	*Lycium*	*pilifolium*	LC

Family	Genus	Sp1	IUCN
Gisekiaceae	*Gisekia*	*pharnaceoides*	
Poaceae	*Eustachys*	*paspaloides*	LC
Poaceae	*Cenchrus*	*ciliaris*	LC
Asphodelaceae	*Bulbine*	*abyssinica*	LC
Asteraceae	*Pentzia*	*globosa*	LC
Fabaceae	*Indigastrum*	*niveum*	
Amaranthaceae	*Chenopodium*	*album*	
Fabaceae	*Medicago*	*laciniata*	NE
Scrophulariaceae	*Selago*	*geniculata*	LC
Cucurbitaceae	*Cucumis*	*myriocarpus*	LC
Phyllanthaceae	*Phyllanthus*	*parvulus*	LC
Asteraceae	*Pentzia*	*incana*	LC
Polygonaceae	*Fagopyrum*	*esculentum*	
Scrophulariaceae	*Selago*	*saxatilis*	LC
Asteraceae	*Erigeron*	*bonariensis*	
Poaceae	*Setaria*	*italica*	NE
Iridaceae	*Moraea*	*polystachya*	LC
Fabaceae	*Lessertia*	*frutescens*	LC
Asteraceae	*Cineraria*	*aspera*	LC
Caryophyllaceae	*Herniaria*	*erckertii*	LC
Poaceae	*Setaria*	*pumila*	LC
Fabaceae	*Rhynchosia*	*totta*	
Ricciaceae	*Riccia*	*albolimbata*	
Poaceae	*Tragus*	*koelerioides*	LC
Fabaceae	*Prosopis*	*chilensis*	NE
Papaveraceae	*Argemone*	*ochroleuca*	
Scrophulariaceae	*Nemesia*	*pubescens*	LC
Asteraceae	*Lasiopogon*	*glomerulatus*	LC
Asteraceae	*Pentzia*	*calva*	LC
Aizoaceae	*Galenia*	*pubescens*	LC
Santalaceae	*Viscum*	*rotundifolium*	LC
Malvaceae	*Hermannia*	*tomentosa*	LC
Fabaceae	*Elephantorrhiza*	*elephantina*	LC
Poaceae	*Melinis*	*repens*	LC
Scrophulariaceae	*Chaenostoma*	*halimifolium*	LC
Santalaceae	*Thesium*	*lacinulatum*	LC
Boraginaceae	*Heliotropium*	*ciliatum*	LC
Poaceae	*Eragrostis*	*echinochloidea*	LC
Poaceae	*Stipagrostis*	*uniplumis*	LC
Santalaceae	*Osyris*	*lanceolata*	LC
Fabaceae	*Vachellia*	*haematoxylon*	LC
Poaceae	*Aristida*	*sp.*	
Apocynaceae	*Brachystelma*	*burchellii*	LC
Poaceae	*Sporobolus*	*fimbriatus*	LC

Family	Genus	Sp1	IUCN
Poaceae	*Enneapogon*	*desvauxii*	LC
Cyperaceae	*Cyperus*	*marginatus*	LC
Amaranthaceae	*Suaeda*	*sp.*	
Rubiaceae	*Kohautia*	*cynanchica*	LC
Fumariaceae	*Fumaria*	*parviflora*	
Fabaceae	*Tephrosia*	*burchellii*	LC
Amaranthaceae	*Gomphrena*	*celosioides*	
Convolvulaceae	*Convolvulus*	*boedeckerianus*	LC
Aizoaceae	*Mestoklema*	*tuberosum*	LC
Malvaceae	*Hermannia*	*sp.*	
Poaceae	*Chloris*	*virgata*	LC
Apocynaceae	*Cynanchum*	*orangeanum*	LC
Asteraceae	*Osteospermum*	*scariosum*	NE
Cleomaceae	*Cleome*	*angustifolia*	LC
Oxalidaceae	*Oxalis*	*haedulipes*	LC
Aizoaceae	*Ruschia*	*sp.*	
Poaceae	*Aristida*	*vestita*	LC
Poaceae	*Eragrostis*	*micrantha*	LC
Malvaceae	*Hermannia*	*erodioides*	LC
Asteraceae	*Hertia*	*kraussii*	LC
Crassulaceae	*Kalanchoe*	*paniculata*	LC
Amaranthaceae	*Amaranthus*	*standleyanus*	
Lamiaceae	*Ocimum*	*americanum*	LC
Acanthaceae	*Barleria*	*rigida*	LC
Hyacinthaceae	*Massonia*	*jasminiflora*	LC
Asparagaceae	*Asparagus*	*suaveolens*	LC
Verbenaceae	*Chascanum*	*pinnatifidum*	LC
Phyllanthaceae	*Phyllanthus*	*reticulatus*	LC
Asteraceae	*Nolletia*	*chrysocomoides*	LC
Asteraceae	*Amellus*	*tridactylus*	LC
Poaceae	*Eragrostis*	*lehmanniana*	LC
Polygalaceae	*Polygala*	*seminuda*	LC
Bruchiaceae	*Cladophascum*	*gymnomitrioides*	
Fabaceae	*Lotononis*	*curtii*	LC
Amaranthaceae	*Chenopodium*	*mucronatum*	LC
Poaceae	*Panicum*	*stapfianum*	LC
Amaranthaceae	*Amaranthus*	*dinteri*	NE
Aizoaceae	*Chasmatophyllum*	*musculinum*	LC
Limeaceae	*Limeum*	*fenestratum*	LC
Asteraceae	*Oedera*	*humilis*	
Poaceae	*Enneapogon*	*scoparius*	LC
Poaceae	*Stipagrostis*	*obtusa*	LC
Thymelaeaceae	*Lasiosiphon*	*polycephalus*	LC
Aizoaceae	*Mestoklema*	*copiosum*	LC

Family	Genus	Sp1	IUCN
Poaceae	*Eragrostis*	*porosa*	LC
Hyacinthaceae	*Ledebouria*	*undulata*	LC
Poaceae	*Fingerhuthia*	*africana*	LC
Cucurbitaceae	*Cucumis*	*africanus*	LC
Anacardiaceae	*Schinus*	*molle*	NE
Poaceae	*Schmidtia*	*pappophoroides*	LC
Poaceae	*Aristida*	*stipitata*	LC
Asteraceae	*Senecio*	*sp.*	
Poaceae	*Cynodon*	*incompletus*	LC
Poaceae	*Eragrostis*	*cilianensis*	LC
Ebenaceae	*Euclea*	*crispa*	LC
Poaceae	*Sporobolus*	*coromandelianus*	LC
Poaceae	*Aristida*	*adscensionis*	LC
Boraginaceae	*Heliotropium*	*lineare*	LC
Brassicaceae	*Erucastrum*	*griquense*	LC
Asphodelaceae	*Bulbine*	*favosa*	LC
Pteridaceae	*Cheilanthes*	*hirta*	
Cyperaceae	*Cyperus*	*laevigatus*	LC
Limeaceae	*Limeum*	*aethiopicum*	NE
Crassulaceae	*Kalanchoe*	*tubiflora*	
Fabaceae	*Indigofera*	*alternans*	LC
Meliaceae	*Melia*	*azedarach*	NE
Bignoniaceae	*Rhigozum*	*obovatum*	LC
Scrophulariaceae	*Peliostomum*	*leucorrhizum*	LC
Poaceae	*Cynodon*	*dactylon*	LC
Campanulaceae	*Wahlenbergia*	*denticulata*	LC
Asphodelaceae	*Aloe*	*claviflora*	LC
Poaceae	*Eragrostis*	*superba*	LC
Asparagaceae	*Asparagus*	*mucronatus*	LC
Poaceae	*Tragus*	*racemosus*	LC
Asteraceae	*Oncosiphon*	*piluliferus*	LC
Thymelaeaceae	*Lasiosiphon*	*burchellii*	LC
Poaceae	*Melinis*	*repens*	LC
Fabaceae	*Senna*	*italica*	LC
Aizoaceae	*Ruschia*	*griquensis*	LC
Cucurbitaceae	*Kedrostis*	*africana*	LC
Amaranthaceae	*Salsola*	*rabieana*	LC
Asteraceae	*Helichrysum*	*lineare*	LC
Gisekiaceae	*Gisekia*	*pharnaceoides*	LC
Oleaceae	*Menodora*	*africana*	LC
Amaranthaceae	*Aerva*	*leucura*	LC
Amaranthaceae	*Salsola*	*aellenii*	LC
Fabaceae	*Melolobium*	*calycinum*	LC
Malvaceae	*Grewia*	*flava*	LC

Family	Genus	Sp1	IUCN
Solanaceae	*Solanum*	*burchellii*	LC
Combretaceae	*Combretum*	*erythrophyllum*	LC
Amaranthaceae	*Sericorema*	*remotiflora*	LC
Amaranthaceae	*Salsola*	*glabrescens*	LC
Cucurbitaceae	*Coccinia*	*sessilifolia*	LC
Poaceae	*Eragrostis*	*homomalla*	LC
Fabaceae	*Crotalaria*	*sphaerocarpa*	LC
Asteraceae	*Arctotis*	*venusta*	LC
Bignoniaceae	*Rhigozum*	*trichotomum*	LC
Poaceae	*Heteropogon*	*contortus*	LC
Commelinaceae	*Commelina*	*africana*	LC
Fabaceae	*Prosopis*	*velutina*	NE
Caryophyllaceae	*Pollichia*	*campestris*	LC
Gentianaceae	*Sebaea*	*pentandra*	LC
Asteraceae	*Dicoma*	*macrocephala*	LC
Asteraceae	*Berkheya*	*pinnatifida*	LC
Solanaceae	*Solanum*	*tomentosum*	
Fabaceae	*Ptycholobium*	*biflorum*	LC
Poaceae	*Schismus*	*barbatus*	LC
Poaceae	*Eragrostis*	*bicolor*	LC
Convolvulaceae	*Ipomoea*	*bolusiana*	LC
Poaceae	*Digitaria*	*eriantha*	LC
Gisekiaceae	*Gisekia*	*africana*	LC
Poaceae	*Panicum*	*schinzii*	LC
Asteraceae	*Troglophyton*	*capillaceum*	LC
Malvaceae	*Hermannia*	*comosa*	LC
Poaceae	*Eragrostis*	*obtusa*	LC
Campanulaceae	*Wahlenbergia*	*nodosa*	LC
Asteraceae	*Helichrysum*	*argyrosphaerum*	LC
Fabaceae	*Gleditsia*	*triacanthos*	NE
Apocynaceae	*Asclepias*	*meyeriana*	LC
Asteraceae	*Geigeria*	*filifolia*	LC
Santalaceae	*Thesium*	*hystrix*	LC
Amaranthaceae	*Alternanthera*	*pungens*	
Solanaceae	*Solanum*	*lichtensteinii*	LC
Poaceae	*Eragrostis*	*biflora*	LC
Aizoaceae	*Mesembryanthemum*	*coriarium*	
Fabaceae	*Calobota*	*cuspidosa*	LC
Asparagaceae	*Asparagus*	*laricinus*	LC
Asteraceae	*Amphiglossa*	*triflora*	LC
Aizoaceae	*Galenia*	*pallens*	DD
Aizoaceae	*Galenia*	*prostrata*	LC
Apocynaceae	*Gomphocarpus*	*tomentosus*	LC
Poaceae	*Eragrostis*	*pseudobtusa*	NE

Family	Genus	Sp1	IUCN
Amaranthaceae	*Amaranthus*	*praetermissus*	LC
Cucurbitaceae	*Cucumis*	*zeyheri*	LC
Juncaceae	*Juncus*	*rigidus*	LC
Poaceae	*Tragus*	*berteronianus*	LC
Fabaceae	*Indigofera*	*daleoides*	LC
Asteraceae	*Lactuca*	*inermis*	LC
Poaceae	*Phragmites*	*australis*	LC
Poaceae	*Leptochloa*	*fusca*	LC
Asteraceae	*Laggera*	*decurrens*	LC
Poaceae	*Panicum*	*coloratum*	LC
Malvaceae	*Hermannia*	*bicolor*	LC
Solanaceae	*Datura*	*ferox*	
Fabaceae	*Medicago*	*sativa*	NE
Apocynaceae	*Stenostelma*	*capense*	LC
Fabaceae	*Vachellia*	*karroo*	LC
Geraniaceae	*Pelargonium*	*minimum*	LC
Hyacinthaceae	*Dipcadi*	*sp.*	
Lamiaceae	*Acrotome*	*inflata*	LC
Scrophulariaceae	*Jamesbrittenia*	*aurantiaca*	LC
Solanaceae	*Lycium*	*horridum*	LC
Anacardiaceae	*Searsia*	*erosa*	LC
Malvaceae	*Hermannia*	*linearifolia*	LC
Asteraceae	*Osteospermum*	*spinescens*	LC
Poaceae	*Cynodon*	*transvaalensis*	LC
Amaranthaceae	*Kyphocarpa*	*angustifolia*	LC
Amaranthaceae	*Atriplex*	*nummularia*	
Scrophulariaceae	*Aptosimum*	*marlothii*	LC
Scrophulariaceae	*Selago*	*sp.*	
Scrophulariaceae	*Limosella*	*grandiflora*	LC
Colchicaceae	*Ornithoglossum*	*vulgare*	LC
Ricciaceae	*Riccia*	*pottsiana*	
Asteraceae	*Osteospermum*	*muricatum*	LC
Poaceae	*Urochloa*	*panicoides*	LC
Pteridaceae	*Cheilanthes*	*eckloniana*	LC
Hyacinthaceae	*Albuca*	*tortuosa*	LC
Asteraceae	*Pentzia*	*calcarea*	LC
Anacardiaceae	*Searsia*	*undulata*	LC
Asteraceae	*Pegolettia*	*retrofracta*	LC
Aizoaceae	*Galenia*	*filiformis*	LC
Scrophulariaceae	*Jamesbrittenia*	*sp.*	
Amaranthaceae	*Hermbstaedtia*	*odorata*	NE
Fabaceae	*Lessertia*	*pauciflora*	LC
Aizoaceae	*Trichodiadema*	*sp.*	
Asparagaceae	*Asparagus*	*cooperi*	LC

Family	Genus	Sp1	IUCN
Anacardiaceae	*Searsia*	*ciliata*	LC
Scrophulariaceae	*Jamesbrittenia*	*atropurpurea*	LC
Scrophulariaceae	*Chaenostoma*	*patrioticum*	LC
Asteraceae	*Helichrysum*	*zeyheri*	LC
Fabaceae	*Rhynchosia*	*totta*	LC
Fabaceae	*Melolobium*	*microphyllum*	LC
Apocynaceae	*Brachystelma*	*foetidum*	LC
Solanaceae	*Nicotiana*	*glauca*	
Poaceae	*Eragrostis*	*truncata*	LC

APPENDIX B. PLANT SPECIES FOUND DURING SURVEYS

Plant species lists for site
Woody species
Dichrostachys cinerea
Eucalyptus grandis
Melia azedarach
Nicotiana glauca
Phytolaca octandra
Pinus spp.
Prosopis glandulosa
Schinus molle
Searsia lancea
Searsia pendulina
Senegalia mellifera
Senegallia caffra
Senegallia hebeclada
Tarchonanthus camphoratus
Tipuana tipu
Vachellia tortilis
Ziziphus mucronata
Grass species
Aristida congesta
Aristida junciformes
Botriochloa insculpta
Cenchrus ciliaris
Chloris virgata
Chloris gayana
Cynodon dactylon
Enneapogon cenchroides
Enneapogon desvauxii
Enneapogon scoparius
Eragrostis echinocloidea
Eragrostis lehmanniana
Fingerhutia africana
Heteropogon contortus
Panicum maximumE
Paspalum dilatatum
Phragmites australis
Setaria verticillata
Sporobolus africanus
Sporobolus iocladus
Stipagrostis uniplumis
Forbs and succulents
Agave sessilana
Argemone ochroleuca
Asparagus suaveolens

Plant species lists for site
Bidens pilosa
Cirsium vulgare
Crotalaria orientalis
Cyperus sexangularis
Gomphocarpus fruticosus
Laggera decurrens
Nicandra physaloides
Nidorella anomala
Oncopsiphon frutticosum
Opuntia ficus-indica
Opuntia stricta
Pentzia calcarea
Salsola kallii
Sarcostemma spp.
Sonchus oleraceus
Tagetes minuta
Typha canepsis
Vigna vexillata

APPENDIX C. BIRD SPECIES LIST FOR QDS

Common_name	Taxon_name
Avocet, Pied	*Recurvirostra avosetta*
Barbet, Acacia Pied	*Tricholaema leucomelas*
Barbet, Black-collared	*Lybius torquatus*
Barbet, Crested	*Trachyphonus vaillantii*
Batis, Pririt	*Batis pririt*
Bee-eater, European	*Merops apiaster*
Bee-eater, Swallow-tailed	*Merops hirundineus*
Bee-eater, White-fronted	*Merops bullockoides*
Bishop, Southern Red	*Euplectes orix*
Bishop, Yellow-crowned	*Euplectes afer*
Bittern, Little	*Ixobrychus minutus*
Bokmakierie, Bokmakierie	*Telophorus zeylonus*
Brubru, Brubru	*Nilaus afer*
Bulbul, African Red-eyed	*Pycnonotus nigricans*
Bunting, Cape	*Emberiza capensis*
Bunting, Cinnamon-breasted	*Emberiza tahapisi*
Bunting, Golden-breasted	*Emberiza flaviventris*
Bunting, Lark-like	*Emberiza impetuani*
Bustard, Kori	*Ardeotis kori*
Bustard, Ludwig's	*Neotis ludwigii*
Buttonquail, Kurrichane	*Turnix sylvaticus*
Buzzard, Jackal	*Buteo rufofuscus*
Buzzard, Steppe	*Buteo vulpinus*
Canary, Black-throated	*Crithagra atrogularis*
Canary, White-throated	*Crithagra albogularis*
Canary, Yellow	*Crithagra flaviventris*
Chat, Anteating	*Myrmecocichla formicivora*
Chat, Familiar	*Cercomela familiaris*
Chat, Sickle-winged	*Cercomela sinuata*
Cisticola, Cloud	*Cisticola textrix*
Cisticola, Desert	*Cisticola aridulus*
Cisticola, Grey-backed	*Cisticola subruficapilla*
Cisticola, Levaillant's	*Cisticola tinniens*
Cisticola, Rattling	*Cisticola chiniana*
Cisticola, Wing-snapping	*Cisticola ayresii*
Cisticola, Zitting	*Cisticola juncidis*
Cliff-swallow, South African	*Hirundo spilodera*
Coot, Red-knobbed	*Fulica cristata*
Cormorant, Reed	*Phalacrocorax africanus*
Cormorant, White-breasted	*Phalacrocorax carbo*
Courser, Burchell's	*Cursorius rufus*

Common_name	Taxon_name
Courser, Double-banded	*Rhinoptilus africanus*
Courser, Temminck's	*Cursorius temminckii*
Crake, Black	*Amaurornis flavirostris*
Crane, Blue	*Anthropoides paradiseus*
Crombec, Long-billed	*Sylvietta rufescens*
Crow, Pied	*Corvus albus*
Cuckoo, African	*Cuculus gularis*
Cuckoo, Black	*Cuculus clamosus*
Cuckoo, Diderick	*Chrysococcyx caprius*
Cuckoo, Jacobin	*Clamator jacobinus*
Darter, African	*Anhinga rufa*
Dove, Laughing	*Streptopelia senegalensis*
Dove, Namaqua	*Oena capensis*
Dove, Red-eyed	*Streptopelia semitorquata*
Dove, Rock	*Columba livia*
Drongo, Fork-tailed	*Dicrurus adsimilis*
Duck, Fulvous	*Dendrocygna bicolor*
Duck, Maccoa	*Oxyura maccoa*
Duck, White-faced	*Dendrocygna viduata*
Duck, Yellow-billed	*Anas undulata*
Eagle, Booted	*Aquila pennatus*
Eagle, Martial	*Polemaetus bellicosus*
Eagle, Tawny	*Aquila rapax*
Eagle, Verreaux's	*Aquila verreauxii*
Eagle-owl, Spotted	*Bubo africanus*
Egret, Cattle	*Bubulcus ibis*
Egret, Great	*Egretta alba*
Egret, Little	*Egretta garzetta*
Egret, Yellow-billed	*Egretta intermedia*
Eremomela, Yellow-bellied	*Eremomela icteropygialis*
Falcon, Amur	*Falco amurensis*
Falcon, Lanner	*Falco biarmicus*
Falcon, Peregrine	*Falco peregrinus*
Falcon, Pygmy	*Polihierax semitorquatus*
Finch, Red-headed	*Amadina erythrocephala*
Finch, Scaly-feathered	*Sporopipes squamifrons*
Firefinch, Red-billed	*Lagonosticta senegala*
Fiscal, Common (Southern)	*Lanius collaris*
Fish-eagle, African	*Haliaeetus vocifer*
Flamingo, Greater	*Phoenicopterus ruber*
Flamingo, Lesser	*Phoenicopterus minor*
Flycatcher, Chat	*Bradornis infuscatus*
Flycatcher, Fairy	*Stenostira scita*

Common_name	Taxon_name
Flycatcher, Fiscal	*Sigelus silens*
Flycatcher, Marico	*Bradornis mariquensis*
Flycatcher, Spotted	*Muscicapa striata*
Francolin, Orange River	*Scleroptila levaillantoides*
Goose, Egyptian	*Alopochen aegyptiacus*
Goose, Spur-winged	*Plectropterus gambensis*
Goshawk, Gabar	*Melierax gabar*
Goshawk, Southern Pale Chanting	*Melierax canorus*
Grebe, Little	*Tachybaptus ruficollis*
Greenshank, Common	*Tringa nebularia*
Guineafowl, Helmeted	*Numida meleagris*
Gull, Grey-headed	*Larus cirrocephalus*
Hamerkop, Hamerkop	*Scopus umbretta*
Harrier, Montagu's	*Circus pygargus*
Heron, Black-headed	*Ardea melanocephala*
Heron, Goliath	*Ardea goliath*
Heron, Grey	*Ardea cinerea*
Heron, Purple	*Ardea purpurea*
Heron, Squacco	*Ardeola ralloides*
Honeyguide, Greater	*Indicator indicator*
Honeyguide, Lesser	*Indicator minor*
Hoopoe, African	*Upupa africana*
Hornbill, Southern Yellow-billed	*Tockus leucomelas*
House-martin, Common	*Delichon urbicum*
Ibis, African Sacred	*Threskiornis aethiopicus*
Ibis, Glossy	*Plegadis falcinellus*
Ibis, Hadeda	*Bostrychia hagedash*
Kestrel, Greater	*Falco rupicoloides*
Kestrel, Lesser	*Falco naumanni*
Kestrel, Rock	*Falco rupicolus*
Kingfisher, Brown-hooded	*Halcyon albiventris*
Kingfisher, Malachite	*Alcedo cristata*
Kingfisher, Pied	*Ceryle rudis*
Kite, Black-shouldered	*Elanus caeruleus*
Korhaan, Blue	*Eupodotis caerulescens*
Korhaan, Northern Black	*Afrotis afraoides*
Korhaan, Red-crested	*Lophotis ruficrista*
Korhaan, Southern Black	*Afrotis afra*
Lapwing, Blacksmith	*Vanellus armatus*
Lapwing, Crowned	*Vanellus coronatus*
Lark, Eastern Clapper	*Mirafra fasciolata*
Lark, Fawn-coloured	*Calendulauda africanoides*
Lark, Large-billed	*Galerida magnirostris*

Common_name	Taxon_name
Lark, Monotonous	*Mirafra passerina*
Lark, Pink-billed	*Spizocorys conirostris*
Lark, Red-capped	*Calandrella cinerea*
Lark, Rufous-naped	*Mirafra africana*
Lark, Sabota	*Calendulauda sabota*
Lark, Spike-heeled	*Chersomanes albofasciata*
Lark, Stark's	*Spizocorys starki*
Longclaw, Cape	*Macronyx capensis*
Martin, Banded	*Riparia cincta*
Martin, Brown-throated	*Riparia paludicola*
Martin, Rock	*Hirundo fuligula*
Martin, Sand	*Riparia riparia*
Masked-weaver, Southern	*Ploceus velatus*
Moorhen, Common	*Gallinula chloropus*
Mousebird, Red-faced	*Urocolius indicus*
Mousebird, Speckled	*Colius striatus*
Mousebird, White-backed	*Colius colius*
Myna, Common	*Acridotheres tristis*
Neddicky, Neddicky	*Cisticola fulvicapilla*
Night-Heron, Black-crowned	*Nycticorax nycticorax*
Nightjar, Rufous-cheeked	*Caprimulgus rufigena*
Ostrich, Common	*Struthio camelus*
Owl, Barn	*Tyto alba*
Owl, Marsh	*Asio capensis*
Owlet, Pearl-spotted	*Glaucidium perlatum*
Painted-snipe, Greater	*Rostratula benghalensis*
Palm-swift, African	*Cypsiurus parvus*
Peacock, Common	*Pavo cristatus*
Penduline-tit, Cape	*Anthoscopus minutus*
Pigeon, Speckled	*Columba guinea*
Pipit, African	*Anthus cinnamomeus*
Pipit, African Rock	*Anthus crenatus*
Pipit, Buffy	*Anthus vaalensis*
Pipit, Kimberley	*Anthus pseudosimilis*
Pipit, Long-billed	*Anthus similis*
Pipit, Plain-backed	*Anthus leucophrys*
Plover, Common Ringed	*Charadrius hiaticula*
Plover, Grey	*Pluvialis squatarola*
Plover, Kittlitz's	*Charadrius pecuarius*
Plover, Three-banded	*Charadrius tricollaris*
Pochard, Southern	*Netta erythrophthalma*
Prinia, Black-chested	*Prinia flavicans*
Pytilia, Green-winged	*Pytilia melba*

Common_name	Taxon_name
Quail, Common	*Coturnix coturnix*
Quailfinch, African	*Ortygospiza atricollis*
Quelea, Red-billed	*Quelea quelea*
Rail, African	*Rallus caerulescens*
Reed-warbler, African	*Acrocephalus baeticatus*
Robin-chat, Cape	*Cossypha caffra*
Rock-thrush, Short-toed	*Monticola brevipes*
Roller, European	*Coracias garrulus*
Roller, Lilac-breasted	*Coracias caudatus*
Ruff, Ruff	*Philomachus pugnax*
Sandgrouse, Burchell's	*Pterocles burchelli*
Sandgrouse, Namaqua	*Pterocles namaqua*
Sandpiper, Common	*Actitis hypoleucos*
Sandpiper, Curlew	*Calidris ferruginea*
Sandpiper, Marsh	*Tringa stagnatilis*
Sandpiper, Wood	*Tringa glareola*
Scimitarbill, Common	*Rhinopomastus cyanomelas*
Scrub-robin, Kalahari	*Cercotrichas paena*
Scrub-robin, Karoo	*Cercotrichas coryphoeus*
Secretarybird, Secretarybird	*Sagittarius serpentarius*
Shelduck, South African	*Tadorna cana*
Shoveler, Cape	*Anas smithii*
Shrike, Crimson-breasted	*Laniarius atrococcineus*
Shrike, Lesser Grey	*Lanius minor*
Shrike, Red-backed	*Lanius collurio*
Snake-eagle, Black-chested	*Circaetus pectoralis*
Snipe, African	*Gallinago nigripennis*
Sparrow, Cape	*Passer melanurus*
Sparrow, House	*Passer domesticus*
Sparrow, Southern Grey-headed	*Passer diffusus*
Sparrowlark, Grey-backed	*Eremopterix verticalis*
Sparrow-weaver, White-browed	*Plocepasser mahali*
Spoonbill, African	*Platalea alba*
Spurfowl, Swainson's	*Pternistis swainsonii*
Starling, Cape Glossy	*Lamprotornis nitens*
Starling, Common	*Sturnus vulgaris*
Starling, Pied	*Spreo bicolor*
Starling, Red-winged	*Onychognathus morio*
Starling, Wattled	*Creatophora cinerea*
Stilt, Black-winged	*Himantopus himantopus*
Stint, Little	*Calidris minuta*
Stonechat, African	*Saxicola torquatus*
Stork, Abdim's	*Ciconia abdimii*

Common_name	Taxon_name
Stork, Saddle-billed	*Ephippiorhynchus senegalensis*
Stork, White	*Ciconia ciconia*
Stork, Yellow-billed	*Mycteria ibis*
Sunbird, Dusky	*Cinnyris fuscus*
Sunbird, White-bellied	*Cinnyris talatala*
Swallow, Barn	*Hirundo rustica*
Swallow, Greater Striped	*Hirundo cucullata*
Swallow, Pearl-breasted	*Hirundo dimidiata*
Swallow, Red-breasted	*Hirundo semirufa*
Swallow, White-throated	*Hirundo albigularis*
Swamphen, African Purple	*Porphyrio madagascariensis*
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*
Swift, African Black	*Apus barbatus*
Swift, Alpine	*Tachymarptis melba*
Swift, Bradfield's	*Apus bradfieldi*
Swift, Horus	*Apus horus*
Swift, Little	*Apus affinis*
Swift, White-rumped	*Apus caffer*
Tchagra, Brown-crowned	*Tchagra australis*
Teal, Cape	*Anas capensis*
Teal, Hottentot	*Anas hottentota*
Teal, Red-billed	*Anas erythrorhyncha*
Tern, Whiskered	*Chlidonias hybrida*
Tern, White-winged	*Chlidonias leucopterus*
Thick-knee, Spotted	*Burhinus capensis*
Thrush, Groundscraper	*Psophocichla litsipsirupa*
Thrush, Karoo	*Turdus smithi*
Tit, Ashy	*Parus cinerascens*
Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*
Turtle-dove, Cape	*Streptopelia capicola*
Vulture, Lappet-faced	*Torgos tracheliotus*
Vulture, White-backed	*Gyps africanus*
Wagtail, Cape	*Motacilla capensis*
Warbler, Rufous-eared	*Malcorus pectoralis*
Warbler, Willow	*Phylloscopus trochilus*
Waxbill, Black-faced	*Estrilda erythronotos*
Waxbill, Common	*Estrilda astrild*
Waxbill, Violet-eared	*Granatina granatina*
Weaver, Cape	*Ploceus capensis*
Weaver, Sociable	*Philetairus socius*
Wheatear, Capped	*Oenanthe pileata*
Wheatear, Mountain	*Oenanthe monticola*
White-eye, Cape	*Zosterops virens*

Common_name	Taxon_name
White-eye, Orange River	*Zosterops pallidus*
Whydah, Pin-tailed	*Vidua macroura*
Wood-hoopoe, Green	*Phoeniculus purpureus*
Woodpecker, Cardinal	*Dendropicos fuscescens*
Woodpecker, Golden-tailed	*Campethera abingoni*

APPENDIX D MAMMAL SPECIES LIST

Family	Genus	Species	Subspecies	Common name	Red list category
Bovidae	*Aepyceros*	*melampus*		Impala	Least Concern
Bovidae	*Alcelaphus*	*buselaphus*		Hartebeest	Not listed
Bovidae	*Alcelaphus*	*caama*		Red Hartebeest	Least Concern
Bovidae	*Antidorcas*	*marsupialis*		Springbok	Least Concern
Bovidae	*Connochaetes*	*gnou*		Black Wildebeest	Least Concern
Bovidae	*Connochaetes*	*taurinus*	*taurinus*	Blue wildebeest	Least Concern
Bovidae	*Damaliscus*	*lunatus*		Common Tsessebe	Least Concern (IUCN 2008)
Bovidae	*Damaliscus*	*pygargus*	*phillipsi*	Blesbok	Least Concern
Bovidae	*Hippotragus*	*equinus*		Roan Antelope	Vulnerable
Bovidae	*Hippotragus*	*niger*	*niger*	Sable antelope	Vulnerable
Bovidae	*Oryx*	*gazella*		Gemsbok	Least Concern
Bovidae	*Raphicerus*	*campestris*		Steenbok	Least Concern
Bovidae	*Sylvicapra*	*grimmia*		Bush Duiker	Least Concern
Bovidae	*Syncerus*	*caffer*		African Buffalo	Least Concern
Bovidae	*Tragelaphus*	*oryx*		Common Eland	Least Concern
Bovidae	*Tragelaphus*	*strepsiceros*		Greater Kudu	Least Concern
Canidae	*Canis*	*mesomelas*		Black-backed Jackal	Least Concern
Canidae	*Otocyon*	*megalotis*		Bat-eared Fox	Least Concern
Cercopithecidae	*Papio*	*ursinus*		Chacma Baboon	Least Concern
Equidae	*Equus*			Asses and Zebras	Not listed
Equidae	*Equus*	*quagga*		Plains Zebra	Not listed
Erinaceidae	*Atelerix*	*frontalis*		Southern African Hedgehog	Near Threatened
Felidae	*Felis*	*catus*		Domestic Cat	Introduced
Felidae	*Felis*	*nigripes*		Black-footed Cat	Least Concern
Giraffidae	*Giraffa*	*camelopardalis*	*camelopardalis*	Nubian Giraffe	Least Concern
Herpestidae	*Atilax*	*paludinosus*		Marsh Mongoose	Least Concern
Herpestidae	*Cynictis*	*penicillata*		Yellow Mongoose	Least Concern
Hyaenidae	*Proteles*	*cristata*		Aardwolf	Least Concern
Hystricidae	*Hystrix*	*africaeaustralis*		Cape Porcupine	Least Concern
Leporidae	*Lepus*	*capensis*		Cape Hare	Least Concern
Leporidae	*Lepus*	*saxatilis*		Scrub Hare	Least Concern
Macroscelididae	*Elephantulus*	*myurus*		Eastern Rock Elephant Shrew	Least Concern
Muridae	*Gerbilliscus*	*leucogaster*		Bushveld Gerbil	Data Deficient
Muridae	*Mastomys*	*coucha*		Southern African Mastomys	Least Concern
Muridae	*Mus*	*minutoides*		Southern African Pygmy Mouse	Least Concern
Muridae	*Rhabdomys*	*pumilio*		Xeric Four-striped Grass Rat	Least Concern
Mustelidae	*Ictonyx*	*striatus*		Striped Polecat	Least Concern
Mustelidae	*Poecilogale*	*albinucha*		African Striped Weasel	Data deficient

Family	Genus	Species	Subspecies	Common name	Red list category
Nesomyidae	*Saccostomus*	*campestris*		Southern African Pouched Mouse	Least Concern
Nesomyidae	*Steatomys*	*krebsii*		Kreb's African Fat Mouse	Least Concern
Pteropodidae	*Eidolon*	*helvum*		African Straw-colored Fruit Bat	Near Threatened (IUCN ver 3.1)
Sciuridae	*Xerus*	*inauris*		South African Ground Squirrel	Least Concern
Suidae	*Phacochoerus*	*africanus*		Common Wart-hog	Least Concern

APPENDIX E HERPETOFAUNA LIST

Reptiles

Family	Genus	Species	Subspecies	Common name	Red list category
Agamidae	*Agama*	*aculeata*	*aculeata*	Common Ground Agama	Least Concern (SARCA 2014)
Agamidae	*Agama*	*atra*		Southern Rock Agama	Least Concern (SARCA 2014)
Amphisbaenidae	*Monopeltis*	*capensis*		Cape Worm Lizard	Least Concern (SARCA 2014)
Chamaeleonidae	*Chamaeleo*	*dilepis*	*dilepis*	Common Flap-neck Chameleon	Least Concern (SARCA 2014)
Colubridae	*Crotaphopeltis*	*hotamboeia*		Red-lipped Snake	Least Concern (SARCA 2014)
Colubridae	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Least Concern (SARCA 2014)
Colubridae	*Dispholidus*	*typus*	*viridis*	Northern Boomslang	Not evaluated
Elapidae	*Elapsoidea*	*sundevallii*	*media*	Highveld Garter Snake	Not listed
Elapidae	*Naja*	*nivea*		Cape Cobra	Least Concern (SARCA 2014)
Gekkonidae	*Chondrodactylus*	*bibronii*		Bibron's Gecko	Least Concern (SARCA 2014)
Gekkonidae	*Lygodactylus*	*capensis*	*capensis*	Common Dwarf Gecko	Least Concern (SARCA 2014)
Gekkonidae	*Pachydactylus*	*capensis*		Cape Gecko	Least Concern (SARCA 2014)
Gekkonidae	*Pachydactylus*	*mariquensis*		Marico Gecko	Least Concern (SARCA 2014)
Lacertidae	*Meroles*	*squamulosus*		Common Rough-scaled Lizard	Least Concern (SARCA 2014)
Lacertidae	*Nucras*	*intertexta*		Spotted Sandveld Lizard	Least Concern (SARCA 2014)
Lamprophiidae	*Aparallactus*	*capensis*		Black-headed Centipede-eater	Least Concern (SARCA 2014)
Lamprophiidae	*Boaedon*	*capensis*		Brown House Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Lycophidion*	*capense*	*capense*	Cape Wolf Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Prosymna*	*bivittata*		Two-striped Shovel-snout	Least Concern (SARCA 2014)
Lamprophiidae	*Psammophis*	*trinasalis*		Fork-marked Sand Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Pseudaspis*	*cana*		Mole Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Xenocalamus*	*bicolor*	*bicolor*	Bicoloured Quill-snouted Snake	Least Concern (SARCA 2014)
Pelomedusidae	*Pelomedusa*	*galeata*		South African Marsh Terrapin	Not evaluated
Scincidae	*Trachylepis*	*capensis*		Cape Skink	Least Concern (SARCA 2014)
Scincidae	*Trachylepis*	*punctatissima*		Speckled Rock Skink	Least Concern (SARCA 2014)
Testudinidae	*Homopus*	*femoralis*		Greater Padloper	Least Concern (SARCA 2014)
Testudinidae	*Psammobates*	*oculifer*		Serrated Tent Tortoise	Least Concern (SARCA 2014)
Testudinidae	*Stigmochelys*	*pardalis*		Leopard Tortoise	Least Concern (SARCA 2014)
Typhlopidae	*Rhinotyphlops*	*lalandei*		Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)
Varanidae	*Varanus*	*albigularis*	*albigularis*	Rock Monitor	Least Concern (SARCA 2014)
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern (SARCA 2014)

Amphibians

Family	Genus	Species	Common name	Red list category
Brevicepitidae	*Breviceps*	*adspersus*	Bushveld Rain Frog	Least Concern
Bufonidae	*Poyntonophrynus*	*vertebralis*	Southern Pygmy Toad	Least Concern
Hyperoliidae	*Kassina*	*senegalensis*	Bubbling Kassina	Least Concern
Pipidae	*Xenopus*	*laevis*	Common Platanna	Least Concern

Family	Genus	Species	Common name	Red list category
Pyxicephalidae	*Amietia*	*fuscigula*	Cape River Frog	Least Concern
Pyxicephalidae	*Cacosternum*	*boettgeri*	Common Caco	Least Concern
Pyxicephalidae	*Tomopterna*	*cryptotis*	Tremelo Sand Frog	Least Concern