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ENVIRONMENTAL

Environmental Impact Assessment for the Blyvoor Gold Mining Project, West Rand, Gauteng

Biodiversity Report

Project Number:

BVG4880

Prepared for:

Blyvoor Gold Capital (Pty) Ltd

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EXECUTIVE SUMMARY

Digby Wells Environmental (hereinafter Digby Wells) was appointed by Blyvoor Gold Capital (Pty) Ltd (hereafter Blyvoor Gold) to undertake a freshwater impact assessment and fauna and flora baseline update as part of an Environmental Application Process to obtain the required authorisation for the Blyvoor Gold mining operation. The Blyvoor Gold Mine is located approximately six kilometres (km) south of Carletonville and 14 km north of Fochville in the Merafong Municipality within the Magisterial District of Oberholzer, in Gauteng Province. Blyvoor Gold Mine is the most westerly mine on the West Wits line, and its operations will be centred around No. 5 Shaft. The predominant surrounding land uses comprise farming, mining and associated Tailing Storage Facilities (TSFs), as well as small residential towns.

Fauna and Flora

The Blyvoor Gold Mine study area falls within the Highveld grassland biome. This biome is bordered by the Drakensberg in the east, the arid Karoo and Kalahari in the west, and the low-lying bushveld to the north. The Highveld Plateau is fairly flat with elevations varying from 1,400 m to 1,800 m. The flat topography means that the landscape is traversed by many meandering rivers, with the grassland community historically playing an important role in natural water purification of the westward flowing rivers that originate on the Drakensberg escarpment (Davies and Day 1998).

The study area falls within two vegetation types, the Carletonville Dolomite Grassland and Gauteng Shale Mountain Bushveld. Data obtained from literature resources indicate that a possible eight plant species of special concern could have been present on site prior to construction commencing.

Fauna expected to occur on site include assemblages within terrestrial and wetland ecosystems: mammals, birds, reptiles, amphibians and invertebrates. Each of these assemblages occurs within unique habitats, the ecological state of these habitats directly relates to the number of species found within them. The main habitats occurring in the project area are grassveld plains with little altitudinal variation.

No red data mammals have distributions in the project area. Ten Red Data bird species have been previously recorded in the area. No red data reptile species are expected, however one red data amphibian species could have been expected to be found on site. Three red data butterfly species have known distributions in the study site.

Wetland and Aquatic Ecology

There are 300.38 ha of wetlands within the Blyvoor project area, consisting of two channelled valley bottom systems and one unchannelled valley bottom system. These systems have been exposed to a variety of impacts, with Present Ecological State (PES) categorisations ranging from ‘Moderately Modified’ (Category C), to ‘Seriously Modified’ (Category E). These are based on modifications to the geomorphology, hydrology and vegetation structures of this system. Ecological Importance and Sensitivity (EIS) has been

categorised with ratings ranging from ‘High’ to ‘Moderate’ as these systems are still able to provide various services.

In terms of aquatic instream integrity of the freshwater systems present, the macro-invertebrate assemblages collected within the study area each exhibited seriously modified conditions (i.e. Ecological Category E) in relation to the reference conditions expected for streams of this nature in the Highveld Ecoregion. The applied Macro-Invertebrate Response Assessment Index (MIRAI) indices suggested that the primary driver of change at site BVG1 was related to poor habitat availability, while at site BVG4, the macro-invertebrate assemblage was influenced by impacts to habitat availability and compounded by further impacts to water quality. At sites BVG2 and BVG3, the key driver of change is likely related to impacts to water quality, the sources of which require confirmation. It should be noted, however, that historical data provides an indication that these systems are likely limited in diversity and function within the greater catchment as a result of various anthropogenic activities including but not limited to; dams, water abstraction activities, agriculture and livestock farming as well as mining.

The freshwater systems have historically been impacted on directly (0.7 ha of freshwater systems have been directly affected at 5 shaft), as well as indirectly through dust pollution and additional impacts related to soil disturbances and clearing of vegetation amongst others. Further impacts through the continuation of mining at Blyvoor Gold Mine are anticipated, however these impacts can be reduced through appropriate mitigation measures. Furthermore, it is anticipated that resumed mining activities at Blyvoor Gold may serve to reduce the level of artisanal mining currently taking place within HGM Unit 3.

It is important to note that while Blyvoor Gold currently holds the Mining Rights to the entire project area, the surface land areas are currently owned/leased by various parties, including other mining entities, which are currently engaged in mining activities of their own. There is thus some overlap in terms of the mitigation and management measures deemed necessary to prevent further impacts to an already degraded receiving environment, with special mention of management of the TSF facilities present on the project area, as well as the anticipated decant associated with the proposed project and dust control.

Although Blyvoor Gold mining activities are anticipated to directly affect only a small portion of the wetland and instream aquatic integrity of the systems observed at the time of the assessment, some indirect impacts are deemed possible and it is highly recommended that ongoing monitoring of the instream integrity in the vicinity of the Blyvoor Gold Mine continue. This will identify any emerging trends in terms of improvements or degradations in the ecological integrity and functioning of these systems as Blyvoor Gold is ultimately responsible for the Mining Rights Area on which these systems occur.

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GLOSSARY OF TERMS

Alien invasive vegetation	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome - usually international in origin.
Basal cover	The cross-sectional area of the plant that extends into the soil.
Base flow	Long-term flow in a river that continues after storm flow has passed.
Biodiversity	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Catchment	The area contributing to runoff at a particular point in a river feature.
Ecoregion	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Groundwater	Subsurface water in the saturated zone below the water table.
Intermittent flow	Flows only for short periods.
Indigenous vegetation	Vegetation occurring naturally within a defined area.
Perennial	Flows all year round.
Wetland	Defined according to the National Water Act, 1998 (Act No. 36 of 1998) (NWA) as: *"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 land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*

LIST OF ACRONYMS

AEL	Atmospheric Emission Licence
AIP	Alien Invasive Plants
BRP	Bioregional Plan
CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
DMR	Department of Mineral Resources
DWA	Department of Water Affairs (currently the Department of Water and Sanitation)
DWAF	Department of Water and Forestry (currently the Department of Water and Sanitation)
DWE	Digby Wells Environmental
DWS	Department of Water and Sanitation
EC	Ecological Class
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMF	Environmental Management Framework
EMO	Environmental Management Officer
ESA	Ecological Support Area
F	Facultative species
FD	Facultative dry-land species
FW	Facultative wetland species
GIS	Geographical Information System
Ha	Hectares
HGM	Hydro-geomorphic
MIRAI	Macro-Invertebrate Response Assessment Index
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MRA	Mining Right Area

NEM:BA	National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystems Priority Areas
NWA	National Water Act, 1998 (Act No. 36 of 1998)
ONA	Other Natural Area
OW	Obligate wetland species
PA	Protected Area
PES	Present Ecological State
REC	Recommended Ecological Category
RQIS	Resource Quality Information Services
SANBI	South African National Biodiversity Institute
SFI	Soil Form Indicator
SQRs	Sub-Quaternary-Reaches
SWI	Soil Wetness Indictor
TSF	Tailings Storage Facility
TUI	Terrain Unit Indicator
WMA	Water Management Areas
WRC	Water Research Commission
WRDM	West Rand District Municipality
WUL	Water Use Licence

1 Introduction

Digby Wells Environmental (hereinafter Digby Wells) was appointed by Blyvoor Gold Capital (Pty) Ltd (hereinafter Blyvoor Gold) to undertake a freshwater impact assessment and fauna and flora baseline update as part of an Environmental Application Amendment Process to obtain the required authorisation for the Blyvoor Gold mining operation.

As part of this application process, Blyvoor Gold wishes to include new proposed activities for authorisation as well as an additional update on existing and proposed infrastructure that is required to recommission the mine to an operational state. These activities include:

- Underground Mining – refurbishment of the surface and underground infrastructure that will be needed to recommence with the underground operations;
- Tailings Retreatment – reclamation of eight existing Tailings Storage Facilities (TSFs) using hydraulic methods and processed at the existing tailings treatment Plant (which requires an Atmospheric Emissions Licence (AEL);
- 'The Orphans' – additional assets and infrastructure not included as part of the purchase agreement; and
- Proposed Metallurgical Plant at No. 5 Shaft –proposed re-establishment of a Plant at No.5 Shaft (this also requires an AEL).

2 Details of the Specialist

This Specialist Report has been compiled by the following specialists:

Table 2-1: Details of the Specialist(s) who prepared this Report

Responsibility	Report Writer
Full Name of Specialist	Kieren Jayne Bremner
Highest Qualification	MSc Aquatic Health
Years of experience in specialist field	11
Registration(s):	South African Council for Natural Scientific Professionals: *Professional Natural Scientist* (Reg. No. 119341)

2.1 Declaration of the Specialist

I, Kieren Jayne Bremner, as the appointed specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent, other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity;

- in terms of the remainder of the general requirements for a specialist, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the applicant, the Department and interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.

Signature of the specialist

Kieren Jayne Bremner

Full Name and Surname of the specialist

Digby Wells Environmental

Name of company

October 2018

Date

3 Scope and Purpose of this Report

Digby Wells was commissioned by Blyvoor Gold to complete a Freshwater Impact Assessment in support of the Water Use Licence (WULA) application as well as the Environmental Impact Assessment (EIA). In addition, an updated fauna and flora baseline was required. The following actions are required for this Scope of Work:

- Determine the vegetation types of the proposed project areas;
- Determine the conservation value of the study site using existing information such as the National Biodiversity Strategies and Action Plans (NBSAP), National Threatened Ecosystems and National Protected Areas Expansion Strategy (NPAES);
- Determine the likely sensitivity of the site based on the information gathered;
- Determine the plant species likely to occur on the site using Mucina and Rutherford (2006), the lists available from the South African National Biodiversity Institute (SANBI) and information requested from Lorraine Mills from Gauteng Department of Agriculture and Rural Development (GDARD);
- Determine the animal species likely to occur on site using the lists available from SANBI as well as distribution maps;
- Determine and list all Red Data and protected species (flora and fauna) likely to occur on sites;
- A detailed desktop assessment of the freshwater systems in the vicinity of the proposed project area;
- A description of the catchment and surrounding land uses;
- A brief assessment of potential impacts to the wetlands and other freshwater systems from the proposed activities;
- Discussion of recommended mitigation measures to be taken into account; and
- Monitoring requirements will also be discussed and set out.

4 Site Locality

The Blyvoor Gold Mine is located approximately six kilometres (km) south of Carletonville and 14 km north of Fochville in the Merafong Municipality within the Magisterial District of Oberholzer, in Gauteng Province. Blyvooruitzicht Gold Mine is the most westerly mine on the West Wits line, and its operations will be centred around No. 5 Shaft whose co-ordinates are 27°20'39.11" East and 26°25'41.88" West. The predominant surrounding land uses comprises farming, mining and associated TSFs, as well as small residential towns. The locality can be seen in Figure 4-1. All freshwater systems within the project area were investigated.

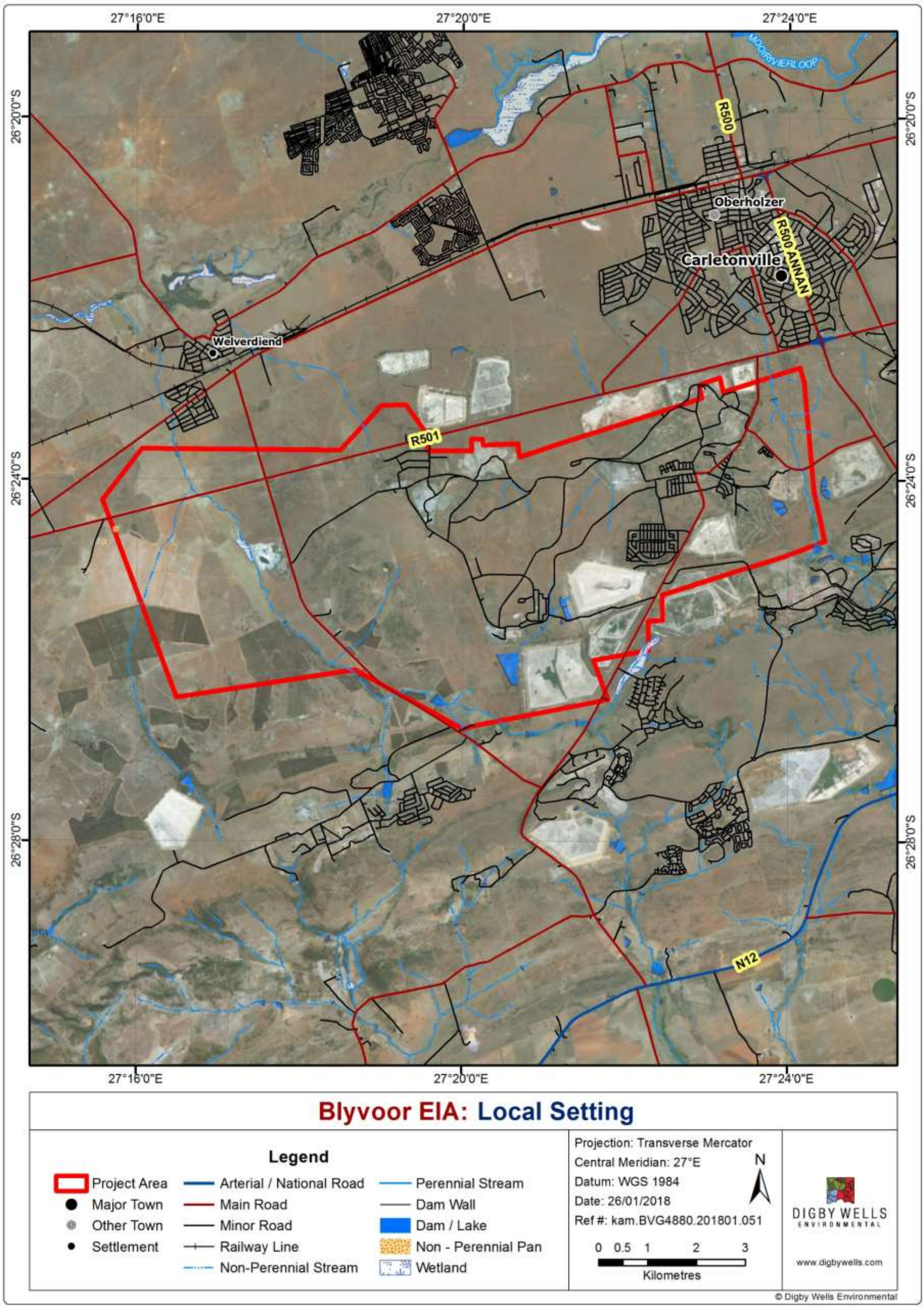


Figure 4-1: Local Setting

5 Methodology

5.1 Wetland Ecology Approach

5.1.1 Literature Review and Desktop Assessment

For the purposes of this Project, wetland areas were identified, and preliminary wetland boundaries were delineated at the desktop level using detailed aerial imagery (Southern Mapping, 2015) along with 5m contours. Baseline and background information was researched and used to understand the area on a desktop level; this included but was not limited to:

- Policies and legal framework;
- National Freshwater Ecosystems Priority Areas (NFEPA) (Nel *et al.,* 2011);
- Mining and Biodiversity Guideline;
- Water Management Areas (WMA) and Quaternary Catchments; and
- Gauteng Conservation Plan (Gauteng C-Plan).

5.1.2 Policy and Legal Framework

The wetlands assessment aims to support the following regulations, regulatory procedures and guidelines:

- Section 24 of the Constitution of the Republic of South Africa ,1996 (Act No. 108 of 1996);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA);
- Section 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- Department of Water and Forestry (DWAF) Guidelines for the Delineation of Wetlands (2005); and
- Regulations on use of water for mining and related activities aimed at the protection of water resources (GN 704 in GG 20119 of 4 June 1999).

5.1.3 National Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas (NFEPA) project provides a collated, nationally consistent information source of wetland and river ecosystems for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes (Nel *et al.* 2011). The spatial layers (FEPA's) include the nationally delineated wetland areas

that are classified into hydrogeomorphic (HGM) NFEPA project types and ranked in terms of their biodiversity importance. These layers were assessed to evaluate the importance of the wetland areas located within the Project area.

Whilst being an invaluable tool, it is important to note that the NFEPA's were delineated and studied at a desktop and low-resolution level. Thus, the wetlands delineated via the ground-truthing field assessment may differ from the NFEPA data layers. The NFEPA assessment does, however, hold significance from a national perspective. As mentioned above, the NFEPA wetlands have been ranked in terms of importance in the conservation of biodiversity and Table 5-1 below indicates the criteria considered.

Table 5-1: NFEPA Wetland Classification Ranking Criteria

Criteria	Rank
Wetlands that intersect with a RAMSAR site.	1
▪ Wetlands within 500 m of an IUCN threatened frog point locality; ▪ Wetlands within 500 m of a threatened water-bird point locality; ▪ Wetlands (excluding dams) with the majority of their area within a sub-quaternary catchment that has sightings or breeding areas for threatened Wattled Cranes, Grey Crowned Cranes and Blue Cranes; ▪ Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of exceptional Biodiversity importance, with valid reasons documented; and ▪ Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands that are good, intact examples from which to choose.	2
Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of biodiversity importance, but with no valid reasons documented.	3
Wetlands (excluding dams) in A or B condition (PES) AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion); and Wetlands in C condition (PES) AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion).	4
Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing Impacted Working for Wetland sites.	5
Any other wetland (excluding dams).	6

5.1.4 Mining and Biodiversity Guideline

The Mining and Biodiversity Guideline was developed collaboratively by the South African Biodiversity Institute (SANBI), the Department of Environmental Affairs (DEA), the Department of Mineral Resources (DMR), the Chamber of Mines (now Mineral Council of South Africa) and the South African Mining and Biodiversity Forum in 2013. The purpose of the guideline was to provide the mining sector with a manual to integrate biodiversity into the planning process thereby encouraging informed decision-making around mining

development and environmental authorisations. The aim of the guideline is to explain the value for mining companies to consider biodiversity management throughout the planning process. The guideline highlights the importance of biodiversity in managing the social, economic and environmental risk of the proposed mining project. The country has been mapped into biodiversity priority areas including the four categories listed in Table 5-2 below, each with associated risks and implications.

Table 5-2: Mining and Biodiversity Guideline Categories (SANBI, 2013)

Category	Risk and Implications for Mining
Legally protected	Mining prohibited; unless authorised by ministers of both the DEA and DMR.
Highest Biodiversity Importance	Highest Risk for Mining: the EIA process must confirm significance of the biodiversity features that may be seen as a fatal flaw to the proposed project. Specialists must provide site-specific recommendations for the application of the mitigation hierarchy that informs the decision making processes of mining licences, water use licences and environmental authorisations. If granted, authorisations should set limits on allowed activities and specify biodiversity related management outcomes.
High Biodiversity Importance	High Risk for Mining: the EIA process must confirm the significance of the biodiversity features for the conservation of biodiversity priority areas. Significance of impacts must be discussed as mining options are possible but must be limited. Authorisations may set limits and specify biodiversity related management outcomes.
Moderate Biodiversity Importance	Moderate Risk for Mining: the EIA process must confirm the significance of the biodiversity features and the potential impacts as mining options must be limited but are possible. Authorisations may set limits and specify biodiversity related management outcomes.

5.1.5 Gauteng Province Conservation Tools

5.1.5.1 Gauteng Conservation Plan Background

Gauteng Nature Conservation, a component of the Gauteng Department of Agriculture and Rural Development (GDARD), produced the Gauteng Conservation Plan Version 3 (C-Plan 3) in December 2010. The latest version is C-Plan 3.3 which became available in October 2011 and was revised in December 2013. C-Plan 3.3 is a valuable tool to ensure adequate, timely and fair service delivery to clients of GfDARD, and will be critical in ensuring adequate protection of biodiversity and the environment in Gauteng Province.

The main purposes of the C-Plan 3.3 are:

- To serve as the primary decision support tool for the biodiversity component of the Environmental Impact Assessment (EIA) process;
- To inform protected area expansion and biodiversity stewardship programmes in the province; and

- To serve as a basis for development of Bioregional Plans in municipalities within the province.

5.1.6 West Rand District Municipality (WRDM) Conservation Tools

5.1.6.1 Environmental Management Framework and Bioregional Plan

The West Rand District Municipality WRDM, according to the WRDM Environmental Management Framework (EMF) (2013), is experiencing extreme pressure between mining, agriculture and tourism in terms of biodiversity, heritage, air quality, water availability and quality, and geological constraints. According to the NEMA EIA Regulations, 2017 (as amended), an EMF is defined as "*a study of the biophysical and socio-cultural systems of a geographically defined area to reveal where specific land uses may best be practiced and to offer performance standards for maintaining appropriate use of such land."* These frameworks are designed to facilitate ease of access to up-to-date environmental information to enable decision making related to environmental management principles. The EMF will serve as a management and decision-support tool that provides authorities with information about the status quo of the environment and the associated planning parameters. It will identify and spatially represent areas of potential conflict between sensitive environments and development proposals. The aim of the EMF is to:

- Promote sustainability;
- Secure environmental protection; and
- Promote cooperative environmental governance.

Bioregional Plans (BRP) are one of a range of tools provided for in the National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA) that can be used to facilitate the management and conservation of biodiversity priority areas outside the protected area network. Similar to the EMF, the purpose of a bioregional plan is to inform land-use planning, environmental assessment and authorisations, and natural resource management, by a range of sectors whose policies and decisions impact on biodiversity. This is done by providing a map of biodiversity priority areas with accompanying land-use planning and decision-making guidelines. The WRDM BRP was published in November 2011 and revised in March 2014; making it the most recent municipal biodiversity and conservation document. The plan was developed in parallel with, and is deliberately designed to be compatible with, the WRDM EMF.

5.1.7 Wetland Identification, Delineation and Classification

The wetland delineation procedure considers four attributes to determine the limitations of the wetland, in accordance with DWAF guidelines (now Department of Water and Sanitation (DWS) (2005)). The four attributes are:

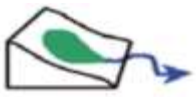
- Terrain Unit Indicator – helps to identify those parts of the landscape where wetlands are more likely to occur;

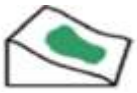
- Soil Form Indicator – identifies the soil forms, which are associated with prolonged and frequent saturation;
- Soil Wetness Indicator – identifies the morphological "signatures" developed in the soil profile because of prolonged and frequent saturation; and
- Vegetation Indicator – identifies hydrophilic vegetation associated with frequently saturated soils.

5.1.7.1 Terrain Indicator

Terrain Unit Indicator (TUI) areas include depressions and channels where water would be most likely to accumulate. These areas are determined with the aid of topographical maps, aerial photographs and engineering and town planning diagrams (DWAF, 2005). The HGM Unit system of classification focuses on the hydro-geomorphic setting of wetlands which incorporates geomorphology; water movement into, through and out of the wetland; and landscape / topographic setting. Once wetlands have been identified, they are categorised into HGM Units as shown in Table 5-3.

Table 5-3: Description of the various HGM Units for Wetland Classification

Hydromorphic wetland type	Diagram	Description
Floodplain		Valley bottom areas with a well-defined stream channel, gently sloped and characterised by floodplain features such as oxbow depression and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.
Valley bottom with a channel		Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterised by the net loss of sediment. Water inputs from the main channel (when channel banks overspill) and from adjacent slopes.
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterised by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from the channel entering the wetland and from adjacent slopes.
Hillslope seepage linked to a stream channel		Slopes on hillsides, which are characterised by colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.

Hydromorphic wetland type	Diagram	Description
Isolated hillslope seepage		Slopes on hillsides that are characterised by colluvial transport (transported by gravity) movement of materials. Water inputs are from sub-surface flow and outflow either very limited or through diffuse sub-surface flow but with no direct link to a surface water channel.
Pan/Depression		A basin-shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. It is inward draining). It may also receive subsurface water. An outlet is usually absent and so this type of wetland is usually isolated from the stream network.

5.1.7.2 Soil Form Indicator

Hydromorphic soils are considered for the Soil Form Indicator (SFI) which will display unique characteristics resulting from prolonged and repeated water saturation (DWAF, 2005). The continued saturation of the soils results in the soils becoming anaerobic and thus resulting in a change of the chemical characteristics of the soil. Iron and manganese are two soil components which are insoluble under aerobic conditions and become soluble when the soil becomes anaerobic and thus begin to leach out into the soil profile. Iron is one of the most abundant elements in soils and is responsible for the red and brown colours of many soils.

Resulting from the prolonged anaerobic conditions, iron is dissolved out of the soil, and the soil matrix is left a greying, greenish or bluish colour, and is said to be “gleyed”. Common in wetlands which are seasonally or temporarily saturated is a fluctuating water table, this results in alternation between aerobic and anaerobic conditions in the soil (DWAF, 2005). Iron will return to an insoluble state in aerobic conditions which will result in deposits in the form of patches or mottles within the soil. Recurrence of this cycle of wetting and drying over many decades concentrates these insoluble iron compounds. Thus, soil that is gleyed and has many mottles may be interpreted as indicating a zone that is seasonally or temporarily saturated (DWAF, 2005).

5.1.7.3 Soil Wetness Indicator

In practice, the Soil Wetness Indictor (SWI) is used as the primary indicator (DWAF, 2005). Hydromorphic soils are often identified by the colours of various soil components. The frequency and duration of the soil saturation periods strongly influences the colours of these components. Grey colours become more prominent in the soil matrix the higher the duration and frequency of saturation in a soil profile (DWAF, 2005). A feature of hydromorphic soils are coloured mottles which are usually absent in permanently saturated soils and are most prominent in seasonally saturated soils, and are less abundant in temporarily saturated soils (DWAF, 2005). The hydromorphic soils must display signs of wetness within 50cm of the soil surface, as this is necessary to support hydrophytic vegetation.

5.1.7.4 Vegetation Indicator

As one moves along the wetness gradient from the centre of the wetland to the edge, and into adjacent terrestrial areas plant communities undergo distinct changes in species composition. Valuable information for determining the wetland boundary and wetness zone is derived from the change in species composition. A supplementary method for employing vegetation as an indicator is to use the broad classification of the wetland plants according to their occurrence in the wetlands and wetness zones (Kotze and Marneweck, 1999; DWAF, 2005). This is summarised in Table 5-4 below. When using vegetation indicators for delineation, emphasis is placed on the group of species that dominate the plant community, rather than on individual indicator species (DWAF, 2005). Areas where soils are a poor indicator (black clay, vertic soils), vegetation (as well as topographical setting) is relied on and the use of the wetland species classification as per Table 5-4 becomes more important. If vegetation was to be used as a primary indicator, undisturbed conditions and expert knowledge are required (DWAF, 2005). Due to this uncertainty, greater emphasis is often placed on the SWI to delineate wetland areas. In this assessment, where possible, the SWI has been relied upon to delineate wetland areas due to the high level of anthropogenic impacts characterising the wetlands and freshwater resources of the general area. The identification of indicator vegetation species and the use of plant community structures have been used to validate these boundaries.

Table 5-4: Classification of Plant Species According to Occurrence in Wetlands (DWAF, 2005)

Type	Description
Obligate Wetland species (OW)	Almost always grow in wetlands: >99% of occurrences.
Facultative Wetland species (FW)	Usually grow in wetlands but occasionally are found in non-wetland areas: 67 – 99 % of occurrences.
Facultative species (F)	Are equally likely to grow in wetlands and non-wetland areas: 34 – 66% of occurrences.
Facultative dry-land species (FD)	Usually grow in non-wetland areas but sometimes grow in wetlands: 1 – 34% of occurrences.

5.1.7.5 Wetland Ecological Health Assessment (WET-Health)

According to Macfarlane *et al*. (2009) the health of a wetland can be defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. A level 1 WET-Health assessment was done on the wetlands in accordance with the method described by Kotze *et al.* (2007) to determine the integrity (health) of the characterised HGM units for the Project area. A Present Ecological State (PES) analysis was conducted to establish baseline integrity (health) for the associated wetlands. The health assessment attempts to evaluate the hydrological, geomorphological and vegetation health in three separate modules to attempt to estimate similarity to or deviation from natural conditions.

Central to WET-Health is the characterisation of HGM Units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface-water dominated, or sub-surface-water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described above.

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial *extent* of the impact of individual activities and then separately assessing the *intensity* of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall *magnitude* of impact. The impact scores and Present State categories are provided in Table 5-5.

Table 5-5: Impact Scores and Present Ecological State Categories used by WET-Health

Impact Category	Description	Combined Impact Score	PES Category
None	Unmodified, natural.	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota has taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognisable.	6-7.9	E
Critical	Modifications have reached a critical level and ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	F

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (Table 5-6).

Table 5-6: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

Once all HGM Units have been assessed, a summary of health for the wetland as a whole needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM Unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provide a summary of impacts, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

5.1.7.6 Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) tool was derived to assess the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. The purpose of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term. The methodology outlined by DWAF (1999) and updated in Rountree and Kotze, (2012), in Rountree *et al.* (2012) was used for this study.

In this method there are three suites of importance criteria; namely:

- **Ecological Importance and Sensitivity:** incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWS and thus enabling consistent assessment approaches across water resource types;
- **Hydro-functional Importance:** which considers water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- **Importance in terms of Basic Human Benefits:** this suite of criteria considers the subsistence uses and cultural benefits of the wetland system.

These determinants are assessed for the wetlands on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. It is recommended that the highest of these three suites of scores be used to determine the overall Importance and Sensitivity category of the wetland system, as defined in Table 5-7.

Table 5-7: Interpretation of Overall EIS Scores for Biotic and Habitat Determinants

Ecological Importance and Sensitivity Category (EIS)	Range of Median
Very high Systems that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these systems is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4
High Systems that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3
Moderate Systems that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2
Low/marginal Systems that are not ecologically important and sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1

5.2 Aquatic Ecology Assessment Approach

To enable an adequate description and the determination of the Present Ecological State (or Ecological Category) associated with the surrounding watercourses, it was envisaged that the following indicators be evaluated as part of the study:

- Stressor Indicators:
  - *In situ* water quality (Temperature, pH, Electrical Conductivity, and Dissolved Oxygen);
- Habitat Indicators:
  - Adapted Invertebrate Habitat Assessment System (IHAS, Version 2.2); and
- Response Indicators:

- Aquatic macroinvertebrates with the use of the South African Scoring System (SASS, Version 5) rapid bio-assessment protocol and the Macro-Invertebrate Response Assessment Index (MIRAI, Version 2).

5.2.1 Water Quality Parameters

Selected *in situ* water quality variables were measured at each of the selected sampling sites using water quality meters manufactured by Extech Instruments, namely an ExStik EC500 Combination Meter and an ExStik DO600 Dissolved Oxygen Meter. Temperature, pH, electrical conductivity and dissolved oxygen were recorded prior to sampling, while the time of day at which the measurements were assessed was also noted for interpretation purposes.

5.2.2 Invertebrate Habitat Assessment System (IHAS), Version 2.2

Assessment of the available habitat for aquatic macroinvertebrate colonization at each of the sampling sites is vital for the correct interpretation of results obtained following biological assessments. It should be noted that the available methods for determining habitat quality are not specific to rapid biomonitoring assessments and are inherently too variable in their approach to achieve consistency amongst users.

Nevertheless, the Invertebrate Habitat Assessment System (IHAS) has routinely been used in conjunction with the South African Scoring System (SASS) as a measure of the variability of aquatic macroinvertebrate biotopes available at the time of the survey (McMillan, 1998). The scoring system was traditionally split into two sections, namely the sampling habitat (comprising 55% of the total score) and the general stream characteristics (comprising 45% of the total score), which were summed together to provide a percentage and then categorized according to the values in Table 4-7.

However, the lack of reliability and evidence of notable variability within the application of the IHAS method has prompted further field validation and testing, which implies a cautious interpretation of results obtained until these studies have been conducted (Ollis *et al.*, 2006). In the interim and for the purpose of this assessment, the IHAS method was adapted by excluding the assessment of the *general stream characteristics*, which resulted in the calculation of a percentage score out of 55 that was then categorised by the aforementioned table.

Table 5-8: Adapted IHAS Scores and associated description of available aquatic macroinvertebrate habitat

IHAS Score (%)	Description
>75	Excellent
65-74	Good
55-64	Adequate / Fair
<55	Poor

5.2.3 South African Scoring System, Version 5

While there are several indicator organisms that are used within these assessment indices, there is a general consensus that benthic macroinvertebrates are amongst the most sensitive components of the aquatic ecosystem. This was further supported by their largely non-mobile (or limited mobility) within reaches of associated watercourses, which also allows for the spatial analysis of disturbances potentially present within the adjacent catchment area. However, it should also be noted that their heterogeneous distribution within the water resource is a major limitation, as this results in spatial and temporal variability within the collected macroinvertebrate assemblages (Dallas and Day, 2004).

South African Scoring System, Version 5 (SASS5) is essentially a biological assessment index which determines the health of a river based on the aquatic macroinvertebrates collected on-site, whereby each taxon is allocated a score based on its perceived sensitivity/tolerance to environmental perturbations (Dallas, 1997). However, the method relies on a standardised sampling technique using a handheld net (300 mm x 300 mm, 1000-micron mesh size) within each of the various habitats available for standardised sampling times and/or areas. Niche habitats (or biotopes) sampled during SASS5 application include:

- Stones (both in-current and out-of-current);
- Vegetation (both aquatic and marginal); and
- Gravel, sand and mud.

Once collection is complete, aquatic macroinvertebrates are identified to family level and a number of assemblage-specific parameters are calculated including the total SASS5 score, the number of taxa collected, and the Average Score per Taxa i.e. SASS score divided by the total number of taxa identified (Thirion, Mocke and Woest, 1995; Davies and Day, 1998; Dickens and Graham, 2002; Gerber and Gabriel, 2002). The SASS bio-assessment index has been proven to be an effective and efficient means to assess water quality impairment and general river health (Dallas, 1997; Chutter, 1998).

5.2.4 Macroinvertebrate Response Assessment Index

To determine the Present Ecological State (PES; or Ecological Category) of the aquatic macroinvertebrates collected/observed, the SASS5 data is used as a basic input (i.e. prevalence and abundance) into the recently improved Macroinvertebrate Response Assessment Index (MIRAI) (Version 2, Thirion. C., *pers. comm.*, 2015). This biological index integrates the ecological requirements of the macroinvertebrate taxa in a community (or assemblage) and their response to flow modification, habitat change, water quality impairment and/or seasonality (Thirion, 2008). The presence and abundance of aquatic macroinvertebrates are compared to a derived list of families/taxa that are expected to be present under natural, un-impacted conditions. Consequently, the aforementioned metric groups were combined within the model to derive the ecological condition of the site in terms of aquatic macroinvertebrates.

Table 5-9: Allocation protocol for the determination of the Present Ecological State for aquatic macroinvertebrates following application of the MIRAI

MIRAI (%)	Ecological Category	Description
90-100	A	Unmodified and natural. Community structures and functions comparable to the best situation to be expected. Optimum community structure for stream size and habitat quality.
80-89	B	Largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged.
60-79	C	Moderately modified. Community structure and function are less than the reference condition. Community composition is lower than expected due to loss of some sensitive forms. Basic ecosystem functions are still predominantly unchanged.
40-59	D	Largely modified. Fewer species present then expected due to loss of most intolerant forms. An extensive loss of basic ecosystem function has occurred.
20-39	E	Seriously modified. Few species present due to loss of most intolerant forms. An extensive loss of basic ecosystem function has occurred.
0-19	F	Critically modified. Few species present. Only tolerant species present, if any.

5.3 Fauna and Flora Assessment approach

A desktop study was undertaken, aiming to identify:

- Potential species in the site area according to the South African National Biodiversity Institute (SANBI);
- Potential Red Data species and their current status; and
- Expected vegetation type and community structure, (Mucina and Rutherford 2006).

5.3.1 Vegetation Communities

Vegetation communities were broadly defined based on satellite imagery.

5.3.2 Species List

The species list was compiled from both the description of the vegetation type of the study area supplied by Mucina and Rutherford (2006) as well as the South African National Biodiversity Institute National Herbarium Pretoria Computerised Information System (SANBI PRECIS) list. Lists of expected faunal species were drawn up from several different sources and the IUCN Red Data species likely to be found on site determined. Lists were drawn up for mammals, birds, reptiles, amphibians and invertebrates. The full list of expected species can be found in the appendices.

5.3.3 Species of Special Concern

From the overall species list, a list of SSC can be drawn up. To be fully comprehensive, this list includes plants on each of the following lists:

- International Union for the Conservation of Nature (IUCN) red data list;
- SANBI red data list;
- The South African Red Data lists for mammals, birds, butterflies;
- GDARD Red and Orange listed species;
- The National Forests Act (Act No. 84 of 1998) Protected Trees; and
- The National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004).

An initial list of Species of Special Concern (SSC) expected to be found within the study area comprises Possible Species of Special Concern (PSSC). If any of these (and any additional species on the above lists) are recorded on site, they are ascribed the status Confirmed Species of Special Concern (CSSC).

The South African Red Data list uses the same criteria as that defined by the IUCN. According to the IUCN all species are classified in nine groups, set through criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation (IUCN, 2017). The categories are described in Table 5-10 below.

Table 5-10: Red Data Categories (taken from SANBI 2017)

CATEGORY		DESCRIPTION
Extinct	(EX)	No known individuals remaining.
Extinct in the Wild	(EW)	Known only to survive in captivity.
Critically Endangered	(CR)	Extremely high risk of extinction in the wild.
Endangered	(EN)	High risk of extinction in the wild
Vulnerable	(VU)	High risk of endangerment in the wild.
Near Threatened	(NT)	Likely to become endangered in the near future.
Least Concern	(LC)	Lowest risk. Does not qualify for a more at risk category.
Data Deficient	(DD)	Not enough data to make an assessment of its risk of extinction.
Not Evaluated	(NE)	Has not yet been evaluated against the criteria.

CATEGORY		DESCRIPTION
	Extinct	**Threatened species** are species that are facing a high risk of extinction. Any species classified in the IUCN categories **CR, EN** or **VU** is a threatened species. **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**, NT, LC** and **DD**
	Threatened	
	Other categories of conservation concern	
	Other categories	

The online IUCN data base was referenced to identify Red Data species and their various threat status categorizations.

5.4 Impact Assessment Methodology

Impacts and risks have been identified based on a description of the activities to be undertaken. Once impacts have been identified, a numerical environmental significance rating process will be undertaken that utilises the probability of an event occurring and the severity of the impact as factors to determine the significance of a particular environmental impact.

The severity of an impact is determined by taking the spatial extent, the duration and the severity of the impacts into consideration. The probability of an impact is then determined by the frequency at which the activity takes place or is likely to take place and by how often the type of impact in question has taken place in similar circumstances.

Following the identification and significance ratings of potential impacts, mitigation and management measures will be incorporated into the Environmental Management Programme (EMP).

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = CONSEQUENCE X PROBABILITY X NATURE

Where

Consequence = intensity + extent + duration

And

Probability = likelihood of an impact occurring

And

Nature = positive (+1) or negative (-1) impact

The matrix calculates the rating out of 147, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 5-12. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation has been applied; post-mitigation is referred to as the residual impact. The significance of an impact is determined and categorised into one of seven categories (The descriptions of the significance ratings are presented in Table 5-13).

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e., there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

Table 5-11: Impact assessment parameter ratings

Rating	Intensity/ Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
7	Irreplaceable loss or damage to biological or physical resources or **highly** sensitive environments. Irreplaceable damage to **highly sensitive** cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or **moderate to highly** sensitive environments. Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur.>65 but <80% probability.

Rating	Intensity/ Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
5	Serious loss and/or damage to physical or biological resources or **highly** sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or **moderately** sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/ Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local including the site and its immediat surrounding area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	**Minor loss and/or effects** to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited extending only as far as the development site area.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/ Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	**Minimal to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 5-12: Probability/consequence matrix

Significance																																						
-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Consequence																																						

Table 5-13: Significance rating description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

6 Assumptions and Limitations

The following limitations were encountered during this study:

- Access to HGM unit 3 was restricted due to safety reasons;
- A Fauna and Flora Impact Assessment was not conducted as it did not form part of the Scope of Work, however an updated baseline for fauna and flora has been included;
- The current fauna and flora baseline is based on available literature sources, and no field work was carried out;
- The composition of freshwater resources in the study area prior to major disturbance is unknown. For this reason, reference conditions are hypothetical, and are based on professional judgement and/or inferred from limited data available;
- With ecology being dynamic and complex, certain aspects, some of which may be important, may have been overlooked. It is, however, expected that the study area has been accurately assessed and considered, based on the field observations undertaken and the consideration of existing studies and monitoring data in terms of freshwater ecology; and
- To obtain a comprehensive understanding of the dynamics of the aquatic biota present within a watercourse (e.g. migratory pathways, seasonal prevalence, breeding cycles, etc.), studies should include investigations conducted during different seasons, over a number of years and through extensive sampling efforts. Given the time constraints of the baseline assessment, such long-term research was not feasible and could not be conducted. Consequently, the findings presented are based on professional experience, supported by a literature review, and extrapolated from the data collected at the time of the field survey.

7 Determining the Baseline Environment

This section provides the environmental baseline for the project area with regards to water resources, fauna, flora, wetlands and environmental sensitives.

7.1 Ecoregion and quaternary catchment

The water resources of South Africa are divided into quaternary catchments, which are regarded as the principal water management units in the country (Department of Water Affairs, 2011). These catchments represent the fourth order of the hierarchical classification system, in which the primary catchments are the major units. The primary drainages are further grouped into or fall under Water Management Areas (WMA) and Catchment Management Agencies (CMA). The Department of Water and Sanitation (DWS) has established nine WMAs and nine CMAs as contained in the National Water Resource Strategy 2 (2013) in terms of Section 5(1) of the NWA. The establishment of these WMAs and CMAs is to improve water governance in different regions of the country, to ensure a fair

and equal distribution of the Nation's freshwater resources, while making sure that the resource quality is sustained.

The study area is located within the Highveld ecoregion (Level II ecoregion 11.01), which has been noted to attain an average temperature range between 12º and 20°C, a maximum temperature range between 20º and 32°C during February and a minimum temperature range between -2º and 4°C during July (Kleynhans et al., 2007; Table 7-1).

Table 7-1: Main attributes of the Highveld Ecoregion

Main attributes	Highveld
Terrain Morphology: Broad division (dominant types in bold) (Primary)	**Plains; Low Relief;** **Plains; Moderate Relief;** Lowlands; Hills and Mountains: Moderate and High Relief; Open Hills; Lowlands; Mountains: Moderate to High Relief; Closed Hills; Mountains: Moderate and High Relief (limited)
Vegetation types (dominant types in bold) (Primary)	Mixed Bushveld limited)**;** Rocky Highveld Grassland; **Dry Sandy Highveld Grassland;** Dry Clay Highveld Grassland; **Moist Cool Highveld Grassland**; Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Clay Highveld Grassland: Patches Afromontana Forest (very limited)
Altitude (m a.m.s.l) (modifying)	1100-2100, 2100-2300 (very limited)
MAP (mm) (Secondary)	400 to 1000
Coefficient of Variation (% of annual precipitation)	<20 to 35
Rainfall concentration index	45 to 65
Rainfall seasonality	Early to late summer
Mean annual temp. (°C)	12 to 20
Mean daily max. temp. (°C): February	20 to 32
Mean daily max. temp. (°C): July	14 to 22
Mean daily min. temp. (°C): February	10 to 18
Mean daily min temp. (°C): July	-2 to 4

Median annual simulated runoff (mm) for quaternary catchment	5 to >250

Furthermore, the study area is located within the C23E quaternary catchment of the Vaal Water Management Area (WMA 5), which lies in the eastern interior of South Africa (Department of Water Affairs and Forestry, 2004). The catchment area is characterised by expansive grazing, mining and industrial areas. The two unnamed drainage features are associated with the MRA, which falls within the Sub-Quaternary-Reaches (SQRs) C23E-and C23E-01436. These systems drain towards the Mooirivierloop to the north of the MRA.

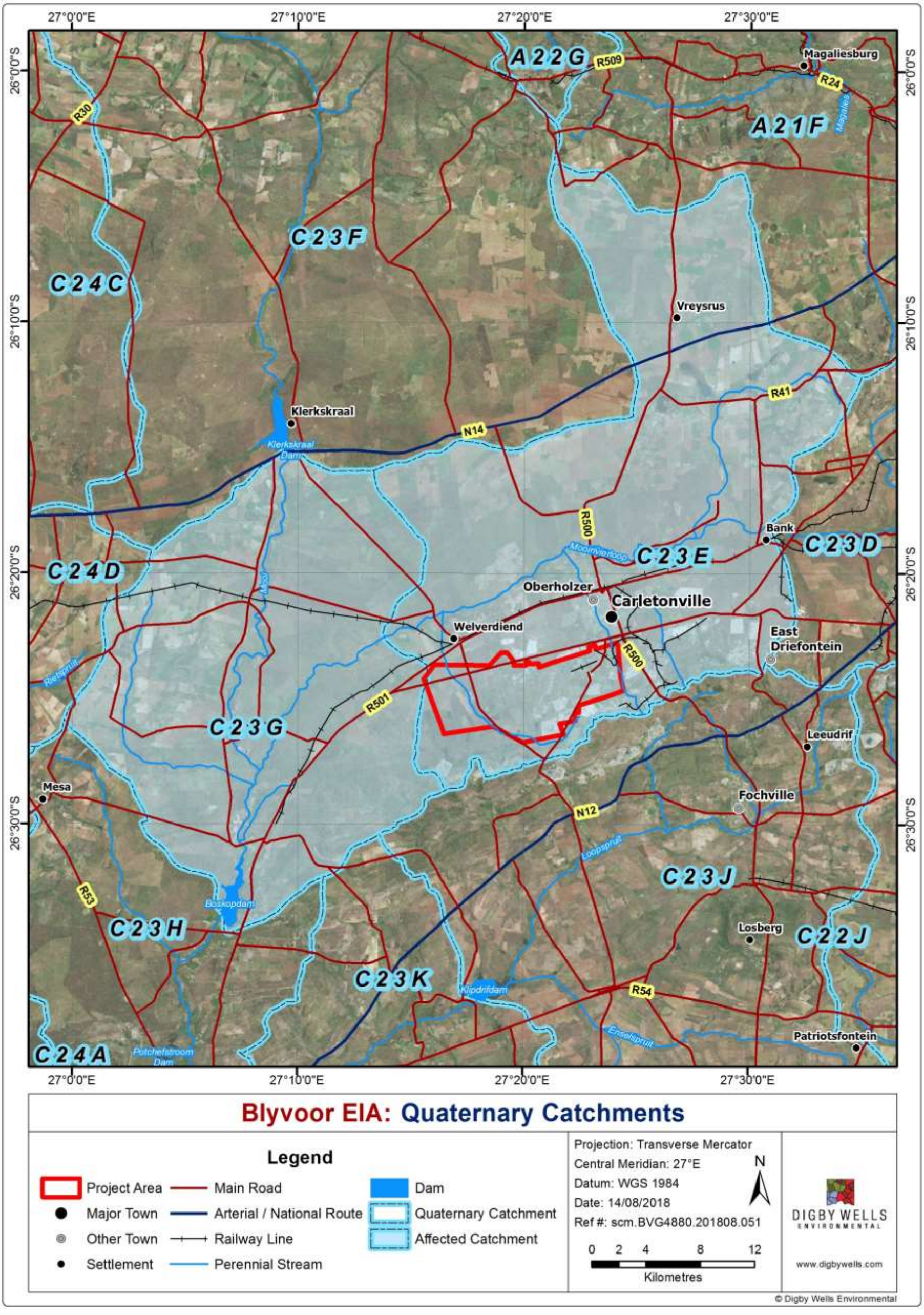


Figure 7-1: Quaternary Catchments

7.2 National Freshwater Ecosystem Priority Areas

Figure 7-2demonstrates the distribution of NFEPA (defined in Section 5.1.3) wetlands within the Project area. The wetland types that dominate the landscape are mostly seeps. Some TSFs have been categorised incorrectly as NFEPA wetlands.

The NFEPA wetlands have been ranked in terms of importance in the conservation of biodiversity. The Project wetlands are rank 4, 5 and 6 (refer to Table 5-1 for the ranking system).

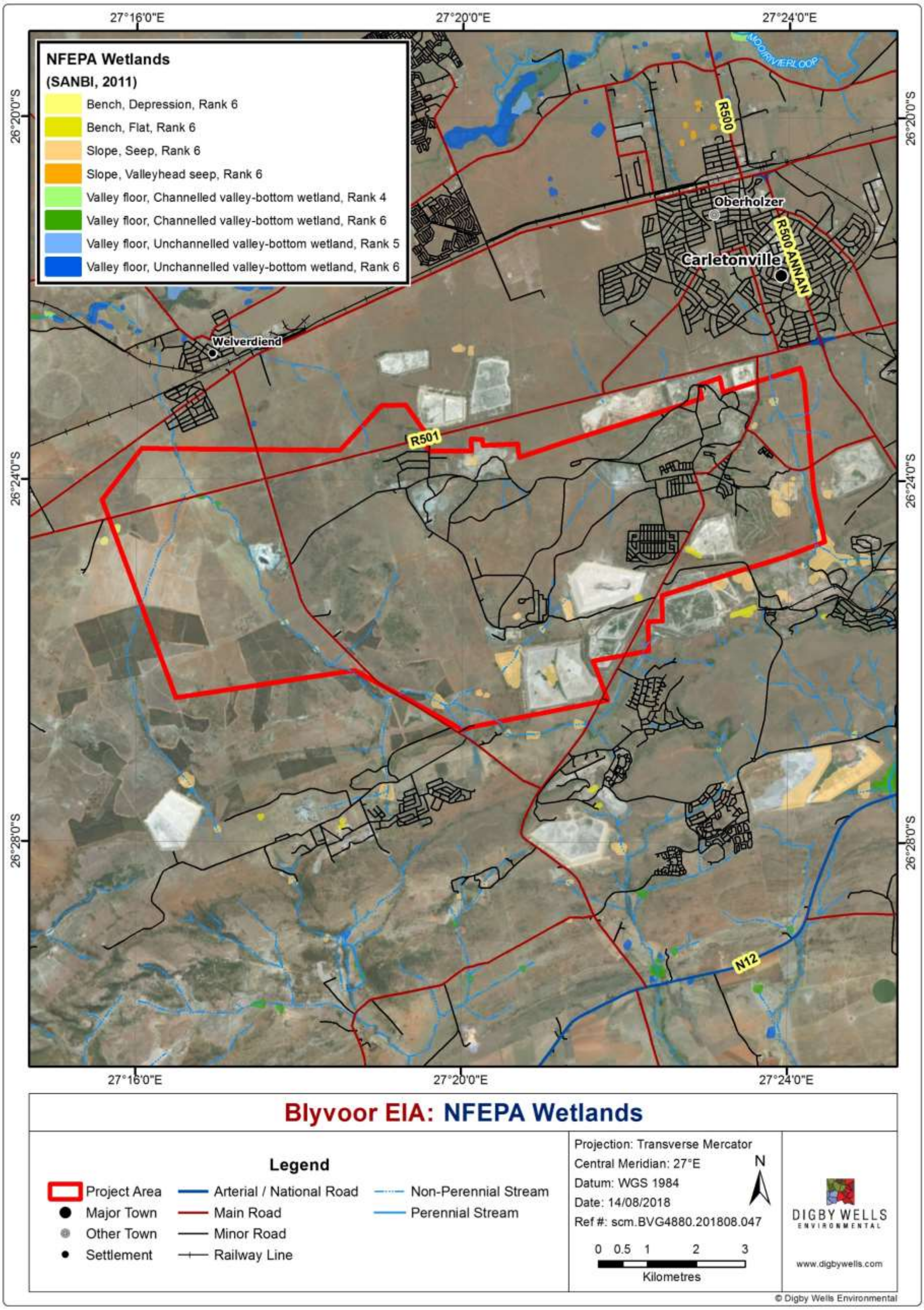


Figure 7-2: NFEPA Wetlands

7.3 Regional Vegetation

The project area falls within Carletonville Dolomite Grassland to the North with patches of Gauteng Shale Mountain Bushveld to the South, as described by Mucina and Rutherford (2006) (refer to Figure 7-3).

7.3.1 Carletonville Dolomite Grassland

This vegetation unit mainly occurs in the North-West Province but also in Gauteng and marginally into the Free State Province. It is distributed in the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province. The altitude ranges from 1360-1620 m.

This vegetation occurs on slightly undulating plains dissected by prominent rocky chert ridges. It forms a complex mosaic pattern dominated by many species. Grasses such as: *Loudetia simplex* (Common Russet Grass), *Hyparrhenia hirta* (Common Thatching Grass), *Brachiaria serrata* (Velvet Signal Grass) and *Heteropogon contortus* (Spear Grass) are prominent while shrubs such as: *Euclea undulata* (Common Guarri), *Searsia magalismontana* (Berg Taaibos), *Zanthoxylon capense* (Small Knobwood) and *Diospyros lycioides* (Bluebush) are scattered in protected places (e.g. among rocks and boulders). The geology of this vegetation unit consists of dolomites and cherts of the Malmani subgroup from the Transvaal super group.

Conservation status is currently considered vulnerable, with only a small extent conserved in statutory reserves (Sterkfontein Caves – part of the Cradle of Humankind World Heritage Site, Oog Van Malmani, Abe Bailey, Boskop Dam, Schoonspruit, Krugersdorp, Olifantsvlei, and Groenkloof) and in at least six private conservation areas. Almost a quarter of the vegetation type has already been transformed by cultivation, urban sprawl or by mining activities as well as construction of the Boskop and Klerkskraal Dams. According to the Department of Agriculture's Predicted Soil Loss data in the vegeatation type. Percentages indicate tonnes/ha/annum; more than 60% is considered very high, 26-60% is high, 6-12% is low, and very low 0-5%. Erosion within this vegetation type varies betwewn 84% and 15%.

7.3.2 Gauteng Shale Mountain Bushveld

This vegetation unit occurs in Gauteng and North-West Provinces, mainly on the ridge of the Gatsrand south of Carletonville–Westonaria–Lenasia and at altitudes from 1300-1750 m. It occurs on low broken ridges varying in steepness and generally with a high surface rock cover. The vegetation is a short (3-6 m), semi-open thicket, dominated by a variety of woody species such as: *Acacia caffra*, *Searsia leptodictya*, *Cussonia spicata* and *Englerophytum magalismontanum*. The understory is dominated by grasses such as: *Cymbopogon pospischilii* and *Digitaria eriantha*. Some of the ridges form plateaus that carry scrubby grassland. The geology consists of shale and andesite from the Pretoria group (Transvaal supergroup).

Conservation status is currently considered to be Vulnerable, statutorily conserved in Skanskop and Hartebeesthoek Nature Reserves, Magaliesburg Nature Area and Groenkloof National Park. Approximately 21% of the entire vegetation unit is transformed mainly by urban and built up areas, mines and quarries, cultivation and plantations. Wattle is a common invader plant species.

7.3.3 Plant Possible Species of Special Concern

The study site lies within three Quarter Degree Square (QDS) grids, namely 2627AD. According to the PRECIS, no Red Data species are expected to occur for the QDS for each of the sites. The list of expected plant species in the study area can be found in Appendix B.

The Plants of South Africa (http://posa.sanbi.org) website list was obtained from the SANBI website, it lists all the Red Data plant species officially recorded by SANBI for Quarter degree square grid. For a plant species to be included in this list, a specimen collected in this grid must be supplied to SANBI. This list is therefore not a comprehensive list representing only those species that may occur in these grids, but rather a guideline as to what is likely to occur here. The sites sampled are also only a very small portion of the whole grid and habitats suitable for certain species in these POSA lists may not be present at the sites sampled. It is therefore not unusual for species in the POSA list to be absent from the sampling sites.

Certain species included in the below list was confirmed by scrutinising previous specialist studies that were undertaken in the past. SSC likely to occur on site are listed in Table 7-2.

Table 7-2: Plant SSC likely to occur on site

Plant species	Status
Kniphofia typhoides	NT (confirmed)
Trachyandra erythrorrhiza	NT (confirmed)
Hypoxis hemerocallidea	Declining (confirmed)
Eucomis autumnalis subsp. clavata	Not Evaluated (confirmed)
Boophone disticha	*Declining*
Adromischus umbraticola subsp. umbraticola	NT
Drimia sanguinea	NT
Khadia beswickii	VU

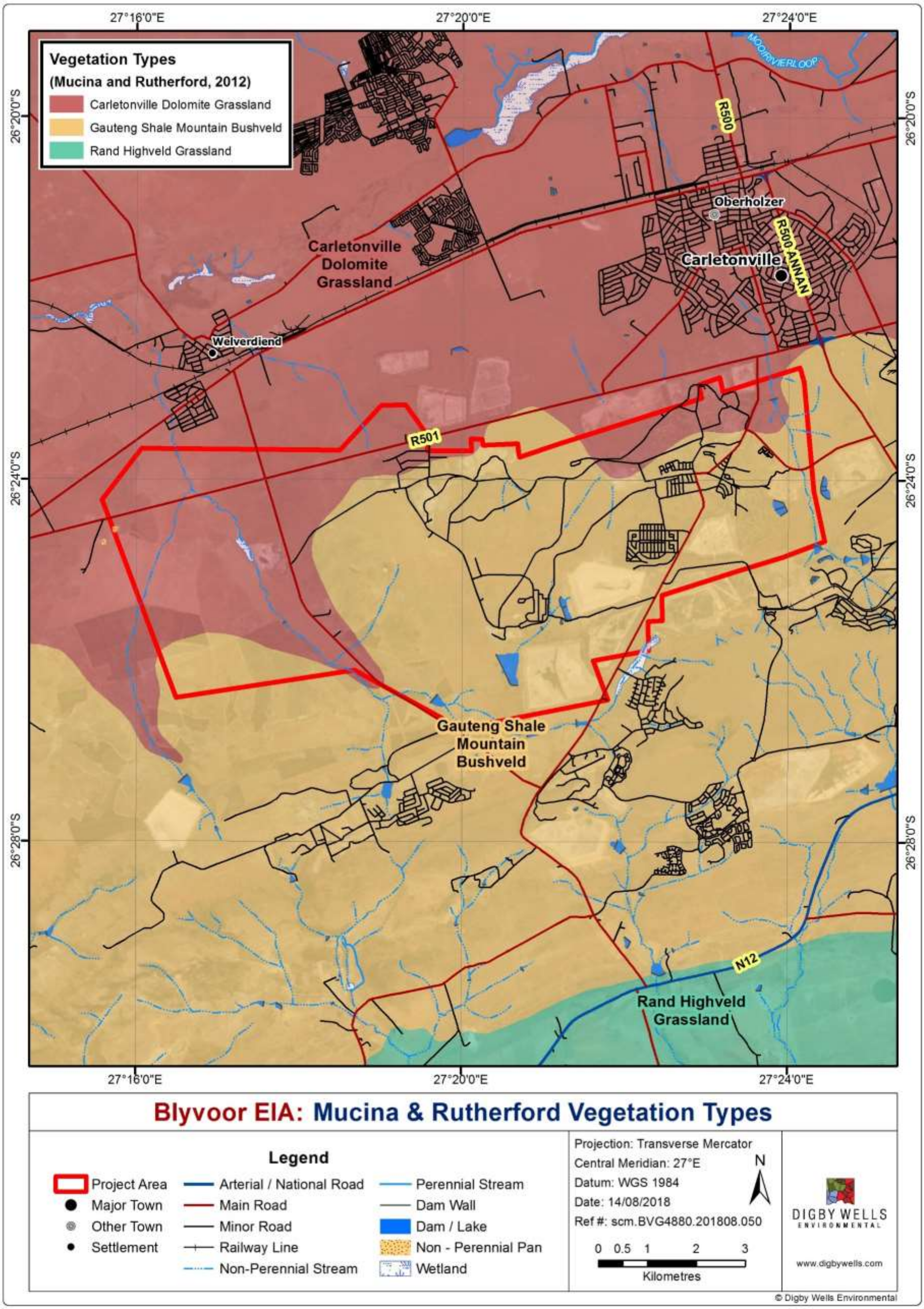


Figure 7-3: Regional Vegetation

7.4 Fauna

Fauna expected to occur on site include assemblages within terrestrial and wetland ecosystems: mammals, birds, reptiles, amphibians and invertebrates. Each of these assemblages occurs within unique habitats and the ecological state of these habitats directly relates to the number of species found within them. The main habitats occurring in the project area are grassland plains and pans, with little altitudinal variation.

7.4.1 Mammals

A database search for mammal species that have been recorded in the three QDS grids (2627 AD) on the virtual museum of the Animal Demography Unit (ADU) (http://www.adu.org.za). This database forms part of the Department of Biological Science at the University of Cape Town. No recent records of mammals have been recorded in the study area. Mammal species that have been recorded in the Gauteng Province, and could possibly occur in the area of interest are discussed below.

Mammal species expected to occur in the area of interest include six species Table 7-3 as per ADU database searches. The limited vegetation types, and their current condition of the Blyvoor project site limits the variety of mammal species expected on site.

Table 7-3: Expected Mammal Species

Family	Genus	Common name	Red list category (IUCN 2018-1)
Sciuridae	*Xerus (Geosciurus) inauris*	South African Ground Squirrel	LC
Bovidae	*Connochaetes gnou*	Black Wildebeest	LC
Bovidae	*Alcelaphus buselaphus caama*	Red Hartebeest	Not Evaluated
Bovidae	*Taurotragus oryx*	Eland	Not Evaluated
Bovidae	*Antidorcas marsupialis*	Springbuck	LC
Bovidae	*Kobus ellipsiprymnus*	Water Buck	Not Evaluated

7.4.2 Avifauna

Birds have been viewed as good ecological indicators, since their presence or absence tends to represent conditions pertaining to the proper functioning of an ecosystem. Bird communities and ecological condition are linked to land cover. As the land cover of an area changes, so do the types of birds in that area (The Bird Community Index, 2007). Land cover is directly linked to habitats within the study area. The diversity of these habitats should give rise to many different species. According to the South African Bird Atlas Project (SABAP2), 319 species of birds have been identified in the area, and the majority of these birds are

Grassland species. All birds that could be present within QDS 2627 AD, are listed in Appendix A. Of these species, 10 have been assigned an international Red Data status with one Endangered, six Near Threatened, and three Vulnerable species recorded. These species are listed in the Table 7-4 below.

Table 7-4: Red Data bird species

Common Name	Scientific Name	Red Data Status SA Red Data Status (2018); (IUCN 2018-1)
Maccoa Duck	*Oxyura maccoa*	NT*, VU*
Lesser Flamingo	*Phoenicopterus minor*	NT*, NT*
Grass Owl	*Tyto capensis*	VU*, LC*
Black Winged Pratincole	*Glareola nordmanni*	NT*, NT*
Blue Korhaan	*Eupodotis caerulescens*	LC*, NT*
European Roller	*Coracias garrulus*	NT*, LC*
Pallid Harrier	*Circus macrourus*	NT*, NT*
White Backed Vulture	*Gyps africanus*	CR*, CR*
Cape Vulture	*Gyps coprotheres*	EN*, EN*
Secretarybird	*Sagittarius serpentarius*	VU*, VU*

Key: NT-Near Threatened, VU-Vulnerable, LC- Least Concerned, CR-Critically Endangered.

7.4.3 Reptiles

Reptiles are ectothermic (cold-blooded) meaning they are organisms that control body temperature through external means. As a result, reptiles are dependent on environmental heat sources. Many reptiles regulate their body temperature by basking in the sun, or in warmer areas. Substrate is an important factor determining which habitats are suitable for which species of reptile. The presence of rocky out crops within a study area is could mean the presence of reptile species. According to the South African Reptile Conservation (SARCA) ADU's virtual museum, a total of 14 species have been recorded in this QDS in the past (http://sarca.adu.org.za/). These species are listed in Table 7-5.

Table 7-5: Expected Reptiles

Scientific name	Common name	Red list Category (SARCA 2014)
Agama atra	Southern Rock Agama	Least Concern
Dasypeltis scabra	Rhombic Egg-eater	Least Concern
Cordylus vittifer	Common Girdled Lizard	Least Concern

Scientific name	Common name	Red list Category (SARCA 2014)
Hemachatus haemachatus	Rinkhals	Least Concern
Lygodactylus capensis capensis	Common Dwarf Gecko	Least Concern
Pachydactylus capensis	Cape Gecko	Least Concern
Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	Least Concern
Aparallactus capensis	Black-headed Centipede-eater	Least Concern
Boaedon capensis	Brown House Snake	Least Concern
Psammophis trinasalis	Fork-marked Sand Snake	Least Concern
Psammophylax rhombeatus rhombeatus	Spotted Grass Snake	Least Concern
Trachylepis varia sensu lato	Common Variable Skink Complex	Least Concern
Afrotyphlops bibronii	Bibron's Blind Snake	Least Concern
Causus rhombeatus	Rhombic Night Adder	Least Concern

7.4.4 Amphibians

Amphibians are viewed as good indicators of changes to an entire ecosystem because they are sensitive to changes in the aquatic and terrestrial environments (Waddle, 2006). Most species of amphibians are dependent on the aquatic environment for reproduction (Duellman and Trueb 1986). Additionally, amphibians are sensitive to water quality and ultra violet radiation because of their permeable skin (Gerlanc and Kaufman 2005). Activities such as feeding and dispersal are spent in terrestrial environments (Waddle, 2006). According to Carruthers (2001), a few factors influence the distribution of amphibians, but because amphibians have porous skin they generally prosper in warm and damp habitats. The presence of suitable habitat within the study area should provide several different species of amphibians.

According to Carruthers (2001), frogs occur throughout southern Africa. Their distribution is generally restricted to the habitat type they prefer, especially in their choice of breeding site. The choices available of these habitats coincide with different biomes, these biomes in turn, are distinguished by means of biotic and abiotic features prevalent within them. Therefore, a collection of amphibians associated with the Grassland biome will all choose to breed under

the prevailing biotic and abiotic features present. Further niche differentiation is encountered by means of geographic location within the biome, this differentiation includes, banks of pans, open water, inundated grasses, reed beds, trees, rivers and open ground, all of which are present within the area of interest. No previous records of amphibians that occur on site were found on the SARCA website (http://sarca.adu.org.za/). The Near threatened Giant Bullfrog (*Pyxicephalus adspersus)* could have been expected on site due to available habitat, before the mine commenced construction.

7.4.5 Invertebrates

Butterflies are a good indication of the habitats available in a specific area (Woodhall 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall 2005). Butterflies are useful indicators as they are relatively easy to locate and catch, and to identify. Red Data species expected to occur on site are the Marsh sylph (*Metisella meninx*), Roodepoort Copper (*Aloeides dentatis dentatis VU*) and Highveld Blue (*Lepidochrysops praeterita EN*).

7.5 Sensitivity and Conservation Planning 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.

7.5.1 Gauteng C-Plan

Knowledge of the distribution of biodiversity, the status of species, the approach for dealing with aspects such as climate change, methods of data analysis, and the nature of threats to biodiversity within a planning region are constantly changing, especially in the Gauteng province which is developing at an extremely rapid rate. This requires that the conservation plan be treated as a living document with periodic review and updates.

The Gauteng Conservation Plan (C-Plan) is based on the systematic conservation principles outlined by Margules and Pressey (2000): complementarity, efficiency, defensibility and flexibility, irreplaceability, retention, persistence and accountability. The Gauteng C-Plan is a living document that is constantly reviewed and updated and documents the distribution of conservation important areas for biodiversity. According to the Gauteng C-Plan, the study area contains Ecological Support Areas and Important Areas (Figure 7-4). Ecological Support Areas contain buffered wetlands, buffered rivers, ridges within 1500 m of Critical

Biodiversity Areas, dolomite, corridors and low cost metropolitan areas and are regarded as being worthy of protection. The project area is in very close proximity to a Protected Area (Abe Bailey Provincial Nature Reserve), which is approximately 1km north of Blyvoor.

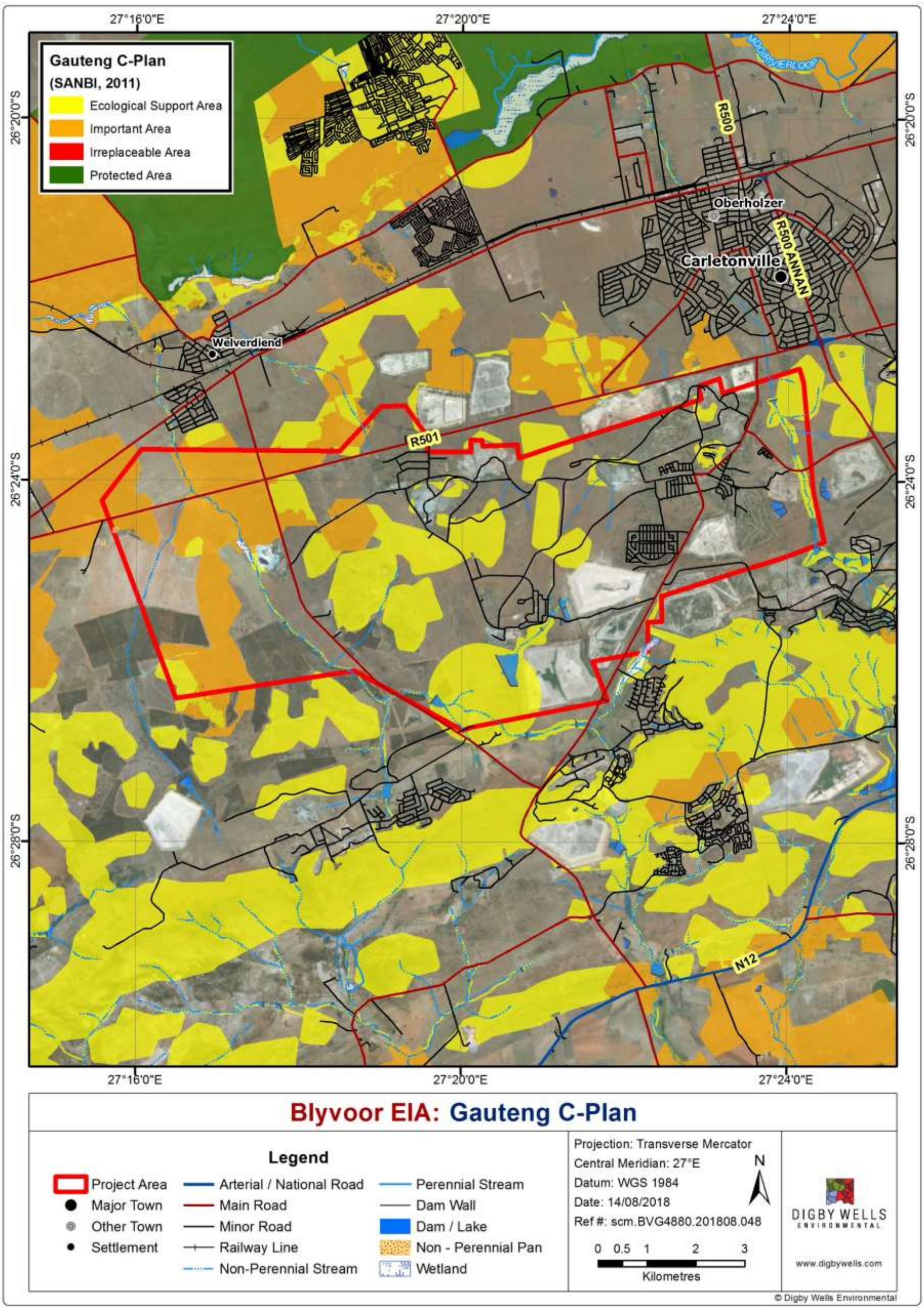


Figure 7-4: Gauteng C-Plan

7.5.2 Mining and Biodiversity Guidelines

The Mining and Biodiversity Guideline (2013) is a cumulative finding of all available biodiversity and ecological related information with a final mapped area. The assessment looks at NFEPA and regional biodiversity plans such as the Gauteng C-Plan. This is shown in Figure 7-5 below.

A large portion on the west of the project area is designated as ‘Highest Risk for Mining’, whilst there are also large patches of land designated as High Risk for Mining”. ‘Moderate Risk for Mining’ is also present, but to a lesser extent.

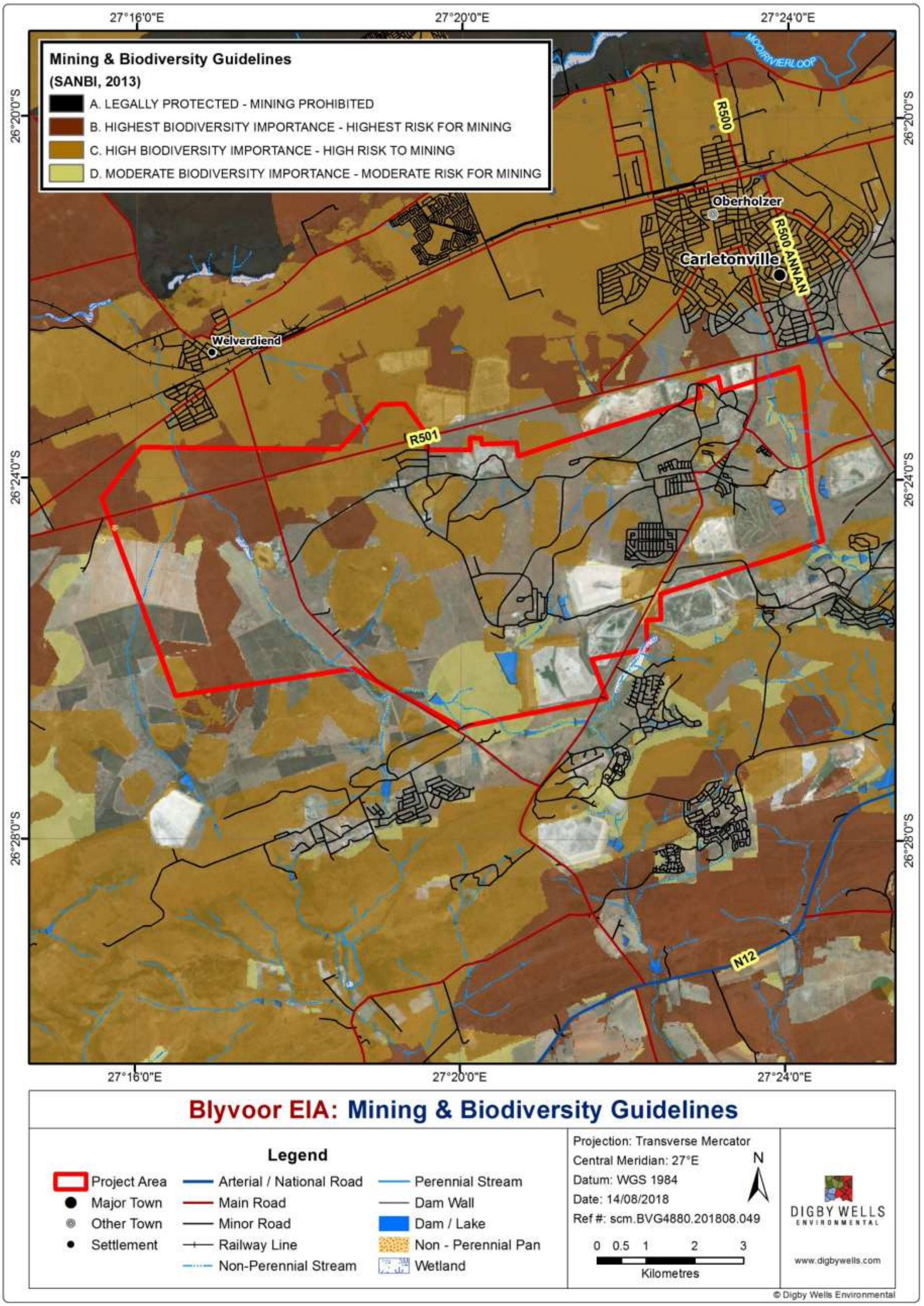


Figure 7-5: Mining and Biodiversity Guideline

7.5.3 WRDM EMF and BRP Wetlands

The WRDM contains a high diversity of river and wetland ecosystems (WRDM BRP, 2014); incorporating a total of 1 032.35 ha of Eastern Temperate Freshwater Wetlands, of which none are conserved. However, there are 3 960ha of important wetlands in the WRDM according to the Gauteng C Plan of which only 2.7% are under formal conservation.

Wetlands, watercourses, and pan wetlands are delineated in the WRDM, as shown in Figure 7-6. The pan wetland systems are highlighted as circular cluster areas; the waterbodies are associated with dams and other non-natural wetland conditions; and the wetlands are associated with valley bottom systems.

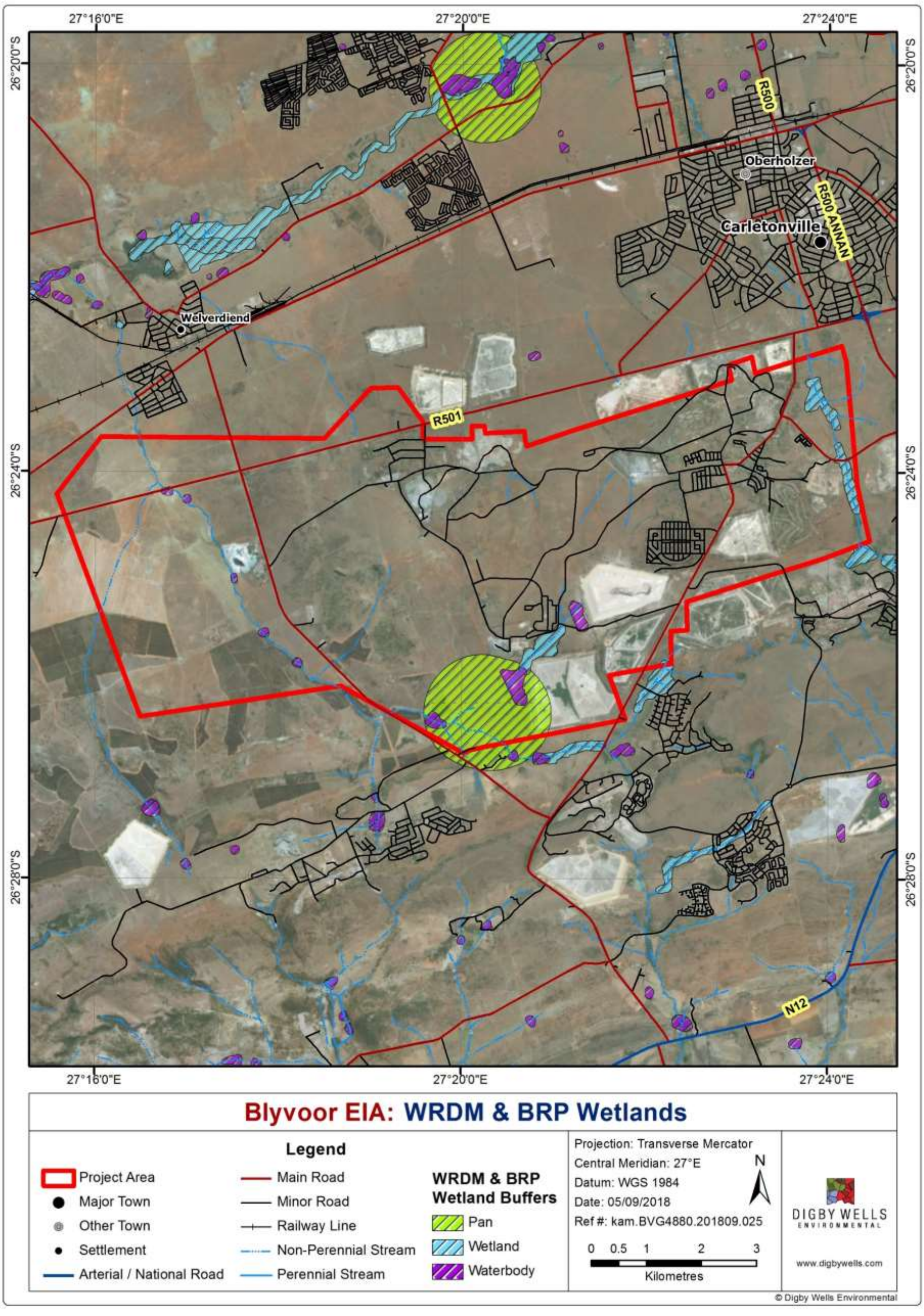


Figure 7-6: WRDM and BRP Wetlands

7.5.4 Important Bird Areas

An Important Bird Area (IBA) is an area recognised 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 h of habitat for our threatened, endemic and congregatory birds. Yet only a million hectares of the total land surface covered by our IBA's is legally protected. The BirdLife SA IBA programme continues a programme of stewardship which will ultimately achieve formal protection (Birdlife, 2013).

These areas are identified by BirdLife International. These sites are small enough to be entirely conserved and differ in their character, habitat or ornithological importance from the surrounding habitat. Often IBAs form part of a country's existing protected area network, and so are protected under national legislation. There is no formal National IBA Conservation Strategy for this area within South Africa (Birdlife, 2013).

The study sites does not coincide with any Important Bird Areas (IBA's), however, the Magaliesberg and Witwatersrand and Suikerbosrand IBA's are located approximately 40km north of the site (Figure 7-7). The Magaliesberg and Witwatersrand IBA falls mostly within the Magaliesburg Protected Natural Environment and is protected according to the NEMA (Act 107 of 1998). Bird species typical of this IBA include: Martial Eagle (*Polemaetus bellicosus*) (although in lesser numbers than in the past), Striped Kingfisher (*Halcyon chelicuti)*, Burnt-necked Eremomela (*Eremomela usticollis*), Barred Wren-Warbler (*Calamonastes fasciolatus),* Marico Flycatcher (*Melaenornis mariquensis*), Crimson-breasted Shrike (*Laniarius atrococcineus*), Scaly-feathered Finch (*Sporopipes squamifrons*), Violet-eared Waxbill (*Granata granatina*), Black-cheeked Waxbill (*Estrilda erythronotos*), Striped Pipit (*Anthus lineiventris*) and Short-toed Rock Thrush (*Monticola brevipes*). The study area may provide refuge for some of these species as they move across the landscape in search of resources.

The Suikerbosrand IBA is located 50 km south of Johannesburg, Suikerbosrand lies between the towns of Heidelberg and Meyerton in Gauteng's industrialised Highveld. The reserve has been expanded in recent years by the addition of an extension northward to the R550 and east up to the N3. The new section includes a large area of grassland, wetlands along the Rietspruit and drainage lines. This extension is extremely valuable as it contains habitats suitable for African Grass Owl (*Tyto capensis)* and Secretarybird (*Sagittarius serpentarius)*.

The reserve is dominated by Suikerbos Ridge, which runs from west to east, rising from the surrounding plateau (1500 m a.s.l.) to reach its greatest height (1918 m a.s.l.) in the form of knolls on the central plateau east of Kareekloof. The ridge is broken by numerous seasonal streams, and the associated well-wooded kloofs and steep cliffs (varying in height from 15 to 45 m) contrast with the predominantly open grassy plains. Two important areas are the aloe forest near Kareekloof and, in the south-west, the vegetation community dominated by *Vachellia* (formerly *Acacia*) *karoo* trees.

The diversity of habitats in the reserve has resulted in more than 270 species being recorded according to SABAP2. It is not certain how many White-bellied Korhaans (*Eupodotis senegalensis*) occur and further research is needed in order to obtain exact numbers. The inclusion of the extended area into the reserve has ensured that African Grass Owl *(Tyto capensis)* remains listed as a key species.

Melodius Lark (*Mirafra cheniana)* has been added as a key species because it has been reported regularly in this IBA since 2007. Up to 50 individuals have been recorded at one time.

Secretarybird breeds in the reserve and two pairs have been recorded here in recent years. Sentinel Rock Thrush *(Monticola exploratory)* occurs in the east and Kalahari Scrub Robin *(Erythropygia paean)*, Red-headed Finch *(Amadina erythrocephala)*, Black-faced Waxbill *(Estrilda erythronotos)* and Violet-eared Waxbill (*Uraeginthus granatinus)* are regularly reported. Independent observers as well as those participating in SABAP2 have recorded Blue Korhaan *Eupodotis caerulescens*, Corn Crake *(Crex crex)* and African Marsh Harrier *(Circus ranivorus)*.

African Grass Owl (12–30 individuals) and Secretarybird (two pairs) are globally threatened species. Regionally threatened species are Melodious Lark *(Mirafra cheniana)*, Blue Korhaan *(Eupodotis caerulescens)* and Corn Crake *(Crex crex)*. Kalahari Scrub Robin (*Erythropygia paena*) and White-bellied Sunbird (*Cinnyris talatala)* are the only biome-restricted species in this IBA.

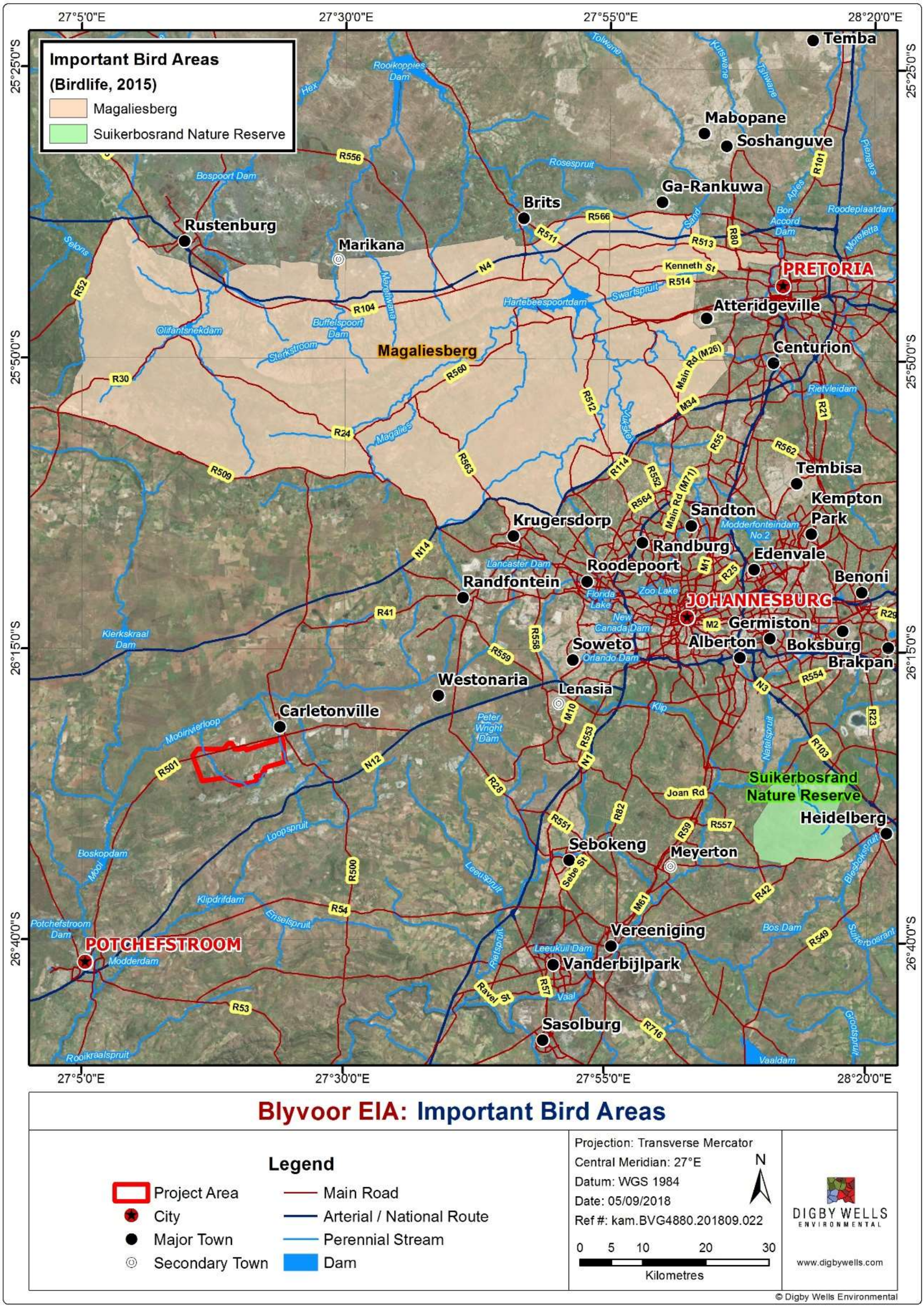


Figure 7-7: Important Bird Areas

7.5.5 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:

- The South African Vegetation Map (Mucina and Rutherford 2006);
- National forest types recognised by the Department of Water Affairs and Forestry (DWAF);
- Priority areas identified in a provincial systematic biodiversity plan; and
- High irreplaceability forest patches or clusters identified by DWAF.

The criteria for identifying threatened terrestrial ecosystems include six criteria overall, two of which are dormant due to lack of data (criteria B and E). The criteria are presented in Table 7-6 below.

Table 7-6: Criteria for the listing of National Threatened Ecosystems

Criterion	Details
A1	Irreversible loss of natural habitat
A2	Ecosystem degradation and loss of integrity
B	Rate of loss of natural habitat
C	Limited extent and imminent threat
D1	Threatened plant species associations
D2	Threatened animal species associations
E	Fragmentation

Criterion	Details
F	Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan

These areas are essential for conservation of the country's ecosystems as well as meeting conservation targets. The study area occurs in close proximity to two Threatened ecosystems below, the Rand Highveld Grassland and the Soweto Highveld Grassland (Figure 7-8**)**. This designation must however be seen in context, as preliminary field investigations have proven that very little natural habitat still remains within the study areas.

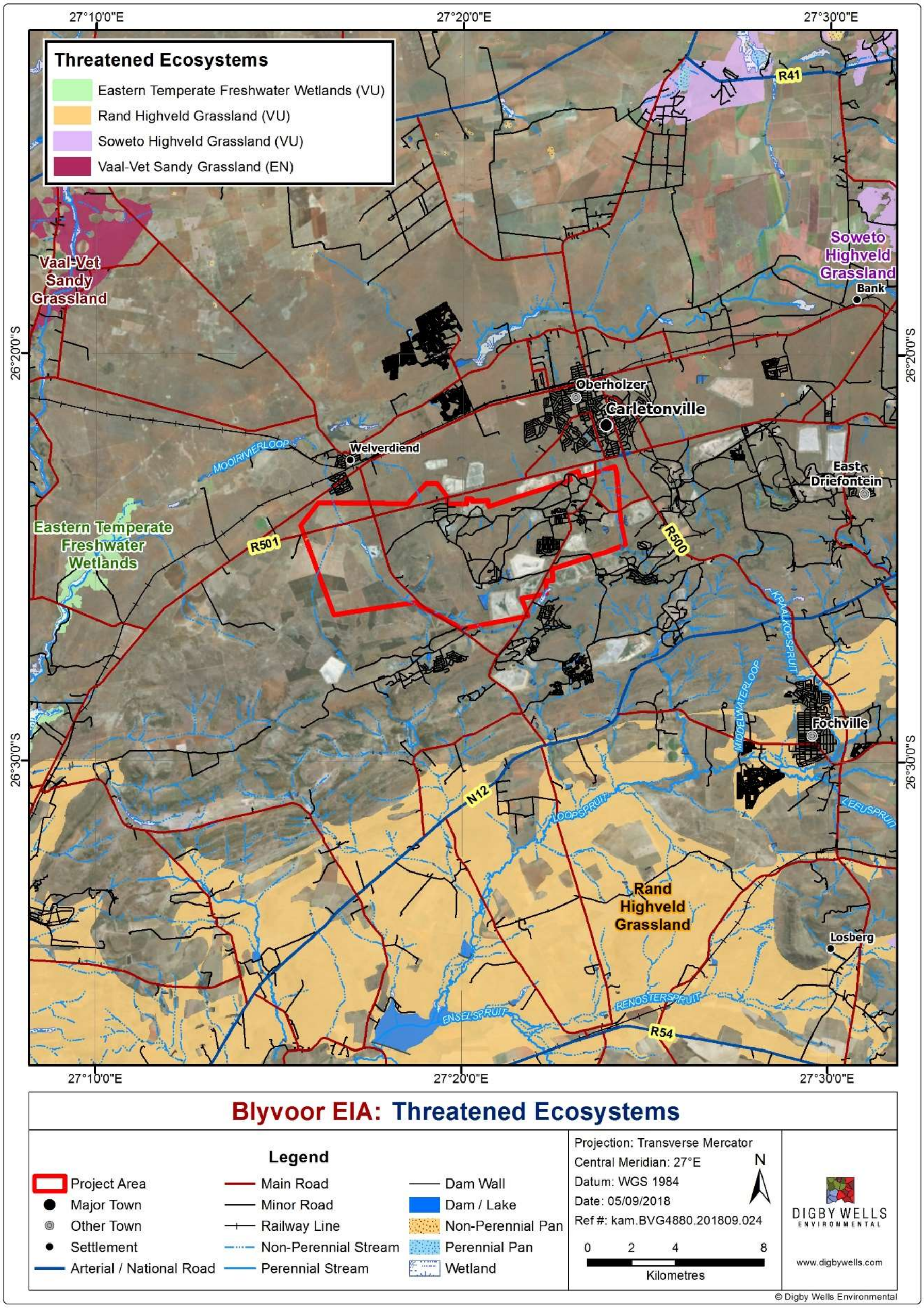


Figure 7-8: Threatened Ecosystems

7.5.6 National Protected Areas Expansion Strategy

The National Protected Areas Expansion Strategy (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. There are no areas earmarked for conservation within the study area, however the north and west of the site, two NPAES areas do occur (Figure 7-9) the Vaal Grasslands.

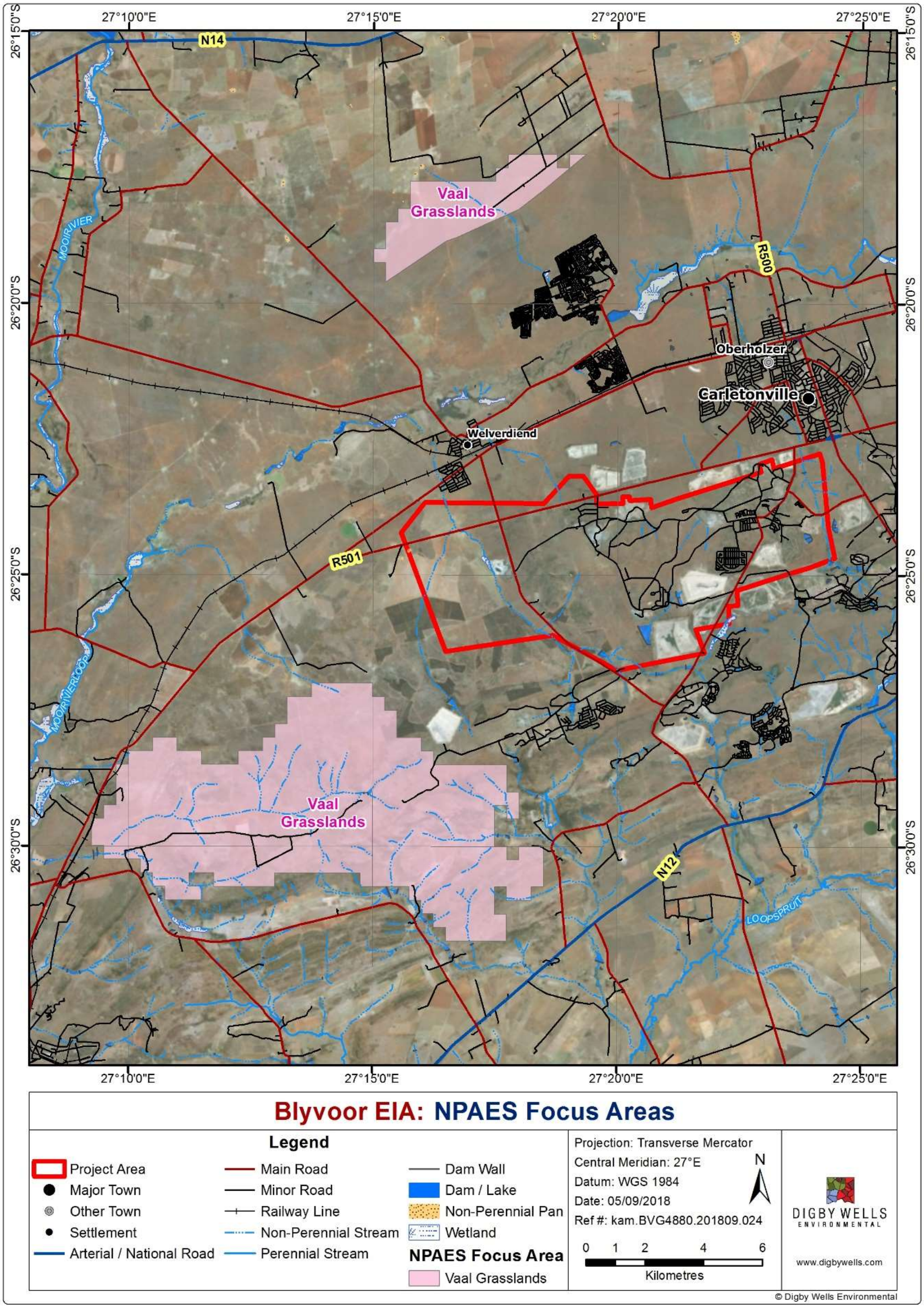


Figure 7-9: NPAES

8 Existing Environment

8.1 Wetland Ecological Assessment

8.1.1 Wetland delineation and classification

Three primary HGM units were identified within the Blyvoor Gold Mining Right Area (MRA) at the time of the assessment. A large channelled valley bottom wetland (HGM Unit 1) was identified on the western portion of the project area, with the upper reaches of the system stretching from the south-western border of the mining rights area. An unchannelled valley bottom wetland (HGM Unit 2), originating from the central portion of the mining rights area, in the vicinity of the Blyvoor Gold TSF, joins HGM Unit 1 downstream of the Blyvoor Gold and Anglo Gold TSF and mining operations. To the east, is a channelled valley bottom system (HGM Unit 3) stretching from the northern to the southern border of the MRA. The breakdown of the wetland types per area is detailed in Table 8-1 and illustrated in Figure 8-1.

Table 8-1: Wetland HGM Units

HGM Unit	HGM Unit Type	Area (ha)
1	Channelled Valley Bottom	193.69
2	Un-channelled Valley Bottom	67.66
3	Channelled Valley Bottom	39.03

The buffer zones relating to the wetlands are illustrated in Figure 8-2. Zones of Regulation of 100m around each wetland have been assigned according to the regulations on use of water for mining and related activities aimed at the protection of water resources (GN R704 in GG 20119 of 4 June 1999).

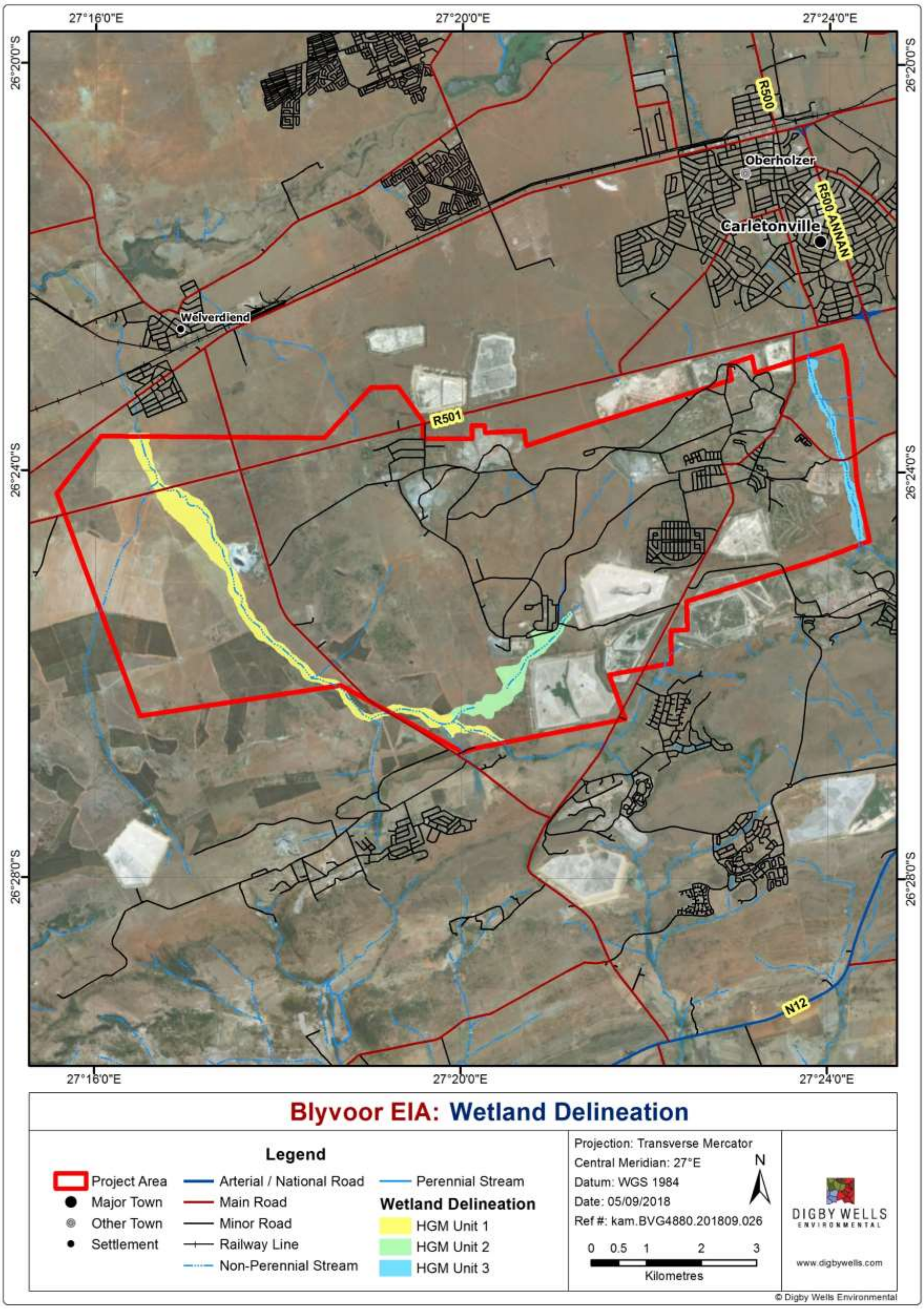


Figure 8-1: Wetland Delineation

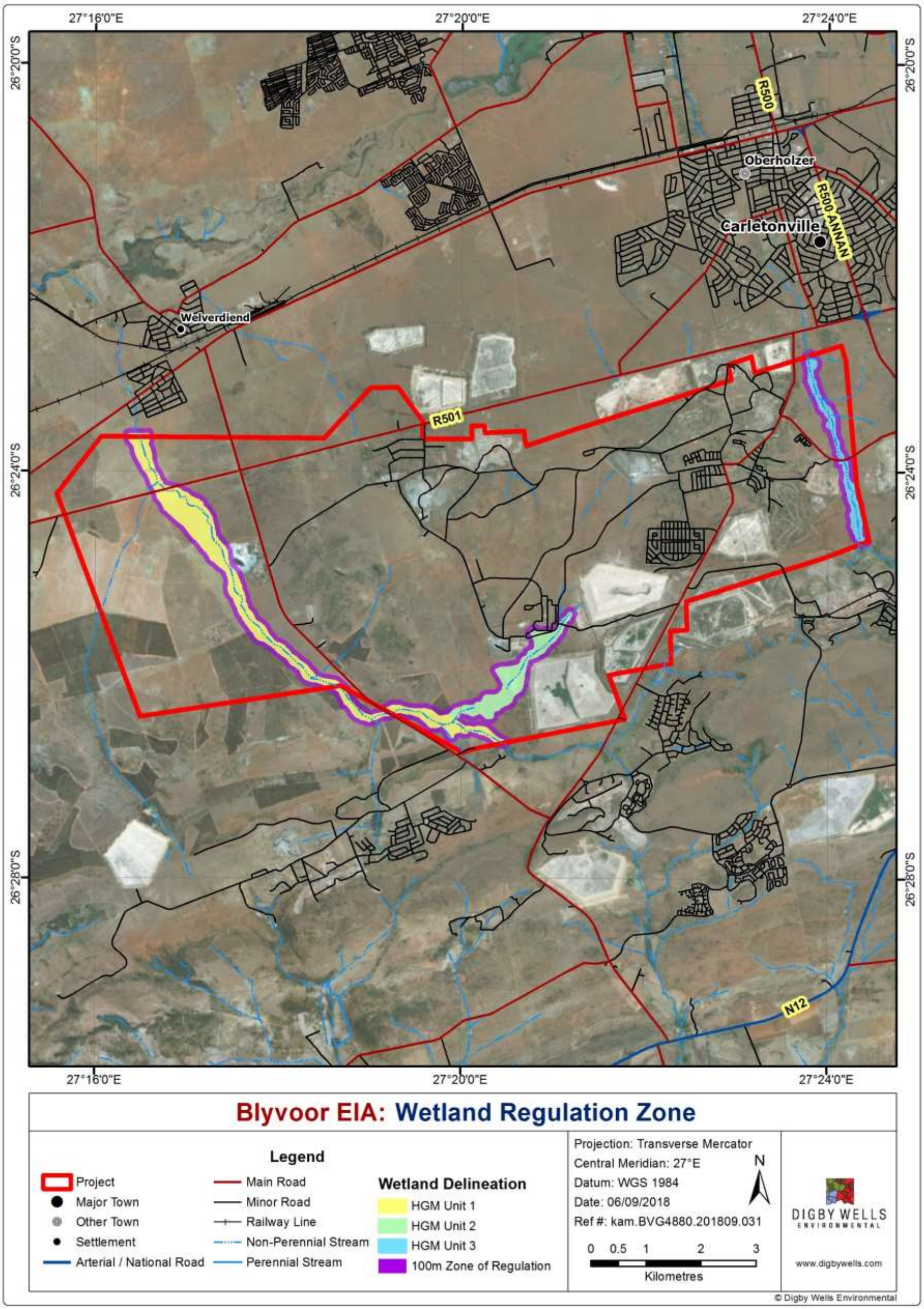


Figure 8-2: Wetland Regulation Zones

8.1.1.1 HGM Unit 1

The temporary zone of the upper reaches of HGM Unit 1 are dominated by *Eragrostis curvula*, *Eragrostis plana, Elionuris muticus* and *Themeda triandra*. Within the seasonal and permanent zones, dense stands of *Phragmites* sp., *Typha capensis* and *Juncus effusus* were observed. Some impacts along this portion of the system include small impoundments, which alter the geomorphology and hydrology of the system, several culverts and small concrete channels were also observed intermittently along the length of this portion of HGM Unit 1.

Further downstream, on the north-western portion of this system, dense patches of *Eucalyptus* and *Seriphium plumosum* encroach into the temporary and seasonal zones of the wetland. A slightly larger impoundment was observed downstream of a large road crossing, where some water abstraction activities were taking place. A stone quarry is situated adjacent to HGM Unit 1 and encroaches into the temporary and seasonal zones.

Some water abstraction activities related to the quarry were observed at the time of the assessment. Other impacts include soil hardening and compaction at various points for road and fence crossings, erosion and the associated loss of vegetation cover as well as some sedimentation instream. Limited cattle grazing activities within the area may further aggravate the erosion and sedimentation observed in areas where erosion has already occurred. Dominant species observed within the temporary zone of this portion of the wetland include *Eragrostis plana, Eragrostis gummiflua, Themeda triandra* and *Cynodon dactylon*. Seasonal zones comprised mainly of *Eragrostis gummiflua* and *Andropogon eucomus*, while the permanent zone species included stands of *Juncus effusus, Typha capensis, Nasturtium officinale* and *Marsilea macrocarpa.* See Table 8-2 for a complete list of species identified in HGM Unit 1.

Table 8-2: Plant species identified in HGM Unit 1

Species name	Temporary	Seasonal and permanent
Cynodon dactylon	x	x
Andropogon eucomus		x
Eragrostis capensis		x
Elionurus muticus	x	
Eragrostis curvula	x	
Eragrostis gummiflua	x	x
Eragrostis plana	x	x
Eucalyptus sp.	x	

Species name	Temporary	Seasonal and permanent
Juncus effusus		x
Phragmites sp.		x
Typha capensis		x
*Verbena bonariensis**		x
Themeda triandra	x	
Digitaria eriantha	x	
Seriphium plumosum	x	
*Persicaria sp.**		x
*Nasturtium officinale**		x
Marsilea macrocarpa		x

* denotes alien species

Figure 8-3: Habitat of the downstream portion of HGM Unit 1 (A: Wetland habitat; B: Culverts; C: Dump; D Wetland habitat; E: Invasive species, Eucalyptus; F: Impoundment)

Figure 8-4: Habitat of the upstream portion of HGM Unit 1 (A: Wetland habitat; B: Seriphium plumosum, an indigenous invader; C: Wetland habitat; D: Impoundment)

8.1.1.2 HGM Unit 2

This HGM Unit has been severely impacted in terms of hydrology and geomorphology. Several trenches and roads cross this wetland, resulting in fragmentation of the system, soil hardening and loss of flow to the areas directly downstream of each structure. Some impact in terms of dust pollution associated with the Blyvoor TSF and potentially other surrounding TSFs was observed. In addition, a number of dams were observed along the length of this system, including the Anglo Return Water Dam associated with the Anglo TSF, which has resulted in a severe modification to this wetland system both upstream in terms of inundation and alterations to water quality, as well as downstream in terms of desiccation of the wetland. The downstream portion of this HGM Unit is characterised by large areas of soil disturbance, loss of natural vegetation and erosion. See Table 8-3 for a complete list of species identified in HGM Unit 2.

Table 8-3: Plant species identified in HGM Unit 2

Species name	Temporary	Seasonal and permanent
Cynodon dactylon	x	
Eragrostis curvula	x	
Eragrostis gummiflua	x	
Eragrostis plana	x	
Hyparrhenia hirta	x	
Juncus effusus	x	x
Phragmites sp.		x
Themeda triandra	x	
Typha capensis		x
*Verbena bonariensis**		x

* denotes alien species

Figure 8-5: Habitat representational of HGM Unit 2 (A: Dense *Phragmites* stands; B: Trenches dug within the wetland; C: Dried out wetland habitat; E: Impoundment; F: A trench that has been dug being invaded by alien species)

8.1.1.3 HGM Unit 3

The temporary zone of this system was dominated by *Bidens pilosa, Cosmos bipinnatus, Eragrostis curvula* and *Setaria sphacelata*. In the seasonal and permanent zones, large *Salix babylonica* and dense stands of *Populus x canescens* were observed, with a sparse understory. Species observed included *Typha capensis*, stands of *Phragmites* sp., *Tagetes minuta, Juncus effusus* and *Lemna* sp. See Table 8-4 for a complete list of species identified in HGM unit 3.

Evidence of artisanal mining along the length of this system included soil disturbance, digging within the seasonal and permanent zones, salt crystallisation at the waters' edge and remnants of equipment used.

Table 8-4: Plant species identified in HGM Unit 3

Species name	Temporary	Seasonal and permanent
Asparagus sp.		x
*Bidens pilosa**	x	
*Cosmos bipinnatus**	x	
Cynodon dactylon	x	
Eragrostis curvula	x	
Juncus effusus		x
Lemna sp.		x
Phragmites sp.		x
*Populus x canescens**		x
*Salix babylonica**		x
Setaria sphacelata	x	
*Tagetes minuta**		x
Typha capensis		x

* denotes alien species

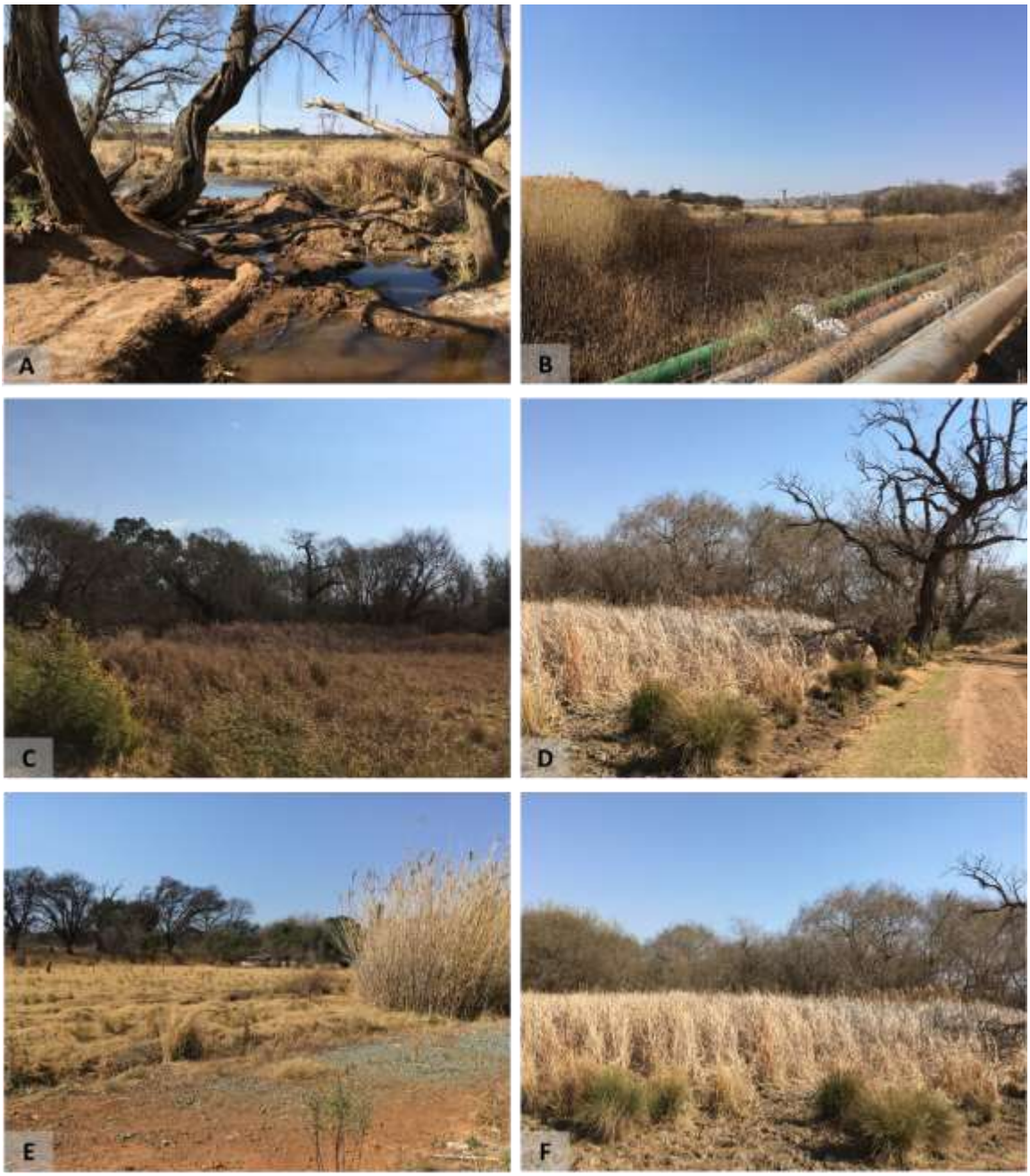


Figure 8-6: Habitat representational of HGM Unit 3 (A: Wetland habitat; B: pipelines within the wetland; C: Wetland habitat; D: *Typha* stands; E: A road within the wetland; F: Dense *Typha* stands)

8.1.2 Sensitivity of the Site

8.1.2.1 Present Ecological State

Table 8-5 indicates the PES scores for the various HGM Units.

HGM Unit 1 obtained a PES Category C (Moderately Modified) on application of the WET-Health assessment tool and may be regarded as moderately modified from its pristine reference state.

HGM Unit 2 obtained a PES Category E (Seriously Modified) on application of the WET-Health assessment tool and may be regarded as seriously modified from its pristine reference state.

HGM Unit 3 was assigned a PES Category D (Largely Modified) on application of the WET-Heath assessment tool based on modifications to the geomorphology as well as the vegetation structures of this system.

Table 8-5: Present Ecological Health Scores

HGM Unit	Hydrological Health Score	Geomorphological Health Score	Vegetation Health Score	Final Ecological Health Score	PES Score
1	1	0.5	7.8	2.8	C
2	7	2.1	8.4	6	E
3	6	0.9	6.4	4.6	D

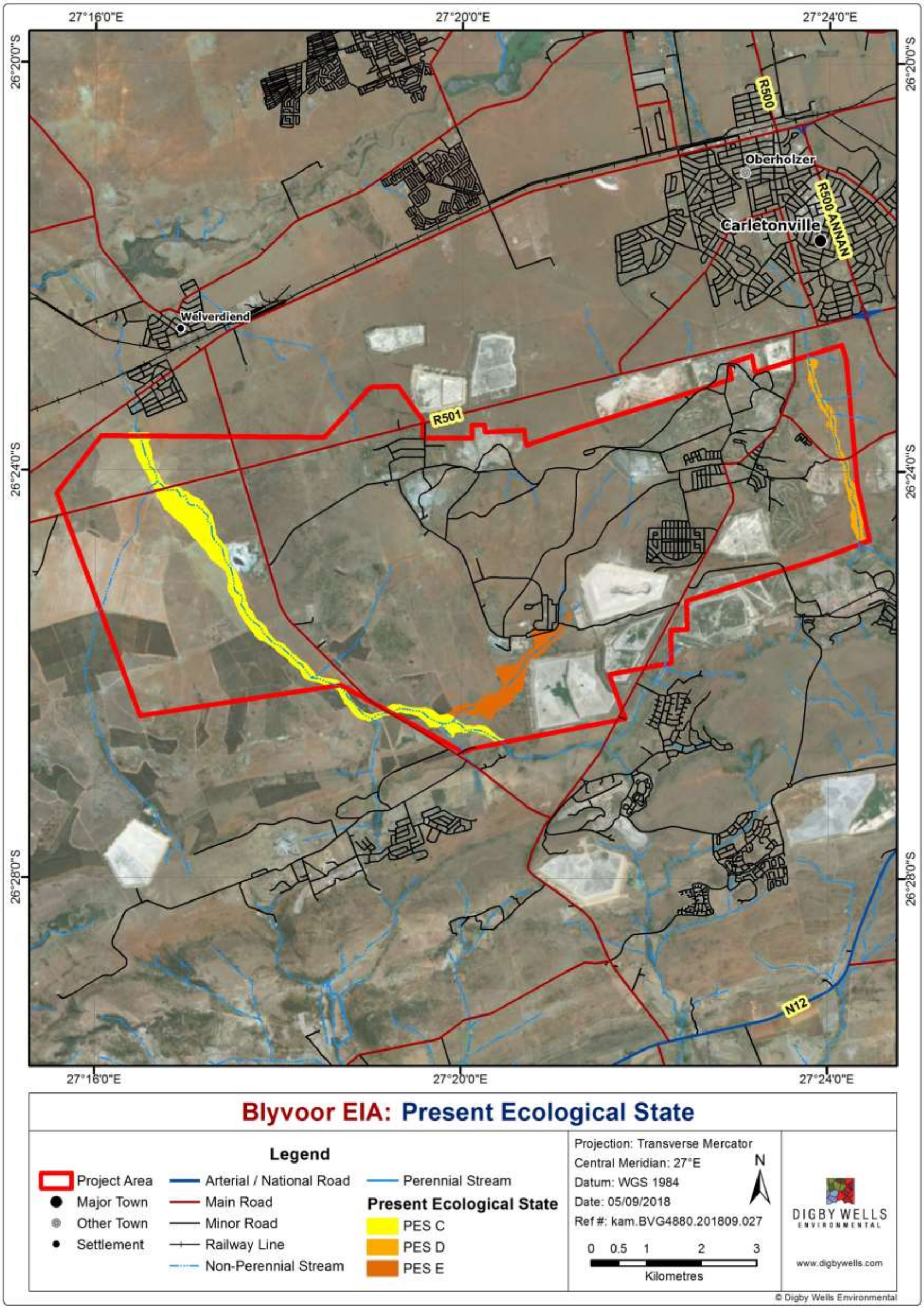


Figure 8-7: Present Ecological State

8.1.2.2 Ecological Importance and Sensitivity

Table 8-6 indicates the EIS scores for various HGM units.

HGM Unit 1 may be regarded as High (2.3) in terms of sensitivity to flow and habitat modifications as well as in terms of biodiversity maintenance and habitat provision.

HGM Unit 2 may be regarded as Moderate (1.8). This score may be largely attributed to the unchanneled valley bottom nature of this system, which will play a key role in terms of stream flow regulation and flood attenuation as well as in the provision of habitat.

HGM Unit 3 may be regarded as Moderate (1.5). However, this score may be largely attributed to the channelled valley bottom nature of this system, which will play a key role in terms of stream flow regulation and flood attenuation as well as in the provision of habitat. In terms of Hydrological Importance as well as Direct Human Benefits, this HGM Unit may be regarded as Low (0.8 and 0.2, respectively).

Table 8-6: EIS Scores

HGM Unit	Ecological Importance & Sensitivity	Hydrological/Functional Importance	Direct Human Benefits	Final EIS Score	Final EIS Category
1	2.3	1.9	1	2.3	High
2	1.8	1.3	0.1	1.8	Moderate
3	1.5	0.8	0.2	1.5	Moderate

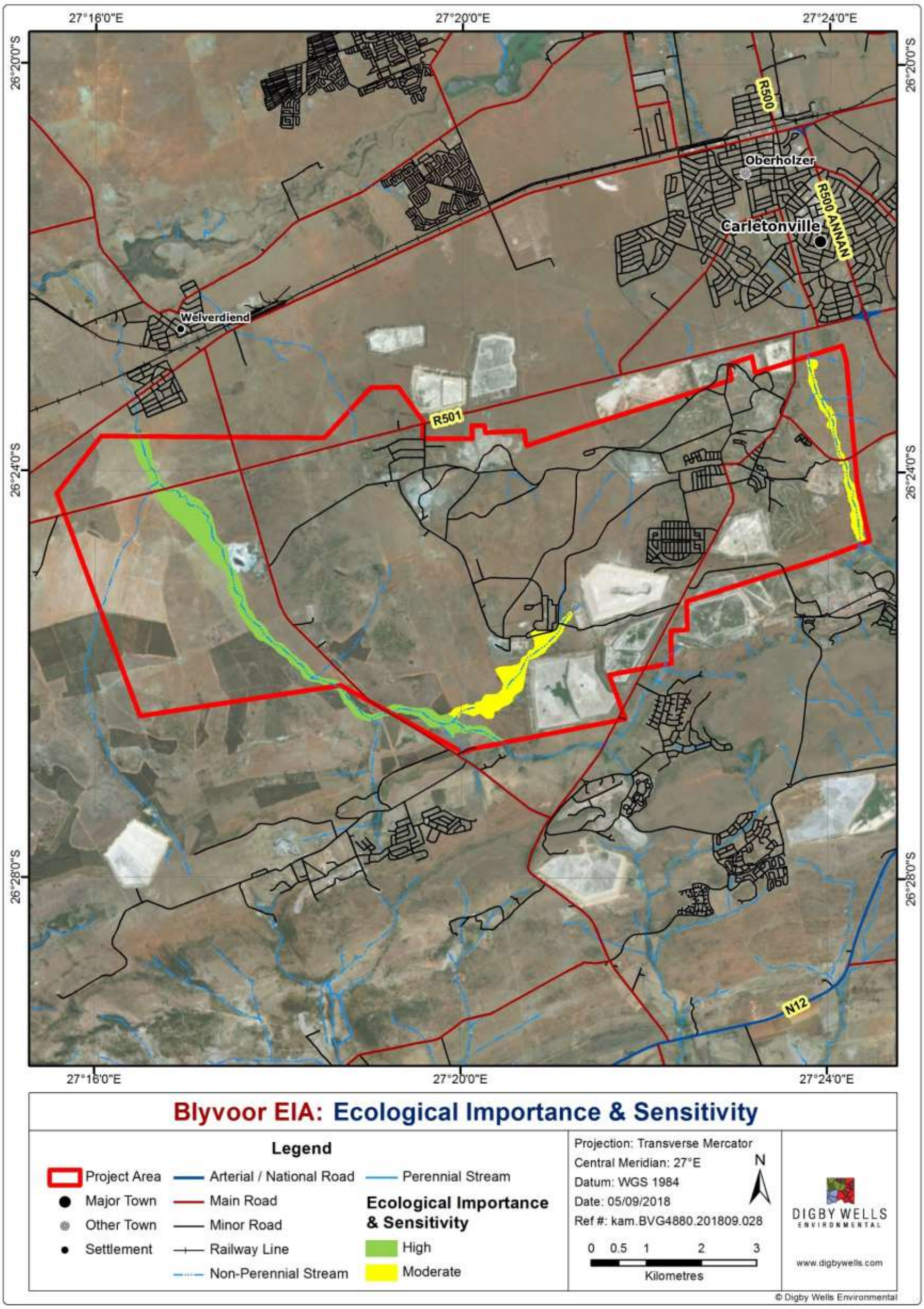


Figure 8-8: Ecological Importance and Sensitivity

8.2 Aquatic Ecological Assessment

8.2.1 Site selection and localities

Table 8-7 displays the locations and photographs of the biomonitoring and water quality sites assessed within the MRA during the August 2018 baseline assessment. Two unnamed river reaches were observed within the Blyvoor MRA, namely, C23E-01465 (Represented by sites BVG1, BVG2 and BVG3) and C23E-01436 (Represented by site BVG4). These systems form part of the Mooirivierloop catchment, however, according to the PESEIS database (2014), these systems are not connected to the main stem of the Mooirivierloop and thus, further investigation of these river reaches was not undertaken. Furthermore, for information purposes, three additional points, considered unsuitable for the application of the SASS5 and MIRAI assessment methodologies, were assessed for water quality only (represented by sites BVG_WQ1, BVG_WQ2 and BVG_WQ3).

Table 8-7: Site localities

Site	GPS Co-ordinates	Photograph
Biomonitoring assessment points		
BVG1	26°24'10.72"S 27°16'45.16"E	

BVG2	26°26'22.20"S 27°19'12.29"E	
BVG3	26°26'38.91"S 27°20'25.39"E	
BVG4	26°24'23.09"S 27°24'18.06"E	

Water quality assessment points		
BVG_WQ1	26°25'38.99"S 27°20'58.17"E	
BVG_WQ2	26°25'57.41"S 27°20'29.47"E	
BVG_WQ3	26°26'23.32"S 27°20'18.00"E	

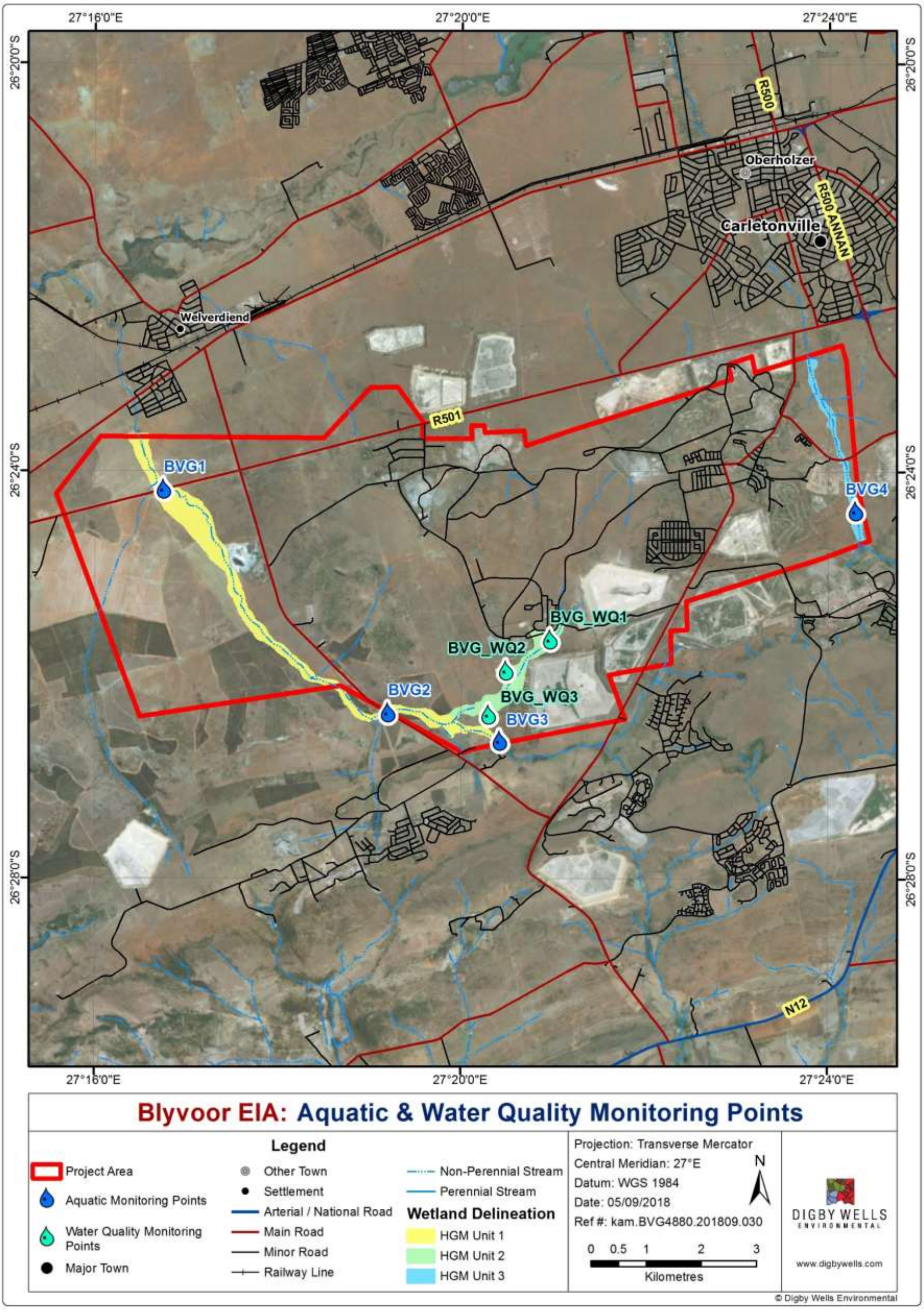


Figure 8-9: Aquatic and Water Quality Monitoring Points

8.2.2 Water Quality Assessment

Due to the highly dynamic nature of flowing systems, water quality conditions have been known to vary both on a temporal and spatial scale within a watercourse (Dallas and Day, 2004). Despite these variations, the assessment of *in situ* water quality variables is important for the interpretation of results obtained during biological investigations, as aquatic organisms are influenced by the environment in which they live. *In situ* water quality findings recorded during the survey are presented in Table 8-8.

Table 8-8: In situ water quality findings

Site	Guideline Values	BVG1	BVG2	BVG3	BVG4	BVG_WQ1	BVG_WQ2	BVG_WQ3
Temperature (C)	-	6.6	11.8	15.9	14.5	12.4	15.7	17.8
pH	6.5-9	8.22	8.27	8.25	8.75	7.29	7.71	10.43
Conductivity (µS/cm)		2750	12430	2450	12620	1158	1420	958
Dissolved oxygen (mg/L)	>5	10.41	10.68	10.80	15.15	5.78	7.30	12.64
Saturation percentage (%)	80-120	86.1	96.3	97.9	146.6	51.7	76.6	152.8
Red shading indicates constituents exceeding recommended guidelines								

Most aquatic systems within South Africa are relatively well-buffered, as a result of dissolved bicarbonate/carbonate ions originating from exposed geological formations and atmospheric deposits, and as such, these systems are expected to exhibit close-to-neutral pH levels (i.e. pH 6.5-9; Department of Water Affairs and Forestry, 1996; Dallas & Day, 2004). The pH values observed within the mining rights area may thus be regarded as somewhat alkaline, however, as these values fall within the recommended guideline values, with the exception of BVG_WQ 3, no negative impact to aquatic life in terms of the pH values observed were deemed likely. At BVG_WQ 3, some impacts to the expected aquatic communities that may have occurred at this site were deemed possible.

Electrical conductivity values recorded at the time of the survey were observed to exhibit extremely high levels, with special mention of sites BVG2 and BVG4. These observations serve as an indication of some contribution of dissolved salts or pollutants to the system. At site BVG2, some impact may be expressed as a result of a tailings spill, unassociated with the Blyvoor Gold operations, observed in the upper reaches of the system at the time of the assessment, however, this cannot be confirmed with certainty and other potential point and diffuse sources of pollution should be investigated so as to suitably mitigate any potential impacts to the system. At site BVG4, elevated dissolved salt concentrations may be related to artisanal mining activities observed along the entire length of the system. However, once again, other potential point and diffuse sources of pollution should be investigated to adequately confirm and mitigate impacts. No obvious spatial trends were observed between sites BVG1, BVG2 and BVG3.

Dissolved oxygen concentrations of 80%-120% saturation are considered adequate to protect all life stages of the vast majority of aquatic organisms that are endemic (or adapted) to inhabiting aerobic warm water habitats (Department of Water Affairs and Forestry, 1996). Furthermore, according to a study conducted by Nebeker, et al. (1996), dissolved oxygen concentrations of less than 5 mg/L are likely to limit the diversity and sensitivity of the aquatic communities likely to occur at each site. At the time of the assessment, all dissolved oxygen concentrations exceeded the minimum of 5 mg/L. However, should the percentage saturation be considered, the dissolved oxygen concentrations at sites BVG_WQ2 and BVG_WQ3 may be regarded as poor. At sites BVG4 and site BVG3_WQ3, the dissolved oxygen concentrations greatly exceeded the upper limit of 120% saturation (i.e. supersaturated). Some level of eutrophication at sites BVG4 and BVG_WQ3 is suspected based on the algal blooms observed at both sites.

8.2.3 Invertebrate Habitat Assessment System (IHAS)

Site BVG1 exhibited poor habitat availability. While both marginal and aquatic vegetation were sampled, marginal vegetation was dominated by stems and shoots, thus minimising the suitability of this biotope to serve as a refuge area for colonisation by macro-invertebrates. Furthermore, sand and mud dominated the remaining available substrate, with no gravel or stones habitats available. Sites BVG2 and BVG3 presented a diversity of habitat

conditions, stones in and out of current, gravel-sand-mud, as well as vegetation, thus increasing the potential for habitat provision for aquatic organisms at these sites. Habitat availability at site BVG4 was considered severely compromised as a result of loss of bankside vegetation due to impacts related to large alien trees in the marginal riparian zones as well as activities related to artisanal mining. Stones in current were absent at this point at the time of the assessment, with marginal habitat limited to stems and stalks in pools. Limited aquatic vegetation was present. In terms of the remaining substrates, the site was severely affected by dredging and siltation and only mud substrates were available for sampling at this point at the time of the assessment.

Table 8-9: IHAS findings

Site	BVG1	BVG2	BVG3	BVG4
IHAS	40.00	70.91	78.00	27.27
Interpretation	**Poor**	**Good**	**Very good**	**Poor**

8.2.4 Macro-invertebrates

Due to the differential sensitivities of aquatic macroinvertebrates, the composition of the aquatic macroinvertebrate community can provide an indication of changes in water quality and other ecological conditions within a watercourse. The use of the SASS has undergone numerous advances, culminating in Version 5 presently being utilised in river health studies along with the application of the MIRAI.

Based on the derived reference list and distribution, a total of approximately 45 different aquatic macroinvertebrate families were to be expected within the study area (based on locality, altitude, geomorphology, site structure and experience). Of these aquatic macroinvertebrate families, a total of only 21 taxa were collected at the time of the survey (including an alien Physidae), ranging from 8 families at the Site BVG4 to 13 families at Site BVG2. Accordingly, the corresponding SASS5 scores ranged from a low 21 to moderate 51 at the same respective sampling sites. The highest Average Score Per Taxon (ASPT) values were observed at Sites BVG2 and BVG3. Only one taxon, generally regarded as moderately sensitive to water quality impairment, was collected, namely Hydracarina (Water Mites).

Table 8-10: SASS5 findings

Site	BVG1	BVG2	BVG3	BVG4
SASS5	21	51	34	41
Taxa	8	13	9	12
ASPT	2.63	3.92	3.78	3.42
% of SASS5 Reference	10.19	24.76	16.51	19.90

% of ASPT Reference	57.42	85.59	82.53	74.67
Dallas 2007 Classification System	E/F	E/F	E/F	E/F

On consideration of the IHAS scores obtained for each assessment point respectively, some correlation between the reduced SASS5 score and the available habitat observed at site BVG1 is evident. At site BVG3, however, while the IHAS score served as an indication of "very good" habitat availability for colonisation by macro-invertebrates, the SASS5 score comprised of only 16.51% of the expected reference assemblage.

Despite the high ASPT scores obtained in relation to the reference macro-invertebrate assemblage, the absolute scores reflect a macro-invertebrate assemblage of relatively low sensitivity, with an increased tolerance for poor water quality and low levels of dissolved oxygen. Both sites BVG1 and BVG4 are dominated by moderately tolerant air-breathing taxa such as *Corixidae* (Water boatmen), *Pleidae* (Pigmy backswimmers) and *Dytiscidae* (Diving beetles). The Dallas (1997) classification system, while not considered sufficient for the determination of the Present Ecological State (PES) and the allocation of an Ecological Category, was applied as a supplementary information source. On application of this system, each of the sites were regarded as Seriously to Critically modified (E/F) from the reference conditions expected in these types of streams and within this portion of the Highveld Ecoregion.

8.2.5 Present Ecological State

Although Chutter (1998) originally developed the SASS5 protocol as an indicator of water quality, it has since become clear that the SASS5 approach gives an indication of more than mere water quality, but also a general indication of the current state of the macroinvertebrate community. While SASS5 does not have a particularly strong cause-effect basis for interpretation, as it was developed for application in the broad synoptic assessment required for the old River Health Programme (RHP), the aim of the MIRAI is to provide a habitat-based cause-and-effect foundation, making use of the SASS5 results, to interpret the deviation of the aquatic macro-invertebrate assemblage. from the reference condition (Thirion, 2008). The use of the MIRAI allows the determination of the PES and an Ecological Category for each site.

Table 8-11: Results obtained following the application MIRAI at selected sampling sites at the time of the August 2018 field survey

Site	REC	MIRAI Value	Ecological Category	Description
BVG1	E	26.44	E	Seriously modified
BVG2	E	30.02	E	Seriously modified
BVG3	E	25.46	E	Seriously modified

BVG4	E	29.22	E	Seriously modified

In relation to perceived reference conditions, it was determined that the ecological condition of the macro-invertebrate assemblages collected within the study area each exhibited seriously modified conditions (i.e. Ecological Category E; Table 8-11). Further interrogation of the applied MIRAI indices suggested that the primary driver of change at site BVG1 was related to poor habitat availability. At site BVG4, the macro-invertebrate assemblage was influenced by impacts to habitat availability and compounded by further impacts to water quality. At sites BVG2 and BVG3, the key driver of change is likely related to impacts to water quality, the sources of which require confirmation.

On further investigation, however, it is important to note that the PESEIS database (2014) provides no information on either of the river reaches investigated at the time of the assessment due to lack of sufficient stream connectivity to the Mooirivierloop further downstream. Thus, despite the compromised ecological integrity observed along each of the river reaches observed within the Blyvoor MRA as a result of the current various impacts to habitat integrity and water quality observed, historical data serves as an indication that these systems are likely limited in diversity and function within the greater catchment as a result of various anthropogenic activities including but not limited to; dams, water abstraction activities, agriculture and livestock farming as well as mining.

9 Impact Assessment

Potential impacts resulting from mining activities during the construction, operation, decommissioning, closure and rehabilitation phases of the Blyvoor Gold Mine were assessed in relation to the freshwater resources in the vicinity of the project area. Impacts to the fauna and flora did not form part of this scope and therefore are excluded from this assessment.

Since the mine footprint is already in existence, the anticipated impacts relating to the proposed project are not considered major. Impacts are limited to those that arise from the development of additional infrastructure as well as potential ongoing impacts associated with the current infrastructures such as seepage and dust from the TSFs entering the freshwater systems.

The assessed potential impacts, descriptions and significance ratings are described below.

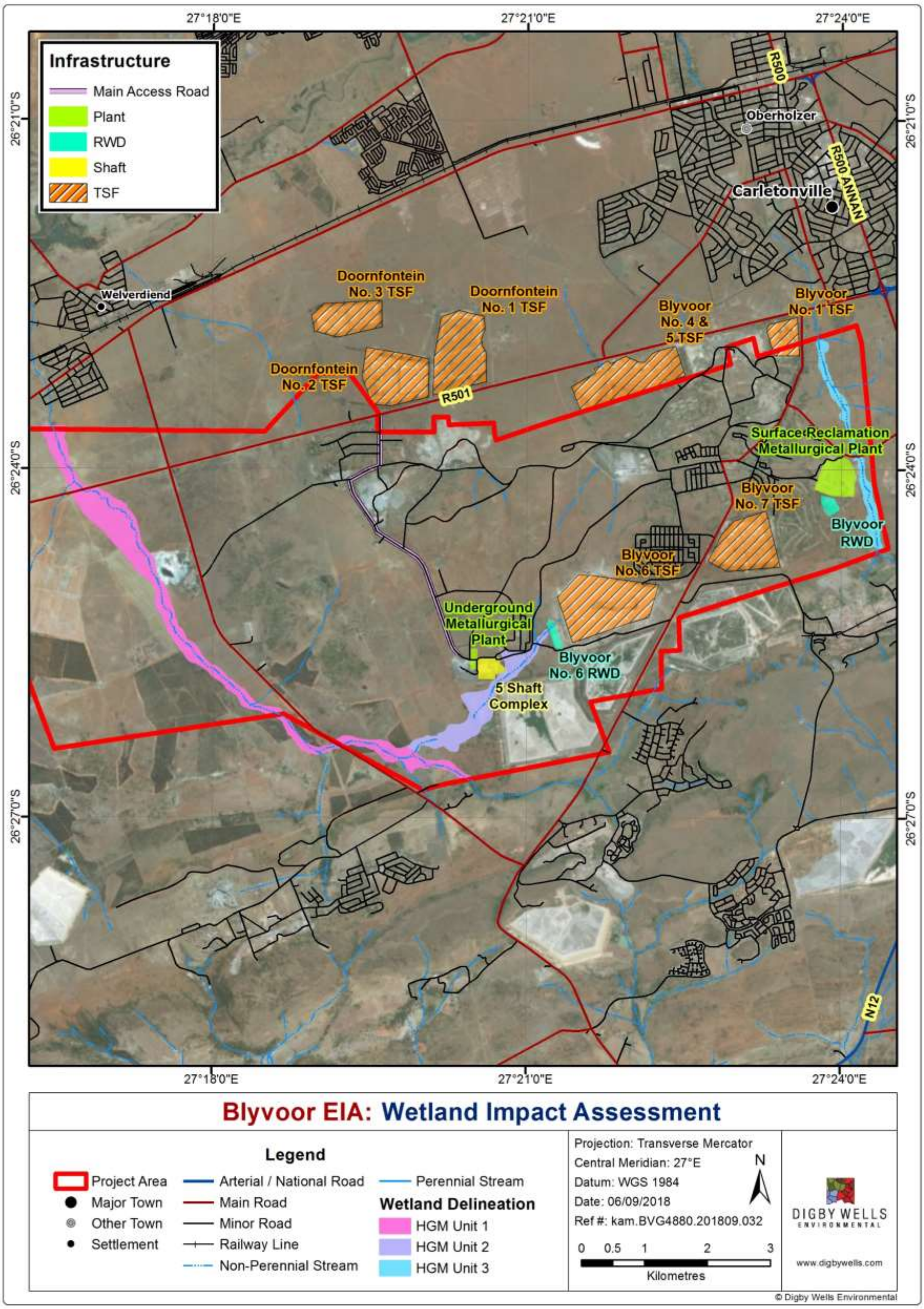


Figure 9-1: Infrastructure in relation to the freshwater systems

9.1 Construction phase

9.1.1 Impact description

The main activities during the construction phase that could result in impacts to the freshwater ecology of the area are associated with construction of the various new infrastructures (new metallurgical plant, structures at 5 Shaft, fencing, etc.), site clearing, soil disturbance, crossing of wetland and river areas, increased vehicular movement, stockpiling of topsoil, storage and dumping of building materials

Among the impacts associated with the proposed construction phase are potential impacts to soil and water quality as a result of the ingress of hydrocarbons.

Larger impacts include compaction of soils, potential loss of natural vegetation and the increased potential for erosion and sedimentation in the vicinity of any areas cleared for stockpiles and resulting in impacts further downstream. Removal of vegetation and disturbance of soils in the vicinity of the construction footprint is likely to give rise to an increased potential for encroachment by robust pioneer species and alien invasive vegetation species, further altering the natural vegetation profiles of the wetlands encountered in the vicinity of the project footprint.

With respect to the underground workings, dewatering may only take place 9 years after operations commence and has therefore been discussed in the operational phase.

The impacts of the construction phase to the freshwater ecology are discussed below:

Table 9-1: Potential Impacts of the Construction Phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Site access, disturbance and construction			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the life of the project has been completed	Minor (negative) – 48
Extent	Local (3)	Erosion and general scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect the local watercourse and river reaches directly downstream.	
Intensity x type of impact	Serious medium-term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium-term impacts.	

Dimension	Rating	Motivation	Significance
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the freshwater systems present are considered probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed.	Negligible (negative) - 27
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the freshwater systems present	
Probability	Unlikely (3)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered unlikely.	
Nature	Negative		

9.1.2 Mitigation measures

The 5 Shaft complex, and metallurgical plant are all in proximity to the HGM Units 2 and 3; therefore, the following mitigation and management measures have been prescribed for the construction phase:

- Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation;
- During the construction phase, erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:

  - Where the track has a slope of less than 2%, berms every 50m should be installed;
  - Where the track slopes between 2% and 10%, berms every 25m should be installed;
  - Where the track slopes between 10%-15%, berms every 20m should be installed; and
  - Where the track has slope greater than 15%, berms every 10m should be installed.

- Limit the footprint area of the construction activities to what is essential in order to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);
- Appropriate storm water measures should be in place. It should be ensured that clean and dirty water separation systems are the first infrastructures to be installed on site and these need to be in working order and regularly maintained;
- If it is absolutely unavoidable that any of the wetland or instream areas present (not withstanding those already accounted for in the proposed activities) will be affected, disturbance must be minimised and suitably rehabilitated;
- Ensure that no incision and canalisation of the wetland and instream features present takes place;
- All erosion noted within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
- Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction;
- All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled;
- Implement and maintain a suitable AIP control programme to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;
- Permit only essential personnel within the 100m zone of regulation for all freshwater features identified;
- No unnecessary crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;
- No material may be dumped or stockpiled within any rivers, tributaries or drainage lines;

- No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland or instream areas and their associated zones of regulation (notwithstanding those areas to be directly impacted upon as a result of the proposed activities). All vehicles must remain on demarcated roads and within the construction footprint. The No-go zone should be avoided;
- All vehicles must be regularly inspected for leaks;
- Re-fueling must take place at a diesel facility, on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;
- All spills should be immediately cleaned up and treated accordingly;
- Freshwater systems should be monitored monthly during construction; and
- Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility.

9.2 Operational phase

9.2.1 Impact Description

The main activities during the operational phase that could result in impacts to the freshwater ecology of the area are associated with the operation. The proposed activities are restricted to a small footprint of historically disturbed land and includes, but is not limited to the mining, operation of the plants, conveying of ore, operation and maintenance of the TSFs (most notably Blyvoor TSF 1, 6 and 7), monitoring and maintenance activities.

Associated potential impacts include could include compaction of soils and hardening of surfaces, loss of catchment yield and surface water recharge, erosion and sedimentation, the potential loss of biodiversity and habitat, loss of natural migration routes for instream fauna and further fragmentation of the systems present. Further to this, the potential for ongoing contamination of the freshwater resources present are deemed possible based on the ingress of hydrocarbons associated with increased vehicular activity, albeit limited in extent due to the proposed underground nature of the operations.

Removal of indigenous vegetation is likely to give rise to an increased potential for encroachment by robust pioneer species and AIPs, further altering the natural vegetation profiles of the freshwater resources encountered in the vicinity of the project footprint.

Hardened surfaces have the potential to result in sheet runoff and there is likely to be a loss in wetland service provision in terms of flood attenuation, sediment trapping and assimilation of toxicants and other pollutants. Storage of water, which is an important service, provided by wetlands in this area, may be compromised, if appropriate mitigation is not adopted. Further alterations to the natural flow regimes will take place and is likely to result in the creation of preferential flow paths over time, which may give rise to erosion and

sedimentation, thus affecting the instream ecology of the systems and their downstream resources.

Furthermore, the potential for ongoing dust pollution from the Blyvoor TSFs 1, 6 and 7 and seepage into freshwater systems, with special mention of HGM unit 2 and 3, and potential for decant from the underground workings thereby contaminating the water quality, is also a potential impact. Contamination from the waste rock dump (not owned by Blyvoor Gold but situated on the Blyvoor Gold Mining Rights Area; see the Groundwater report for details on the acid generating potential of the ore and TSFs) into HGM unit 2 is also a potential impact.

With respect to the underground workings, dewatering may need to occur 9 years after operations commence, which could potentially result in a cone of depression that may result in an alteration in the water table, thereby causing desiccation of the wetlands and moisture stress to the wetland vegetation, especially in relation to HGM Unit 2. However, as dewatering is expected to occur below 2400 mbs, no impact on the water table is currently anticipated. Table 9-2 summarises potential impacts to the freshwater ecology identified during the operational phase.

Table 9-2: Impact assessment parameter ratings for the operational phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Operation of the underground mining, TSFs, conveying and processing			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the life of the project has been completed.	Moderate (negative) – 78
Extent	Greater municipal area (4)	Degraded habitat due to water quality deterioration from maintenance activities, decant, TSF and WRDs will affect entire watercourses and river reaches.	
Intensity x type of impact	Serious medium-term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium-term impacts.	
Probability	Highly probable (6)	Should no precautionary measures be implemented, further impacts to the freshwater systems are considered highly probable.	
Nature	Negative		

Dimension	Rating	Motivation	Significance
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed.	Negligible (negative) – 27
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the operational phase.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present.	
Probability	Unlikely (3)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered unlikely.	
Nature	Negative		

Table 9-3: Impact assessment parameter ratings for the operational phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Potential decant associated with the Blyvoor Gold Mining Rights area			
Prior to Mitigation/Management			
Duration	Permanent (7)	The impact is irreversible, even with management, and will remain after the life of the project.	Moderate (negative) – 112
Extent	Greater municipal area (4)	Degraded water quality and channelization and associated erosion and sedimentation due decant will affect entire watercourses and river reaches.	

Dimension	Rating	Motivation	Significance
Intensity x type of impact	Serious medium term environmental effects (5)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts.	
Probability	Definite (7)	Decant is expected to occur.	
Nature	Negative		
Post-Mitigation			
Duration	Permanent (7)	The impact is irreversible, even with management, and will remain after the life of the project.	Minor (negative) – 70
Extent	Limited (2)	Impacts will be limited only to the project footprint area.	
Intensity x type of impact	Minimal effects on the biological or physical environment (1)	Due to the impacted nature of the systems present, should the decant be treated to appropriate standards and discharged diffusely, the project could result in only a minimal ecological impact to the freshwater systems present.	
Probability	Definite (7)	Decant is expected to occur in the vicinity of the Blyvoor Gold Mining Rights area	
Nature	Negative		

Table 9-4: Potential Impacts of the Operational Phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Dewatering			
Prior to Mitigation/Management			
Duration	Beyond project life (6)	Impacts relating to the water table will remain for some time after the life of the project and is potentially irreversible even with management	Minor (negative) – 56
Extent	Local (3)	Dewatering could potentially result in a cone of depression that may result in alteration in the water table, thereby causing desiccation of the wetlands and moisture stress to the wetland vegetation within the municipal area.	
Intensity x type of impact	Serious medium-term environmental effects (5)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the freshwater systems present are considered possible. It should be noted, however, that historical dewatering has already taken place in the area with minor impacts to the surface water resources and thus the extent is somewhat reduced.	
Nature	Negative		
Post-Mitigation			
Duration	No mitigation measures possible		
Extent			
Intensity x type of impact			
Probability			
Nature			

9.2.2 Mitigation measures

The following mitigation and management measures have been prescribed for the operational phase:

- Ensure proper dust protection mechanisms are in place to reduce sedimentation and contamination of the wetland systems due to the TSFs, with special mention of TSF 1, 6 and 7;
- Ensure continued testing of the water quality of decant and ensure treatment is of a suitable standard if necessary, before discharging into the Wonderfonteinspruit. Ensure decant is suitably discharged so as not to cause channelization of the wetland;
- Both RWDs are in close proximity to the freshwater resources present. It should be ensured that there is no leaching of harmful substances into the freshwater resources;
- Biomonitoring is recommended to be conducted by suitably qualified wetland and aquatic ecologists.
- Toxicological testing is recommended to take place on the freshwater resources present at least once annually or prior to any planned discharges on at least three trophic levels. This will help to determine any impacts to the aquatic communities present as a result of seepage or spills and in the case of any planned discharges, to determine a safe dilution ratio.
- Limit the footprint area of the operational activities to what is absolutely essential in order to minimise impacts as a result of any potential vegetation clearing and compaction of soils (all areas but critically so in freshwater areas);
- If it is absolutely unavoidable that any of the freshwater areas present will be affected, disturbance must be minimised and suitably rehabilitated;
- Ensure that no incision and canalisation of the freshwater features present takes place as a result of the proposed operational activities;
- All erosion noted within the operational footprint as a result of any potential surface activities should be remedied immediately and included as part of the ongoing rehabilitation plan;
- A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;
- All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel;
- No unnecessary crossing of the wetland features, instream areas and their associated buffers, as well as the constructed berms or canals should take place and

the substrate conditions of the wetlands, instream areas and downstream stream connectivity must be maintained;

- No vehicles or heavy machinery may be allowed to drive indiscriminately within any freshwater areas and their associated zones of regulation. All vehicles must remain on demarcated roads;
- All vehicles must be regularly inspected for leaks;
- Re-fuelling must take place on a sealed surface area away from freshwater features to prevent ingress of hydrocarbons into topsoil;
- All spills should be immediately cleaned up and treated accordingly;
- Appropriate sanitary facilities must be provided for the duration of the operational activities and all waste must be removed to an appropriate waste facility;
- Monitor all systems for erosion and incision;
- All erosion noted within the footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
- Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation;
- All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled (see the Soil Specialist Report for more information);
- Permit only essential personnel within the 100m zones of regulation for all freshwater features identified; and
- Ongoing wetland rehabilitation is necessary during the operational phase as stipulated in the monitoring section.

9.3 Decommissioning, closure and rehabilitation phase

9.3.1 Impact description

Among the impacts associated with the decommissioning, closure and rehabilitation phase are minor potential impacts to soil and water quality as a result of the ingress of hydrocarbons and mechanical spills associated with moving machinery required for the decommissioning activities.

Larger impacts include compaction of soils, potential loss of natural vegetation and the increased potential for erosion and sedimentation in the decommissioned areas and resulting in impacts further downstream.

Any temporary storage or dumping of decommissioned infrastructure within wetland areas, has the potential to result in loss of stream connectivity, loss of refuge areas, alterations to the terrain profiles of the areas and the creation of preferential flow paths, which may result

in sedimentation, alterations to the vegetation structure of the area, encourage alien vegetation encroachment and result in increased erosion and sedimentation potentials.

Removal of vegetation and disturbance of soils in the vicinity of the decommissioning footprint is likely to give rise to an increased potential for encroachment by robust pioneer species and alien invasive vegetation species, further altering the natural vegetation profiles of the wetlands encountered in the vicinity of the decommissioning footprint.

Decant from the underground workings is also a potential impact. Discharge of decant into freshwater systems may degrade water quality and cause channelization and associated erosion and sedimentation. Furthermore, the potential for ongoing dust pollution from the Blyvoor TSFs 1, 6 and 7 and seepage into freshwater systems, with special mention of HGM Unit 2 and 3, is a potential impact.

Table 9-5: Impact assessment parameter ratings for the Decommissioning, Closure and Rehabilitation Phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Potential decant associated with the Blyvoor Gold Mining Rights area			
Prior to Mitigation/Management			
Duration	Permanent (7)	The impact is irreversible, even with management, and will remain after the life of the project.	Moderate (negative) – 112
Extent	Greater municipal area (4)	Degraded water quality and channelization and associated erosion and sedimentation due decant will affect entire watercourses and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (5)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts.	
Probability	Definite (7)	Decant is expected to occur.	
Nature	Negative		
Post-Mitigation			
Duration	Permanent (7)	The impact is irreversible, even with management, and will remain after the life of the project.	Minor (negative) – 70

Dimension	Rating	Motivation	Significance
Extent	Limited (2)	Impacts will be limited only to the project footprint area.	
Intensity x type of impact	Minimal effects on the biological or physical environment (1)	Due to the impacted nature of the systems present, should the decant be treated to appropriate standards and discharged diffusely, the project could result in only a minimal ecological impact to the freshwater systems present.	
Probability	Definite (7)	Decant is expected to occur in the vicinity of the Blyvoor Gold Mining Rights area.	
Nature	Negative		

Table 9-6: Potential Impacts of the Decommissioning, Closure and Rehabilitation Phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Decommissioning of all infrastructure			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the decommissioning, rehabilitation and closure phases of the project have been completed.	Minor (negative) – 48
Extent	Local (3)	Erosion and general scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect the local watercourse and river reaches directly downstream.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	

Dimension	Rating	Motivation	Significance
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the freshwater systems present are considered probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the decommissioning, rehabilitation and closure phases of the project have been completed.	Negligible (negative) – 27
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase. Funding is in place for planned and unplanned closures.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the freshwater systems present.	
Probability	Unlikely (3)	Should the proposed project proceed, and the appropriate management and mitigation measures be implemented, impacts are considered unlikely.	
Nature	Negative		

Table 9-7: Impact assessment parameter ratings for the Decommissioning, Closure and Rehabilitation Phase

Activity and Interactions: Rehabilitation measures			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the rehabilitation of the project has been completed.	Minor (negative) – 48

Extent	Local (3)	Erosion and general scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect the local watercourse and river reaches directly downstream.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the sensitivity of the freshwater systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the freshwater systems present are considered probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the rehabilitation and closure phases of the project have been completed.	Negligible (negative) – 27
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the flora and wetland systems present	
Probability	Unlikely (3)	Should the proposed project proceed, and the appropriate management and mitigation measures be implemented, impacts are considered unlikely.	
Nature	Negative		

9.3.2 Mitigation measures

The following mitigation and management measures have been prescribed for the decommissioning, closure and rehabilitation phase:

- Ensure maintenance of TSFs to reduce dust pollution;
- Test the water quality of decant and treat if necessary, before discharging into the Wonderfonteinspruit. Decant should be discharged diffusely so as not to cause channelization of the wetland;
- Ensure that sound environmental management is in place during the proposed decommissioning phase;
- Limit the footprint area of the decommissioning and rehabilitation activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);
- All erosion noted within the decommissioning area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan;
- All soils compacted as a result of decommissioning activities should be ripped/scarified (<300mm) and profiled;
- Permit only essential personnel within the zones of regulation for all freshwater features identified;
- Wherever possible, restrict decommissioning activities to the drier winter months to avoid sedimentation of the freshwater resources further downstream;
- No material may be dumped or stockpiled within any wetland areas (or the buffers) in the vicinity of the proposed decommissioning footprint;
- Freshwater resources and their associated zones of regulation are to be clearly demarcated and avoided wherever possible;
- An AIP management plan to be implemented and managed for the life of the proposed decommissioning, rehabilitation, closure and post-closure phases;
- As much vegetation growth as possible should be promoted within the proposed development area during all phases. In order to protect soils, vegetation clearance should be kept to a minimum;
- Monitor all freshwater systems for erosion and incision;
- All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the project area footprint;

- Compacted soils should be ripped, re-profiled and re-seeded;
- All vehicles must be regularly inspected for leaks;
- Re-fueling must take place at a diesel facility on a sealed and bunded surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;
- All existing litter, debris should be removed from the freshwater systems and littering should be prohibited on an ongoing basis;
- All spills from machinery should be immediately cleaned up and treated accordingly;
- Appropriate sanitary facilities must be provided for the duration of the rehabilitation activities and all waste must be removed to an appropriate waste facility; and
- Monitoring should be carried out as specified in the monitoring programme.

10 Cumulative Impacts

The freshwater resources in this area are currently impacted as a result of extensive historical and current mining activities in the area including illegal mining. This has significant impacts on water quality within these freshwater systems as well as sedimentation from TSFs. In addition, other impacts to freshwater resources present in the vicinity of the proposed project include agricultural cultivation, urban settlements, road construction, powerlines and associated servitudes and grazing activities.

11 Monitoring

11.1 Wetland Monitoring

Monitoring to be conducted by an independent suitably qualified wetland specialist. The recommended timing of such monitoring audits should be as follows:

- Monthly during the construction phase;
- Biannually during the operational phase;
- Monthly during the rehabilitation phase; and
- Annually for a minimum of three years after the rehabilitation phase.

11.2 Aquatic Biomonitoring

Monitoring to be conducted by an independent suitably qualified aquatic specialist. The recommended timing of such monitoring audits should be as follows:

- Quarterly during the construction phase;
- Biannually during the operational phase; and
- Annually for a minimum of three years after the rehabilitation phase.

Monitoring is required upstream and downstream of the proposed activities and should include as a minimum: water quality, macro-invertebrate integrity, toxicological testing and habitat suitability assessments.

It is highly recommended that ongoing monitoring of the instream integrity in the vicinity of the Blyvoor Gold Mine continue so as to identify any emerging trends in terms of improvements or degradations in the ecological integrity and functioning of these systems, with special relevance to maintenance of biodiversity. It is advisable that the same assessor be utilised for ongoing monitoring purposes so as to minimise fluctuations and irregularities in the results as a result of variations in sampling times and efficiency.

12 Conclusion

There are 300.38 ha of wetlands within the Blyvoor project area, consisting of two channelled valley bottom systems and one unchannelled valley bottom system. These systems have been exposed to a variety of impacts, with PES categorisations ranging from ‘Moderately Modified’ (Category C), to ‘Seriously Modified’ (Category E). These are based on modifications to the geomorphology, hydrology and vegetation structures of this system. EIS has been categorised with ratings ranging from ‘High’ to ‘Moderate’ as these systems are still able to provide various services.

In terms of aquatic instream integrity of the freshwater systems present, the macro-invertebrate assemblages collected within the study area each exhibited seriously modified conditions (i.e. Ecological Category E) in relation to the reference conditions expected for streams of this nature in the Highveld Ecoregion. The applied MIRAI indices suggested that the primary driver of change at site BVG1 was related to poor habitat availability, while at site BVG4, the macro-invertebrate assemblage was influenced by impacts to habitat availability and compounded by further impacts to water quality. At sites BVG2 and BVG3, the key driver of change is likely related to impacts to water quality, the sources of which require confirmation. It should be noted, however, that historical data provides an indication that these systems are likely limited in diversity and function within the greater catchment as a result of various anthropogenic activities including but not limited to; dams, water abstraction activities, agriculture and livestock farming as well as mining.

The freshwater systems have historically been impacted on directly (0.7 ha of freshwater systems have been directly affected at 5 shaft), as well as indirectly through dust pollution and additional impacts related to soil disturbances and clearing of vegetation amongst others. Further impacts through the continuation of mining at Blyvoor Gold Mine are anticipated, however these impacts can be reduced through appropriate mitigation measures. Furthermore, it is anticipated that resumed mining activities at Blyvoor Gold may serve to reduce the level of artisanal mining currently taking place within HGM Unit 3.

It is important to note that while Blyvoor Gold currently holds the Mining Rights to the entire project area, the surface land areas are currently owned/leased by various parties, including

other mining entities, which are currently engaged in mining activities of their own. There is thus some overlap in terms of the mitigation and management measures deemed necessary to prevent further impacts to an already degraded receiving environment, with special mention of management of the TSF facilities present on the project area, as well as the anticipated decant associated with the proposed project and dust control.

Although Blyvoor Gold mining activities are anticipated to directly affect only a small portion of the wetland and instream aquatic integrity of the systems observed at the time of the assessment, some indirect impacts are deemed possible and it is highly recommended that ongoing monitoring of the instream integrity in the vicinity of the Blyvoor Gold Mine continue. This will identify any emerging trends in terms of improvements or degradations in the ecological integrity and functioning of these systems as Blyvoor Gold is ultimately responsible for the Mining Rights Area on which these systems occur.

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Appendix A: Expected Birds for QDS 2627AD

QDGC	Common Name	Taxon Name
2627AD	Ostrich, Common	*Struthio camelus*
2627AD	Grebe, Great Crested	*Podiceps cristatus*
2627AD	Grebe, Little	*Tachybaptus ruficollis*
2627AD	Cormorant, White-breasted	*Phalacrocorax carbo*
2627AD	Cormorant, Reed	*Phalacrocorax africanus*
2627AD	Darter, African	*Anhinga rufa*
2627AD	Heron, Grey	*Ardea cinerea*
2627AD	Heron, Black-headed	*Ardea melanocephala*
2627AD	Heron, Goliath	*Ardea goliath*
2627AD	Heron, Purple	*Ardea purpurea*
2627AD	Egret, Great	*Egretta alba*
2627AD	Egret, Little	*Egretta garzetta*
2627AD	Egret, Yellow-billed	*Egretta intermedia*
2627AD	Egret, Cattle	*Bubulcus ibis*
2627AD	Heron, Squacco	*Ardeola ralloides*
2627AD	Heron, Green-backed	*Butorides striata*
2627AD	Heron, Black	*Egretta ardesiaca*
2627AD	Bittern, Little	*Ixobrychus minutus*
2627AD	Night-Heron, Black-crowned	*Nycticorax nycticorax*
2627AD	Hamerkop, Hamerkop	*Scopus umbretta*
2627AD	Stork, Yellow-billed	*Mycteria ibis*
2627AD	Stork, Abdim's	*Ciconia abdimii*
2627AD	Stork, White	*Ciconia ciconia*
2627AD	Ibis, African Sacred	*Threskiornis aethiopicus*
2627AD	Ibis, Glossy	*Plegadis falcinellus*
2627AD	Ibis, Hadeda	*Bostrychia hagedash*
2627AD	Spoonbill, African	*Platalea alba*
2627AD	Flamingo, Greater	*Phoenicopterus ruber*
2627AD	Flamingo, Lesser	*Phoenicopterus minor*
2627AD	Goose, Spur-winged	*Plectropterus gambensis*
2627AD	Goose, Egyptian	*Alopochen aegyptiacus*

QDGC	Common Name	Taxon Name
2627AD	Shelduck, South African	*Tadorna cana*
2627AD	Duck, Knob-billed	*Sarkidiornis melanotos*
2627AD	Shoveler, Cape	*Anas smithii*
2627AD	Duck, African Black	*Anas sparsa*
2627AD	Duck, Yellow-billed	*Anas undulata*
2627AD	Teal, Red-billed	*Anas erythrorhyncha*
2627AD	Teal, Cape	*Anas capensis*
2627AD	Teal, Hottentot	*Anas hottentota*
2627AD	Duck, White-faced	*Dendrocygna viduata*
2627AD	Duck, Fulvous	*Dendrocygna bicolor*
2627AD	Pochard, Southern	*Netta erythrophthalma*
2627AD	Duck, Maccoa	*Oxyura maccoa*
2627AD	Secretarybird, Secretarybird	*Sagittarius serpentarius*
2627AD	Vulture, Cape	*Gyps coprotheres*
2627AD	Vulture, White-backed	*Gyps africanus*
2627AD	Falcon, Lanner	*Falco biarmicus*
2627AD	Falcon, Amur	*Falco amurensis*
2627AD	Falcon, Red-footed	*Falco vespertinus*
2627AD	Kestrel, Greater	*Falco rupicoloides*
2627AD	Kestrel, Rock	*Falco rupicolus*
2627AD	Kestrel, Lesser	*Falco naumanni*
2627AD	Hawk, African Cuckoo	*Aviceda cuculoides*
2627AD	Kite, Yellow-billed	*Milvus aegyptius*
2627AD	Kite, Black-shouldered	*Elanus caeruleus*
2627AD	Honey-buzzard, European	*Pernis apivorus*
2627AD	Eagle, Verreaux's	*Aquila verreauxii*
2627AD	Snake-eagle, Black-chested	*Circaetus pectoralis*
2627AD	Fish-eagle, African	*Haliaeetus vocifer*
2627AD	Buzzard, Jackal	*Buteo rufofuscus*
2627AD	Buzzard, Steppe	*Buteo vulpinus*
2627AD	Sparrowhawk, Ovambo	*Accipiter ovampensis*

QDGC	Common Name	Taxon Name
2627AD	Sparrowhawk, Little	*Accipiter minullus*
2627AD	Sparrowhawk, Black	*Accipiter melanoleucus*
2627AD	Goshawk, Gabar	*Melierax gabar*
2627AD	Goshawk, Southern Pale Chanting	*Melierax canorus*
2627AD	Marsh-harrier, African	*Circus ranivorus*
2627AD	Harrier, Montagu's	*Circus pygargus*
2627AD	Harrier-Hawk, African	*Polyboroides typus*
2627AD	Osprey, Osprey	*Pandion haliaetus*
2627AD	Francolin, Coqui	*Peliperdix coqui*
2627AD	Francolin, Orange River	*Scleroptila levaillantoides*
2627AD	Spurfowl, Natal	*Pternistis natalensis*
2627AD	Spurfowl, Swainson's	*Pternistis swainsonii*
2627AD	Quail, Common	*Coturnix coturnix*
2627AD	Guineafowl, Helmeted	*Numida meleagris*
2627AD	Buttonquail, Kurrichane	*Turnix sylvaticus*
2627AD	Rail, African	*Rallus caerulescens*
2627AD	Crake, African	*Crecopsis egregia*
2627AD	Crake, Black	*Amaurornis flavirostris*
2627AD	Flufftail, Red-chested	*Sarothrura rufa*
2627AD	Swamphen, African Purple	*Porphyrio madagascariensis*
2627AD	Moorhen, Common	*Gallinula chloropus*
2627AD	Coot, Red-knobbed	*Fulica cristata*
2627AD	Jacana, African	*Actophilornis africanus*
2627AD	Plover, Common Ringed	*Charadrius hiaticula*
2627AD	Plover, Kittlitz's	*Charadrius pecuarius*
2627AD	Plover, Three-banded	*Charadrius tricollaris*
2627AD	Lapwing, Crowned	*Vanellus coronatus*
2627AD	Lapwing, Blacksmith	*Vanellus armatus*
2627AD	Lapwing, African Wattled	*Vanellus senegallus*
2627AD	Snipe, African	*Gallinago nigripennis*
2627AD	Sandpiper, Curlew	*Calidris ferruginea*

QDGC	Common Name	Taxon Name
2627AD	Stint, Little	*Calidris minuta*
2627AD	Ruff, Ruff	*Philomachus pugnax*
2627AD	Sandpiper, Common	*Actitis hypoleucos*
2627AD	Sandpiper, Marsh	*Tringa stagnatilis*
2627AD	Greenshank, Common	*Tringa nebularia*
2627AD	Sandpiper, Wood	*Tringa glareola*
2627AD	Avocet, Pied	*Recurvirostra avosetta*
2627AD	Stilt, Black-winged	*Himantopus himantopus*
2627AD	Thick-knee, Spotted	*Burhinus capensis*
2627AD	Courser, Temminck's	*Cursorius temminckii*
2627AD	Pratincole, Black-winged	*Glareola nordmanni*
2627AD	Gull, Grey-headed	*Larus cirrocephalus*
2627AD	Tern, Caspian	*Sterna caspia*
2627AD	Tern, White-winged	*Chlidonias leucopterus*
2627AD	Tern, Whiskered	*Chlidonias hybrida*
2627AD	Sandgrouse, Namaqua	*Pterocles namaqua*
2627AD	Pigeon, Speckled	*Columba guinea*
2627AD	Olive-pigeon, African	*Columba arquatrix*
2627AD	Dove, Red-eyed	*Streptopelia semitorquata*
2627AD	Turtle-dove, Cape	*Streptopelia capicola*
2627AD	Dove, Laughing	*Streptopelia senegalensis*
2627AD	Dove, Namaqua	*Oena capensis*
2627AD	Green-pigeon, African	*Treron calvus*
2627AD	Go-away-bird, Grey	*Corythaixoides concolor*
2627AD	Cuckoo, Red-chested	*Cuculus solitarius*
2627AD	Cuckoo, Black	*Cuculus clamosus*
2627AD	Cuckoo, Great Spotted	*Clamator glandarius*
2627AD	Cuckoo, Jacobin	*Clamator jacobinus*
2627AD	Cuckoo, Klaas's	*Chrysococcyx klaas*
2627AD	Cuckoo, Diderick	*Chrysococcyx caprius*
2627AD	Owl, Barn	*Tyto alba*

QDGC	Common Name	Taxon Name
2627AD	Grass-owl, African	*Tyto capensis*
2627AD	Owl, Marsh	*Asio capensis*
2627AD	Eagle-owl, Spotted	*Bubo africanus*
2627AD	Nightjar, Rufous-cheeked	*Caprimulgus rufigena*
2627AD	Nightjar, Fiery-necked	*Caprimulgus pectoralis*
2627AD	Swift, Common	*Apus apus*
2627AD	Swift, African Black	*Apus barbatus*
2627AD	Swift, White-rumped	*Apus caffer*
2627AD	Swift, Horus	*Apus horus*
2627AD	Swift, Little	*Apus affinis*
2627AD	Swift, Alpine	*Tachymarptis melba*
2627AD	Palm-swift, African	*Cypsiurus parvus*
2627AD	Mousebird, Speckled	*Colius striatus*
2627AD	Mousebird, White-backed	*Colius colius*
2627AD	Mousebird, Red-faced	*Urocolius indicus*
2627AD	Kingfisher, Pied	*Ceryle rudis*
2627AD	Kingfisher, Giant	*Megaceryle maximus*
2627AD	Kingfisher, Half-collared	*Alcedo semitorquata*
2627AD	Kingfisher, Malachite	*Alcedo cristata*
2627AD	Kingfisher, Brown-hooded	*Halcyon albiventris*
2627AD	Bee-eater, European	*Merops apiaster*
2627AD	Bee-eater, White-fronted	*Merops bullockoides*
2627AD	Bee-eater, Little	*Merops pusillus*
2627AD	Bee-eater, Swallow-tailed	*Merops hirundineus*
2627AD	Hoopoe, African	*Upupa africana*
2627AD	Wood-hoopoe, Green	*Phoeniculus purpureus*
2627AD	Scimitarbill, Common	*Rhinopomastus cyanomelas*
2627AD	Hornbill, African Grey	*Tockus nasutus*
2627AD	Barbet, Black-collared	*Lybius torquatus*
2627AD	Barbet, Acacia Pied	*Tricholaema leucomelas*
2627AD	Barbet, Crested	*Trachyphonus vaillantii*

QDGC	Common Name	Taxon Name
2627AD	Honeyguide, Greater	*Indicator indicator*
2627AD	Honeyguide, Lesser	*Indicator minor*
2627AD	Honeybird, Brown-backed	*Prodotiscus regulus*
2627AD	Woodpecker, Golden-tailed	*Campethera abingoni*
2627AD	Woodpecker, Cardinal	*Dendropicos fuscescens*
2627AD	Wryneck, Red-throated	*Jynx ruficollis*
2627AD	Lark, Melodious	*Mirafra cheniana*
2627AD	Lark, Rufous-naped	*Mirafra africana*
2627AD	Lark, Sabota	*Calendulauda sabota*
2627AD	Lark, Spike-heeled	*Chersomanes albofasciata*
2627AD	Sparrowlark, Chestnut-backed	*Eremopterix leucotis*
2627AD	Lark, Red-capped	*Calandrella cinerea*
2627AD	Lark, Pink-billed	*Spizocorys conirostris*
2627AD	Swallow, Barn	*Hirundo rustica*
2627AD	Swallow, White-throated	*Hirundo albigularis*
2627AD	Swallow, Pearl-breasted	*Hirundo dimidiata*
2627AD	Swallow, Red-breasted	*Hirundo semirufa*
2627AD	Swallow, Greater Striped	*Hirundo cucullata*
2627AD	Swallow, Lesser Striped	*Hirundo abyssinica*
2627AD	Cliff-swallow, South African	*Hirundo spilodera*
2627AD	Martin, Rock	*Hirundo fuligula*
2627AD	House-martin, Common	*Delichon urbicum*
2627AD	Martin, Sand	*Riparia riparia*
2627AD	Martin, Brown-throated	*Riparia paludicola*
2627AD	Martin, Banded	*Riparia cincta*
2627AD	Tit, Ashy	*Parus cinerascens*
2627AD	Oriole, Black-headed	*Oriolus larvatus*
2627AD	Crow, Pied	*Corvus albus*
2627AD	Babbler, Arrow-marked	*Turdoides jardineii*
2627AD	Babbler, Southern Pied	*Turdoides bicolor*
2627AD	Bulbul, African Red-eyed	*Pycnonotus nigricans*

QDGC	Common Name	Taxon Name
2627AD	Bulbul, Dark-capped	*Pycnonotus tricolor*
2627AD	Thrush, Kurrichane	*Turdus libonyanus*
2627AD	Thrush, Groundscraper	*Psophocichla litsipsirupa*
2627AD	Rock-thrush, Short-toed	*Monticola brevipes*
2627AD	Wheatear, Mountain	*Oenanthe monticola*
2627AD	Wheatear, Capped	*Oenanthe pileata*
2627AD	Chat, Familiar	*Cercomela familiaris*
2627AD	Cliff-chat, Mocking	*Thamnolaea cinnamomeiventris*
2627AD	Chat, Anteating	*Myrmecocichla formicivora*
2627AD	Stonechat, African	*Saxicola torquatus*
2627AD	Robin-chat, Cape	*Cossypha caffra*
2627AD	Robin-chat, White-throated	*Cossypha humeralis*
2627AD	Scrub-robin, Kalahari	*Cercotrichas paena*
2627AD	Whitethroat, Common	*Sylvia communis*
2627AD	Warbler, Garden	*Sylvia borin*
2627AD	Warbler, Icterine	*Hippolais icterina*
2627AD	Warbler, Willow	*Phylloscopus trochilus*
2627AD	Eremomela, Yellow-bellied	*Eremomela icteropygialis*
2627AD	Reed-warbler, Great	*Acrocephalus arundinaceus*
2627AD	Swamp-warbler, Lesser	*Acrocephalus gracilirostris*
2627AD	Reed-warbler, African	*Acrocephalus baeticatus*
2627AD	Warbler, Marsh	*Acrocephalus palustris*
2627AD	Warbler, Sedge	*Acrocephalus schoenobaenus*
2627AD	Rush-warbler, Little	*Bradypterus baboecala*
2627AD	Grassbird, Cape	*Sphenoeacus afer*
2627AD	Crombec, Long-billed	*Sylvietta rufescens*
2627AD	Apalis, Bar-throated	*Apalis thoracica*
2627AD	Cisticola, Zitting	*Cisticola juncidis*
2627AD	Cisticola, Desert	*Cisticola aridulus*
2627AD	Cisticola, Cloud	*Cisticola textrix*
2627AD	Cisticola, Wing-snapping	*Cisticola ayresii*

QDGC	Common Name	Taxon Name
2627AD	Neddicky, Neddicky	*Cisticola fulvicapilla*
2627AD	Cisticola, Wailing	*Cisticola lais*
2627AD	Cisticola, Rattling	*Cisticola chiniana*
2627AD	Cisticola, Levaillant's	*Cisticola tinniens*
2627AD	Cisticola, Lazy	*Cisticola aberrans*
2627AD	Prinia, Tawny-flanked	*Prinia subflava*
2627AD	Prinia, Black-chested	*Prinia flavicans*
2627AD	Flycatcher, Spotted	*Muscicapa striata*
2627AD	Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*
2627AD	Flycatcher, Marico	*Bradornis mariquensis*
2627AD	Flycatcher, Fiscal	*Sigelus silens*
2627AD	Warbler, Dark-capped Yellow	*Chloropeta natalensis*
2627AD	Batis, Chinspot	*Batis molitor*
2627AD	Flycatcher, Fairy	*Stenostira scita*
2627AD	Paradise-flycatcher, African	*Terpsiphone viridis*
2627AD	Wagtail, Cape	*Motacilla capensis*
2627AD	Wagtail, Yellow	*Motacilla flava*
2627AD	Pipit, African	*Anthus cinnamomeus*
2627AD	Pipit, Long-billed	*Anthus similis*
2627AD	Pipit, Plain-backed	*Anthus leucophrys*
2627AD	Pipit, Buffy	*Anthus vaalensis*
2627AD	Pipit, Striped	*Anthus lineiventris*
2627AD	Longclaw, Cape	*Macronyx capensis*
2627AD	Shrike, Lesser Grey	*Lanius minor*
2627AD	Fiscal, Common (Southern)	*Lanius collaris*
2627AD	Shrike, Red-backed	*Lanius collurio*
2627AD	Boubou, Southern	*Laniarius ferrugineus*
2627AD	Shrike, Crimson-breasted	*Laniarius atrococcineus*
2627AD	Puffback, Black-backed	*Dryoscopus cubla*
2627AD	Tchagra, Brown-crowned	*Tchagra australis*
2627AD	Tchagra, Black-crowned	*Tchagra senegalus*

QDGC	Common Name	Taxon Name
2627AD	Bokmakierie, Bokmakierie	*Telophorus zeylonus*
2627AD	Bush-shrike, Grey-headed	*Malaconotus blanchoti*
2627AD	Brubru, Brubru	*Nilaus afer*
2627AD	Myna, Common	*Acridotheres tristis*
2627AD	Starling, Wattled	*Creatophora cinerea*
2627AD	Starling, Violet-backed	*Cinnyricinclus leucogaster*
2627AD	Starling, Cape Glossy	*Lamprotornis nitens*
2627AD	Starling, Red-winged	*Onychognathus morio*
2627AD	Starling, Pied	*Spreo bicolor*
2627AD	Sunbird, Malachite	*Nectarinia famosa*
2627AD	Sunbird, Marico	*Cinnyris mariquensis*
2627AD	Sunbird, Greater Double-collared	*Cinnyris afer*
2627AD	Sunbird, White-bellied	*Cinnyris talatala*
2627AD	Sunbird, Amethyst	*Chalcomitra amethystina*
2627AD	Sparrow-weaver, White-browed	*Plocepasser mahali*
2627AD	Sparrow, House	*Passer domesticus*
2627AD	Sparrow, Cape	*Passer melanurus*
2627AD	Petronia, Yellow-throated	*Petronia superciliaris*
2627AD	Finch, Scaly-feathered	*Sporopipes squamifrons*
2627AD	Weaver, Village	*Ploceus cucullatus*
2627AD	Weaver, Cape	*Ploceus capensis*
2627AD	Masked-weaver, Southern	*Ploceus velatus*
2627AD	Weaver, Thick-billed	*Amblyospiza albifrons*
2627AD	Quelea, Red-billed	*Quelea quelea*
2627AD	Bishop, Southern Red	*Euplectes orix*
2627AD	Bishop, Yellow-crowned	*Euplectes afer*
2627AD	Widowbird, Red-collared	*Euplectes ardens*
2627AD	Widowbird, White-winged	*Euplectes albonotatus*
2627AD	Widowbird, Long-tailed	*Euplectes progne*
2627AD	Finch, Red-headed	*Amadina erythrocephala*
2627AD	Finch, Cut-throat	*Amadina fasciata*

QDGC	Common Name	Taxon Name
2627AD	Mannikin, Bronze	*Spermestes cucullatus*
2627AD	Pytilia, Green-winged	*Pytilia melba*
2627AD	Firefinch, African	*Lagonosticta rubricata*
2627AD	Firefinch, Jameson's	*Lagonosticta rhodopareia*
2627AD	Firefinch, Red-billed	*Lagonosticta senegala*
2627AD	Waxbill, Orange-breasted	*Amandava subflava*
2627AD	Waxbill, Blue	*Uraeginthus angolensis*
2627AD	Waxbill, Violet-eared	*Granatina granatina*
2627AD	Waxbill, Black-faced	*Estrilda erythronotos*
2627AD	Waxbill, Common	*Estrilda astrild*
2627AD	Quailfinch, African	*Ortygospiza atricollis*
2627AD	Whydah, Pin-tailed	*Vidua macroura*
2627AD	Whydah, Shaft-tailed	*Vidua regia*
2627AD	Indigobird, Dusky	*Vidua funerea*
2627AD	Indigobird, Purple	*Vidua purpurascens*
2627AD	Indigobird, Village	*Vidua chalybeata*
2627AD	Paradise-whydah, Long-tailed	*Vidua paradisaea*
2627AD	Finch, Cuckoo	*Anomalospiza imberbis*
2627AD	Canary, Yellow-fronted	*Crithagra mozambicus*
2627AD	Canary, Black-throated	*Crithagra atrogularis*
2627AD	Canary, Yellow	*Crithagra flaviventris*
2627AD	Seedeater, Streaky-headed	*Crithagra gularis*
2627AD	Bunting, Lark-like	*Emberiza impetuani*
2627AD	Bunting, Cinnamon-breasted	*Emberiza tahapisi*
2627AD	Bunting, Cape	*Emberiza capensis*
2627AD	Bunting, Golden-breasted	*Emberiza flaviventris*
2627AD	Dove, Rock	*Columba livia*
2627AD	Parakeet, Rose-ringed	*Psittacula krameri*
2627AD	Duck, Mallard	*Anas platyrhynchos*
2627AD	Peacock, Common	*Pavo cristatus*
2627AD	Korhaan, Northern Black	*Afrotis afraoides*

QDGC	Common Name	Taxon Name
2627AD	Thrush, Karoo	*Turdus smithi*
2627AD	White-eye, Orange River	*Zosterops pallidus*
2627AD	White-eye, Cape	*Zosterops virens*
2627AD	Lark, Eastern Clapper	*Mirafra fasciolata*
2627AD	Pochard, Red-crested	*Netta rufina*
2627AD	Coucal, Burchell's	*Centropus burchellii*
2627AD	Lark, Cape Clapper	*Mirafra apiata*
2627AD	Sparrow, Southern Grey-headed	*Passer diffusus*
2627AD	Goose, Domestic	*Anser anser*

Appendix B: Expected Plant Species

Family	Species	Threat status
ACANTHACEAE	*Barleria macrostegia Nees*	LC
ACANTHACEAE	*Barleria pretoriensis C.B.Clarke*	LC
ACANTHACEAE	*Blepharis angusta (Nees) T.Anderson*	LC
ACANTHACEAE	*Blepharis innocua C.B.Clarke*	LC
ACANTHACEAE	*Blepharis squarrosa (Nees) T.Anderson*	LC
ACANTHACEAE	*Blepharis stainbankiae C.B.Clarke*	LC
ACANTHACEAE	*Chaetacanthus costatus Nees*	LC
ACANTHACEAE	*Crabbea acaulis N.E.Br.*	LC
ACANTHACEAE	*Crabbea angustifolia Nees*	LC
ACANTHACEAE	*Crabbea hirsuta Harv.*	LC
ACANTHACEAE	*Justicia anagalloides (Nees) T.Anderson*	LC
ACHARIACEAE	*Kiggelaria africana L.*	LC
AMARANTHACEAE	*Achyranthes aspera L. var. aspera*	Not Evaluated
AMARANTHACEAE	*Aerva leucura Moq.*	LC
AMARANTHACEAE	*Alternanthera pungens Kunth*	Not Evaluated
AMARANTHACEAE	*Amaranthus hybridus L. subsp. hybridus var. hybridus*	Not Evaluated
AMARANTHACEAE	*Amaranthus thunbergii Moq.*	LC
AMARANTHACEAE	*Cyathula uncinulata (Schrad.) Schinz*	LC
AMARANTHACEAE	*Gomphrena celosioides Mart.*	Not Evaluated
AMARANTHACEAE	*Guilleminea densa (Willd. ex Roem. & Schult.) Moq.*	Not Evaluated
AMARANTHACEAE	*Kyphocarpa angustifolia (Moq.) Lopr.*	LC
AMARYLLIDACEAE	*Ammocharis coranica (Ker Gawl.) Herb.*	LC
AMARYLLIDACEAE	***Boophone disticha (L.f.) Herb.***	**Declining**
AMARYLLIDACEAE	*Haemanthus montanus Baker*	LC
AMARYLLIDACEAE	*Nerine laticoma (Ker Gawl.) T.Durand & Schinz*	LC

Family	Species	Threat status
AMARYLLIDACEAE	*Scadoxus puniceus (L.) Friis & Nordal*	LC
ANACARDIACEAE	*Searsia discolor (E.Mey. ex Sond.) Moffett*	LC
ANACARDIACEAE	*Searsia magalismontana (Sond.) Moffett subsp. magalismontana*	LC
ANACARDIACEAE	*Searsia pyroides (Burch.) Moffett var. gracilis (Engl.) Moffett*	LC
ANACARDIACEAE	*Searsia pyroides (Burch.) Moffett var. integrifolia (Engl.) Moffett*	LC
ANACARDIACEAE	*Searsia pyroides (Burch.) Moffett var. pyroides*	LC
ANACARDIACEAE	*Searsia rigida (Mill.) F.A.Barkley var. dentata (Engl.) Moffett*	LC
ANACARDIACEAE	*Searsia rigida (Mill.) F.A.Barkley var. margaretae (Burtt Davy ex Moffett) Moffett*	LC
ANTHERICACEAE	*Chlorophytum angulicaule (Baker) Kativu*	LC
ANTHERICACEAE	*Chlorophytum bowkeri Baker*	LC
ANTHERICACEAE	*Chlorophytum cooperi (Baker) Nordal*	LC
ANTHERICACEAE	*Chlorophytum transvaalense (Baker) Kativu*	LC
ANTHERICACEAE	*Chlorophytum trichophlebium (Baker) Nordal*	LC
APIACEAE	*Berula thunbergii (DC.) H.Wolff*	LC
APIACEAE	*Deverra burchellii (DC.) Eckl. & Zeyh.*	LC
APIACEAE	*Heteromorpha arborescens (Spreng.) Cham. & Schltdl. var. abyssinica (Hochst. ex A.Rich.) H.Wolff*	LC
APOCYNACEAE	*Ancylobotrys capensis (Oliv.) Pichon*	LC
APOCYNACEAE	*Araujia sericifera Brot.*	Not Evaluated
APOCYNACEAE	*Asclepias adscendens (Schltr.) Schltr.*	LC
APOCYNACEAE	*Asclepias eminens (Harv.) Schltr.*	LC
APOCYNACEAE	*Asclepias fallax (Schltr.) Schltr.*	LC

Family	Species	Threat status
APOCYNACEAE	*Asclepias meyeriana (Schltr.) Schltr.*	LC
APOCYNACEAE	*Aspidoglossum biflorum E.Mey.*	LC
APOCYNACEAE	*Aspidoglossum glabrescens (Schltr.) Kupicha*	LC
APOCYNACEAE	*Aspidoglossum interruptum (E.Mey.) Bullock*	LC
APOCYNACEAE	*Aspidoglossum ovalifolium (Schltr.) Kupicha*	LC
APOCYNACEAE	*Brachystelma chloranthum (Schltr.) Peckover*	LC
APOCYNACEAE	*Brachystelma circinatum E.Mey.*	LC
APOCYNACEAE	*Brachystelma oianthum Schltr.*	LC
APOCYNACEAE	*Ceropegia rendallii N.E.Br.*	LC
APOCYNACEAE	*Cryptolepis oblongifolia (Meisn.) Schltr.*	LC
APOCYNACEAE	*Gomphocarpus fruticosus (L.) Aiton f. subsp. fruticosus*	LC
APOCYNACEAE	*Gomphocarpus rivularis Schltr.*	LC
APOCYNACEAE	*Orbea lutea (N.E.Br.) Bruyns subsp. lutea*	LC
APOCYNACEAE	*Orthanthera jasminiflora (Decne.) Schinz*	LC
APOCYNACEAE	*Pentarrhinum insipidum E.Mey.*	LC
APOCYNACEAE	*Raphionacme hirsuta (E.Mey.) R.A.Dyer*	LC
APOCYNACEAE	*Raphionacme velutina Schltr.*	LC
APOCYNACEAE	*Riocreuxia polyantha Schltr.*	LC
AQUIFOLIACEAE	***Ilex mitis (L.) Radlk. var. mitis***	**Declining**
ARALIACEAE	*Cussonia paniculata Eckl. & Zeyh. subsp. paniculata*	LC
ARALIACEAE	*Cussonia paniculata Eckl. & Zeyh. subsp. sinuata (Reyneke & Kok) De Winter*	LC
ASPARAGACEAE	*Asparagus asparagoides (L.) Druce*	LC

Family	Species	Threat status
ASPARAGACEAE	*Asparagus laricinus Burch.*	LC
ASPHODELACEAE	*Aloe verecunda Pole-Evans*	LC
ASPHODELACEAE	*Aloe zebrina Baker*	LC
ASPHODELACEAE	*Bulbine abyssinica A.Rich.*	LC
ASPHODELACEAE	*Bulbine capitata Poelln.*	LC
ASPHODELACEAE	*Bulbine narcissifolia Salm-Dyck*	LC
ASPHODELACEAE	*Chortolirion angolense (Baker) A.Berger*	LC
ASPHODELACEAE	*Kniphofia porphyrantha Baker*	LC
ASPHODELACEAE	*Trachyandra saltii (Baker) Oberm. var. saltii*	LC
ASPLENIACEAE	*Asplenium aethiopicum (Burm.f.) Bech.*	LC
ASPLENIACEAE	*Asplenium cordatum (Thunb.) Sw.*	LC
ASTERACEAE	*Acanthospermum glabratum (DC.) Wild*	Not Evaluated
ASTERACEAE	*Artemisia afra Jacq. ex Willd. var. afra*	LC
ASTERACEAE	*Aster squamatus (Spreng.) Hieron.*	Not Evaluated
ASTERACEAE	*Berkheya radula (Harv.) De Wild.*	LC
ASTERACEAE	*Berkheya zeyheri Oliv. & Hiern subsp. zeyheri*	LC
ASTERACEAE	*Bidens bipinnata L.*	Not Evaluated
ASTERACEAE	*Bidens pilosa L.*	Not Evaluated
ASTERACEAE	*Chrysocoma ciliata L.*	LC
ASTERACEAE	*Cineraria albicans N.E.Br.*	LC
ASTERACEAE	*Cirsium vulgare (Savi) Ten.*	Not Evaluated
ASTERACEAE	*Conyza bonariensis (L.) Cronquist*	Not Evaluated
ASTERACEAE	*Conyza canadensis (L.) Cronquist*	Not Evaluated
ASTERACEAE	*Conyza podocephala DC.*	LC
ASTERACEAE	*Dicoma anomala Sond. subsp. anomala*	LC

Family	Species	Threat status
ASTERACEAE	*Dicoma anomala Sond. subsp. gerrardii (Harv. ex F.C.Wilson) S.Ortíz & Rodr.Oubiña*	LC
ASTERACEAE	*Dicoma macrocephala DC.*	LC
ASTERACEAE	*Dimorphotheca spectabilis Schltr.*	LC
ASTERACEAE	*Eclipta prostrata (L.) L.*	Not Evaluated
ASTERACEAE	*Galinsoga parviflora Cav.*	Not Evaluated
ASTERACEAE	*Gazania krebsiana Less. subsp. serrulata (DC.) Roessler*	LC
ASTERACEAE	*Geigeria burkei Harv. subsp. burkei var. burkei*	LC
ASTERACEAE	*Gerbera piloselloides (L.) Cass.*	LC
ASTERACEAE	*Helichrysum aureum (Houtt.) Merr. var. monocephalum (DC.) Hilliard*	LC
ASTERACEAE	*Helichrysum caespititium (DC.) Harv.*	LC
ASTERACEAE	*Helichrysum callicomum Harv.*	LC
ASTERACEAE	*Helichrysum cerastioides DC. var. cerastioides*	LC
ASTERACEAE	*Helichrysum chionosphaerum DC.*	LC
ASTERACEAE	*Helichrysum dregeanum Sond. & Harv.*	LC
ASTERACEAE	*Helichrysum lepidissimum S.Moore*	LC
ASTERACEAE	*Helichrysum nudifolium (L.) Less. var. nudifolium*	LC
ASTERACEAE	*Helichrysum paronychioides DC.*	LC
ASTERACEAE	*Helichrysum rugulosum Less.*	LC
ASTERACEAE	*Helichrysum setosum Harv.*	LC
ASTERACEAE	*Hilliardiella aristata (DC.) H.Rob.*	LC
ASTERACEAE	*Hypochaeris brasiliensis (Less.) Griseb.*	Not Evaluated
ASTERACEAE	*Lactuca serriola L.*	Not Evaluated

Family	Species	Threat status
ASTERACEAE	*Launaea rarifolia (Oliv. & Hiern) Boulos var. rarifolia*	LC
ASTERACEAE	*Lopholaena coriifolia (Sond.) E.Phillips & C.A.Sm.*	LC
ASTERACEAE	*Nidorella hottentotica DC.*	LC
ASTERACEAE	*Nidorella hottentotica DC.*	LC
ASTERACEAE	*Nidorella resedifolia DC. subsp. resedifolia*	LC
ASTERACEAE	*Osteospermum muricatum E.Mey. ex DC. subsp. muricatum*	LC
ASTERACEAE	*Pseudognaphalium oligandrum (DC.) Hilliard & B.L.Burtt*	LC
ASTERACEAE	*Schkuhria pinnata (Lam.) Kuntze ex Thell.*	Not Evaluated
ASTERACEAE	*Senecio affinis DC.*	LC
ASTERACEAE	*Senecio burchellii DC.*	LC
ASTERACEAE	*Senecio coronatus (Thunb.) Harv.*	LC
ASTERACEAE	*Senecio erubescens Aiton var. crepidifolius DC.*	LC
ASTERACEAE	*Senecio hieracioides DC.*	LC
ASTERACEAE	*Senecio inornatus DC.*	LC
ASTERACEAE	*Senecio oxyriifolius DC. subsp. oxyriifolius*	LC
ASTERACEAE	*Senecio venosus Harv.*	LC
ASTERACEAE	*Sonchus dregeanus DC.*	LC
ASTERACEAE	*Sonchus oleraceus L.*	Not Evaluated
ASTERACEAE	*Tagetes minuta L.*	Not Evaluated
ASTERACEAE	*Taraxacum brunneum Soest*	Not Evaluated
ASTERACEAE	*Tarchonanthus camphoratus L.*	LC
ASTERACEAE	*Tolpis capensis (L.) Sch.Bip.*	LC
ASTERACEAE	*Tragopogon dubius Scop.*	Not Evaluated
ASTERACEAE	*Tripteris aghillana DC. var. aghillana*	LC

Family	Species	Threat status
ASTERACEAE	*Ursinia nana DC. subsp. leptophylla Prassler*	LC
ASTERACEAE	*Vernonia galpinii Klatt*	LC
ASTERACEAE	*Xanthium spinosum L.*	Not Evaluated
ASTERACEAE	*Xanthium strumarium L.*	Not Evaluated
ASTERACEAE	*Zinnia peruviana (L.) L.*	Not Evaluated
BASELLACEAE	*Anredera cordifolia (Ten.) Steenis*	Not Evaluated
BORAGINACEAE	*Cynoglossum lanceolatum Forssk.*	LC
BORAGINACEAE	*Ehretia rigida (Thunb.) Druce subsp. nervifolia Retief & A.E.van Wyk*	LC
BORAGINACEAE	*Lappula heteracantha Ledeb.*	Not Evaluated
BORAGINACEAE	*Lithospermum cinereum A.DC.*	LC
BRASSICACEAE	*Diplotaxis muralis (L.) DC.*	Not Evaluated
BRASSICACEAE	*Lepidium africanum (Burm.f.) DC. subsp. africanum*	LC
BRASSICACEAE	*Raphanus raphanistrum L.*	Not Evaluated
BRASSICACEAE	*Sisymbrium turczaninowii Sond.*	LC
BUDDLEJACEAE	*Buddleja saligna Willd.*	LC
CAMPANULACEAE	*Wahlenbergia denticulata (Burch.) A.DC. var. transvaalensis (Adamson) W.G.Welman*	LC
CAMPANULACEAE	*Wahlenbergia undulata (L.f.) A.DC.*	LC
CAPPARACEAE	*Cleome maculata (Sond.) Szyszyl.*	LC
CAPPARACEAE	*Maerua cafra (DC.) Pax*	LC
CARYOPHYLLACEAE	*Dianthus mooiensis F.N.Williams subsp. mooiensis var. mooiensis*	Not Evaluated
CARYOPHYLLACEAE	*Pollichia campestris Aiton*	LC
CELASTRACEAE	*Gymnosporia buxifolia (L.) Szyszyl.*	LC
CELASTRACEAE	*Gymnosporia polyacanthus (Sond.) Szyszyl. subsp. vaccinifolia (P.Conrath) M.Jordaan*	LC
CELTIDACEAE	*Celtis africana Burm.f.*	LC

Family	Species	Threat status
CHENOPODIACEAE	*Chenopodium album L.*	Not Evaluated
CHENOPODIACEAE	*Chenopodium ambrosioides L.*	Not Evaluated
CHENOPODIACEAE	*Chenopodium carinatum R.Br.*	Not Evaluated
CHENOPODIACEAE	*Chenopodium multifidum L.*	Not Evaluated
CHENOPODIACEAE	*Einadia nutans (R.Br.) A.J.Scott subsp. nutans*	Not Evaluated
CHRYSOBALANACEAE	*Parinari capensis Harv. subsp. capensis*	LC
COMMELINACEAE	*Commelina africana L. var. barberae (C.B.Clarke) C.B.Clarke*	LC
COMMELINACEAE	*Commelina africana L. var. lancispatha C.B.Clarke*	LC
COMMELINACEAE	*Commelina benghalensis L.*	LC
COMMELINACEAE	*Commelina livingstonii C.B.Clarke*	LC
COMMELINACEAE	*Cyanotis speciosa (L.f.) Hassk.*	LC
CONVOLVULACEAE	*Convolvulus multifidus Thunb.*	LC
CONVOLVULACEAE	*Convolvulus sagittatus Thunb.*	LC
CONVOLVULACEAE	*Cuscuta campestris Yunck.*	Not Evaluated
CONVOLVULACEAE	*Falkia oblonga Bernh. ex C.Krauss*	LC
CONVOLVULACEAE	*Ipomoea bathycolpos Hallier f.*	LC
CONVOLVULACEAE	*Ipomoea crassipes Hook. var. crassipes*	LC
CONVOLVULACEAE	*Ipomoea oblongata E.Mey. ex Choisy*	LC
CONVOLVULACEAE	*Ipomoea obscura (L.) Ker Gawl. var. obscura*	LC
CONVOLVULACEAE	*Ipomoea ommanneyi Rendle*	LC
CONVOLVULACEAE	*Ipomoea purpurea (L.) Roth*	Not Evaluated
CONVOLVULACEAE	*Xenostegia tridentata (L.) D.F.Austin & Staples subsp. angustifolia (Jacq.) Lejoly & Lisowski*	LC
CRASSULACEAE	***Adromischus umbraticola C.A.Sm. subsp. umbraticola***	**NT**
CRASSULACEAE	*Crassula dependens Bolus*	LC

Family	Species	Threat status
CRASSULACEAE	*Crassula lanceolata (Eckl. & Zeyh.) Endl. ex Walp. subsp. transvaalensis (Kuntze) Toelken*	LC
CRASSULACEAE	*Crassula setulosa Harv. var. setulosa forma setulosa*	Not Evaluated
CUCURBITACEAE	*Acanthosicyos naudinianus (Sond.) C.Jeffrey*	LC
CUCURBITACEAE	*Citrullus lanatus (Thunb.) Matsum. & Nakai*	LC
CUCURBITACEAE	*Coccinia sessilifolia (Sond.) Cogn.*	LC
CUCURBITACEAE	*Cucumis heptadactylus Naudin*	LC
CUCURBITACEAE	*Cucumis hirsutus Sond.*	LC
CUCURBITACEAE	*Cucumis zeyheri Sond.*	LC
CUCURBITACEAE	*Kedrostis africana (L.) Cogn.*	LC
CUCURBITACEAE	*Momordica balsamina L.*	LC
CUCURBITACEAE	*Peponium mackenii (Naudin) Engl.*	LC
CYPERACEAE	*Abildgaardia ovata (Burm.f.) Kral*	LC
CYPERACEAE	*Ascolepis capensis (Kunth) Ridl.*	LC
CYPERACEAE	*Bulbostylis burchellii (Ficalho & Hiern) C.B.Clarke*	LC
CYPERACEAE	*Bulbostylis oritrephes (Ridl.) C.B.Clarke*	LC
CYPERACEAE	*Carex cognata Kunth*	LC
CYPERACEAE	*Carex glomerabilis V.I.Krecz.*	LC
CYPERACEAE	*Cladium mariscus (L.) Pohl subsp. jamaicense (Crantz) Kük.*	LC
CYPERACEAE	*Coleochloa setifera (Ridl.) Gilly*	LC
CYPERACEAE	*Cyperus capensis (Steud.) Endl.*	LC
CYPERACEAE	*Cyperus congestus Vahl*	LC
CYPERACEAE	*Cyperus esculentus L. var. esculentus*	LC
CYPERACEAE	*Cyperus longus L. var. tenuiflorus (Rottb.) Boeck.*	LC
CYPERACEAE	*Cyperus margaritaceus Vahl var. margaritaceus*	LC

Family	Species	Threat status
CYPERACEAE	*Cyperus semitrifidus Schrad.*	LC
CYPERACEAE	*Isolepis costata Hochst. ex A.Rich.*	LC
CYPERACEAE	*Kyllinga alba Nees*	LC
CYPERACEAE	*Kyllinga erecta Schumach. var. erecta*	LC
CYPERACEAE	*Pycreus mundii Nees*	LC
CYPERACEAE	*Rhynchospora brownii Roem. & Schult.*	LC
CYPERACEAE	*Schoenoplectus brachyceras (Hochst. ex A.Rich.) Lye*	LC
CYPERACEAE	*Schoenoplectus corymbosus (Roth ex Roem. & Schult.) J.Raynal*	LC
CYPERACEAE	*Schoenoplectus tabernaemontani (C.C.Gmel.) Palla*	Not Evaluated
CYPERACEAE	*Scirpoides burkei (C.B.Clarke) Goetgh., Muasya & D.A.Simpson*	LC
CYPERACEAE	*Scirpoides dioeca (Kunth) Browning*	LC
DIPSACACEAE	*Cephalaria zeyheriana Szabó*	LC
DIPSACACEAE	*Scabiosa columbaria L.*	LC
EBENACEAE	*Diospyros lycioides Desf. subsp. guerkei (Kuntze) De Winter*	LC
EBENACEAE	*Diospyros whyteana (Hiern) F.White*	LC
EBENACEAE	*Euclea crispa (Thunb.) Gürke subsp. crispa*	LC
ERICACEAE	*Erica alopecurus Harv. var. alopecurus*	LC
ERIOSPERMACEAE	*Eriospermum cooperi Baker var. cooperi*	LC
EUPHORBIACEAE	*Acalypha angustata Sond.*	LC
EUPHORBIACEAE	*Acalypha caperonioides Baill. var. caperonioides*	DDT
EUPHORBIACEAE	*Clutia pulchella L. var. pulchella*	LC

Family	Species	Threat status
EUPHORBIACEAE	*Euphorbia rhombifolia Boiss.*	LC
EXORMOTHECACEAE	*Exormotheca pustulosa Mitt.*	
FABACEAE	*Acacia karroo Hayne*	LC
FABACEAE	*Acacia mearnsii De Wild.*	Not Evaluated
FABACEAE	*Acacia permixta Burtt Davy*	LC
FABACEAE	*Chamaecrista biensis (Steyaert) Lock*	LC
FABACEAE	*Chamaecrista comosa E.Mey. var. capricornia (Steyaert) Lock*	LC
FABACEAE	*Dichilus lebeckioides DC.*	LC
FABACEAE	*Elephantorrhiza elephantina (Burch.) Skeels*	LC
FABACEAE	*Eriosema burkei Benth. ex Harv. var. burkei*	LC
FABACEAE	*Eriosema cordatum E.Mey.*	LC
FABACEAE	*Erythrina zeyheri Harv.*	LC
FABACEAE	*Indigastrum burkeanum (Benth. ex Harv.) Schrire*	LC
FABACEAE	*Indigofera confusa Prain & Baker f.*	LC
FABACEAE	*Indigofera cryptantha Benth. ex Harv. var. cryptantha*	LC
FABACEAE	*Indigofera hedyantha Eckl. & Zeyh.*	LC
FABACEAE	*Indigofera hilaris Eckl. & Zeyh. var. hilaris*	LC
FABACEAE	*Indigofera melanadenia Benth. ex Harv.*	LC
FABACEAE	*Indigofera oxytropis Benth. ex Harv.*	LC
FABACEAE	*Indigofera zeyheri Spreng. ex Eckl. & Zeyh.*	LC
FABACEAE	*Lotononis laxa Eckl. & Zeyh.*	LC
FABACEAE	*Medicago sativa L.*	Not Evaluated
FABACEAE	*Melilotus albus Medik.*	Not Evaluated
FABACEAE	*Melolobium microphyllum (L.f.) Eckl. & Zeyh.*	LC

Family	Species	Threat status
FABACEAE	*Mundulea sericea (Willd.) A.Chev. subsp. sericea*	LC
FABACEAE	*Pearsonia cajanifolia (Harv.) Polhill subsp. cajanifolia*	LC
FABACEAE	*Pearsonia sessilifolia (Harv.) Dummer subsp. sessilifolia*	LC
FABACEAE	*Pearsonia uniflora (Kensit) Polhill*	LC
FABACEAE	*Rhynchosia nervosa Benth. ex Harv. var. nervosa*	LC
FABACEAE	*Rhynchosia totta (Thunb.) DC. var. totta*	LC
FABACEAE	*Sphenostylis angustifolia Sond.*	LC
FABACEAE	*Tephrosia capensis (Jacq.) Pers. var. capensis*	LC
FABACEAE	*Tephrosia elongata E.Mey. var. elongata*	LC
FABACEAE	*Tephrosia semiglabra Sond.*	LC
FABACEAE	*Tylosema esculentum (Burch.) A.Schreib.*	LC
FABACEAE	*Vigna unguiculata (L.) Walp. subsp. stenophylla (Harv.) Maréchal, Mascherpa & Stainier*	LC
FABACEAE	*Vigna vexillata (L.) A.Rich. var. vexillata*	LC
FABACEAE	*Zornia milneana Mohlenbr.*	LC
GERANIACEAE	*Monsonia angustifolia E.Mey. ex A.Rich.*	LC
GERANIACEAE	*Monsonia burkeana Planch. ex Harv.*	LC
GERANIACEAE	*Pelargonium luridum (Andrews) Sweet*	LC
GUNNERACEAE	***Gunnera perpensa L.***	**Declining**
HYACINTHACEAE	*Dipcadi viride (L.) Moench*	LC
HYACINTHACEAE	***Drimia sanguinea (Schinz) Jessop***	**NT**
HYACINTHACEAE	*Drimiopsis burkei Baker subsp. burkei*	LC
HYACINTHACEAE	*Eucomis autumnalis (Mill.) Chitt. subsp. clavata (Baker) Reyneke*	Not Evaluated

Family	Species	Threat status
HYACINTHACEAE	*Ledebouria cooperi (Hook.f.) Jessop*	LC
HYACINTHACEAE	*Ledebouria luteola Jessop*	LC
HYACINTHACEAE	*Ledebouria marginata (Baker) Jessop*	LC
HYACINTHACEAE	*Ornithogalum tenuifolium F.Delaroche subsp. tenuifolium*	Not Evaluated
HYPERICACEAE	*Hypericum lalandii Choisy*	LC
HYPOXIDACEAE	*Hypoxis argentea Harv. ex Baker var. argentea*	LC
HYPOXIDACEAE	*Hypoxis interjecta Nel*	LC
HYPOXIDACEAE	*Hypoxis iridifolia Baker*	LC
HYPOXIDACEAE	*Hypoxis rigidula Baker var. rigidula*	LC
IRIDACEAE	*Babiana bainesii Baker*	LC
IRIDACEAE	*Gladiolus antholyzoides Baker*	LC
IRIDACEAE	*Gladiolus crassifolius Baker*	LC
IRIDACEAE	*Gladiolus elliotii Baker*	LC
IRIDACEAE	*Moraea pallida (Baker) Goldblatt*	LC
IRIDACEAE	*Tritonia nelsonii Baker*	LC
JUNCACEAE	*Juncus effusus L.*	LC
JUNCACEAE	*Juncus exsertus Buchenau*	LC
JUNCACEAE	*Juncus oxycarpus E.Mey. ex Kunth*	LC
LAMIACEAE	*Acrotome hispida Benth.*	LC
LAMIACEAE	*Leucas martinicensis (Jacq.) R.Br.*	LC
LAMIACEAE	*Mentha aquatica L.*	LC
LAMIACEAE	*Ocimum obovatum E.Mey. ex Benth. subsp. obovatum var. obovatum*	LC
LAMIACEAE	*Pycnostachys reticulata (E.Mey.) Benth.*	LC
LAMIACEAE	*Rotheca hirsuta (Hochst.) R.Fern.*	LC
LAMIACEAE	*Salvia stenophylla Burch. ex Benth.*	

Family	Species	Threat status
LAMIACEAE	*Stachys spathulata Burch. ex Benth.*	LC
LAMIACEAE	*Syncolostemon canescens (Gürke) D.F.Otieno*	LC
LAMIACEAE	*Teucrium trifidum Retz.*	LC
LOBELIACEAE	*Cyphia assimilis Sond.*	LC
LYTHRACEAE	*Nesaea cordata Hiern*	LC
MALVACEAE	*Abutilon austro-africanum Hochr.*	LC
MALVACEAE	*Corchorus asplenifolius Burch.*	LC
MALVACEAE	*Grewia flava DC.*	LC
MALVACEAE	*Grewia occidentalis L. var. occidentalis*	LC
MALVACEAE	*Hermannia cordata (E.Mey. ex E.Phillips) De Winter*	LC
MALVACEAE	*Hermannia depressa N.E.Br.*	LC
MALVACEAE	*Hermannia lancifolia Szyszyl.*	LC
MALVACEAE	*Hermannia tomentosa (Turcz.) Schinz ex Engl.*	LC
MALVACEAE	*Hibiscus aethiopicus L. var. ovatus Harv.*	LC
MALVACEAE	*Hibiscus calyphyllus Cav.*	LC
MALVACEAE	*Hibiscus microcarpus Garcke*	LC
MALVACEAE	*Hibiscus trionum L.*	
MALVACEAE	*Malva parviflora L. var. parviflora*	Not Evaluated
MALVACEAE	*Pavonia burchellii (DC.) R.A.Dyer*	LC
MALVACEAE	*Sida chrysantha Ulbr.*	LC
MALVACEAE	*Sida dregei Burtt Davy*	LC
MALVACEAE	*Triumfetta sonderi Ficalho & Hiern*	LC
MELIACEAE	*Melia azedarach L.*	Not Evaluated
MENISPERMACEAE	*Antizoma angustifolia (Burch.) Miers ex Harv.*	LC
MESEMBRYANTHEMACEAE	***Khadia beswickii (L.Bolus) N.E.Br.***	**VU**
MOLLUGINACEAE	*Limeum viscosum (J.Gay) Fenzl subsp. viscosum var. glomeratum (Eckl. & Zeyh.) Friedrich*	LC

Family	Species	Threat status
MOLLUGINACEAE	*Limeum viscosum (J.Gay) Fenzl subsp. viscosum var. kraussii Friedrich*	LC
MYROTHAMNACEAE	*Myrothamnus flabellifolius Welw.*	DDT
NYMPHAEACEAE	*Nymphaea nouchali Burm.f. var. caerulea (Savigny) Verdc.*	LC
OLEACEAE	*Menodora africana Hook.*	LC
OLEACEAE	*Olea europaea L. subsp. africana (Mill.) P.S.Green*	LC
ONAGRACEAE	*Oenothera rosea L'Hér. ex Aiton*	Not Evaluated
ONAGRACEAE	*Oenothera stricta Ledeb. ex Link subsp. stricta*	Not Evaluated
ONAGRACEAE	*Oenothera tetraptera Cav.*	Not Evaluated
OPHIOGLOSSACEAE	*Ophioglossum polyphyllum A.Braun var. polyphyllum*	LC
ORCHIDACEAE	*Bonatea antennifera Rolfe*	LC
ORCHIDACEAE	*Eulophia hians Spreng. var. hians*	LC
ORCHIDACEAE	*Eulophia leontoglossa Rchb.f.*	LC
ORCHIDACEAE	*Eulophia ovalis Lindl. var. ovalis*	LC
OROBANCHACEAE	*Graderia subintegra Mast.*	LC
OROBANCHACEAE	*Sopubia cana Harv. var. cana*	LC
OROBANCHACEAE	*Striga asiatica (L.) Kuntze*	LC
OROBANCHACEAE	*Striga elegans Benth.*	LC
OXALIDACEAE	*Oxalis corniculata L.*	Not Evaluated
PAPAVERACEAE	*Argemone ochroleuca Sweet subsp. ochroleuca*	Not Evaluated
PAPAVERACEAE	*Papaver aculeatum Thunb.*	LC
PHYLLANTHACEAE	*Phyllanthus incurvus Thunb.*	LC
PHYLLANTHACEAE	*Phyllanthus parvulus Sond. var. parvulus*	LC
PHYTOLACCACEAE	*Phytolacca octandra L.*	Not Evaluated
PITTOSPORACEAE	*Pittosporum viridiflorum Sims*	LC
PLANTAGINACEAE	*Plantago lanceolata L.*	LC

Family	Species	Threat status
PLANTAGINACEAE	*Plantago major L.*	
POACEAE	*Agrostis lachnantha Nees var. lachnantha*	LC
POACEAE	*Alloteropsis semialata (R.Br.) Hitchc. subsp. eckloniana (Nees) Gibbs Russ.*	LC
POACEAE	*Andropogon eucomus Nees*	LC
POACEAE	*Andropogon schirensis Hochst. ex A.Rich.*	LC
POACEAE	*Aristida aequiglumis Hack.*	LC
POACEAE	*Aristida canescens Henrard subsp. canescens*	LC
POACEAE	*Aristida congesta Roem. & Schult. subsp. congesta*	LC
POACEAE	*Aristida diffusa Trin. subsp. burkei (Stapf) Melderis*	LC
POACEAE	*Aristida stipitata Hack. subsp. graciliflora (Pilg.) Melderis*	LC
POACEAE	*Bewsia biflora (Hack.) Gooss.*	LC
POACEAE	*Brachiaria serrata (Thunb.) Stapf*	LC
POACEAE	*Bromus catharticus Vahl*	Not Evaluated
POACEAE	*Chloris pycnothrix Trin.*	LC
POACEAE	*Chloris virgata Sw.*	LC
POACEAE	*Cynodon dactylon (L.) Pers.*	LC
POACEAE	*Cynodon hirsutus Stent*	LC
POACEAE	*Digitaria eriantha Steud.*	LC
POACEAE	*Digitaria tricholaenoides Stapf*	LC
POACEAE	*Diheteropogon amplectens (Nees) Clayton var. amplectens*	LC
POACEAE	*Echinochloa colona (L.) Link*	LC
POACEAE	*Ehrharta erecta Lam. var. natalensis Stapf*	LC
POACEAE	*Elionurus muticus (Spreng.) Kunth*	LC
POACEAE	*Enneapogon scoparius Stapf*	LC
POACEAE	*Eragrostis biflora Hack. ex Schinz*	LC

Family	Species	Threat status
POACEAE	*Eragrostis capensis (Thunb.) Trin.*	LC
POACEAE	*Eragrostis chloromelas Steud.*	LC
POACEAE	*Eragrostis cilianensis (All.) Vignolo ex Janch.*	LC
POACEAE	*Eragrostis curvula (Schrad.) Nees*	LC
POACEAE	*Eragrostis gummiflua Nees*	LC
POACEAE	*Eragrostis obtusa Munro ex Ficalho & Hiern*	LC
POACEAE	*Eragrostis patentipilosa Hack.*	LC
POACEAE	*Eragrostis plana Nees*	LC
POACEAE	*Eragrostis racemosa (Thunb.) Steud.*	LC
POACEAE	*Eragrostis sclerantha Nees subsp. sclerantha*	LC
POACEAE	*Eragrostis superba Peyr.*	LC
POACEAE	*Eragrostis tef (Zuccagni) Trotter*	Not Evaluated
POACEAE	*Eragrostis trichophora Coss. & Durieu*	LC
POACEAE	*Eustachys paspaloides (Vahl) Lanza & Mattei*	LC
POACEAE	*Helictotrichon turgidulum (Stapf) Schweick.*	LC
POACEAE	*Heteropogon contortus (L.) Roem. & Schult.*	LC
POACEAE	*Hyparrhenia anamesa Clayton*	LC
POACEAE	*Hyparrhenia dregeana (Nees) Stapf ex Stent*	LC
POACEAE	*Hyparrhenia hirta (L.) Stapf*	LC
POACEAE	*Leersia hexandra Sw.*	LC
POACEAE	*Lolium multiflorum Lam.*	Not Evaluated
POACEAE	*Loudetia simplex (Nees) C.E.Hubb.*	LC
POACEAE	*Melinis nerviglumis (Franch.) Zizka*	LC
POACEAE	*Melinis repens (Willd.) Zizka subsp. repens*	LC
POACEAE	*Microchloa caffra Nees*	LC

Family	Species	Threat status
POACEAE	*Monocymbium ceresiiforme (Nees) Stapf*	LC
POACEAE	*Oropetium capense Stapf*	LC
POACEAE	*Panicum natalense Hochst.*	LC
POACEAE	*Panicum repens L.*	LC
POACEAE	*Panicum schinzii Hack.*	LC
POACEAE	*Paspalum dilatatum Poir.*	Not Evaluated
POACEAE	*Paspalum distichum L.*	LC
POACEAE	*Pennisetum thunbergii Kunth*	LC
POACEAE	*Perotis patens Gand.*	LC
POACEAE	*Phragmites australis (Cav.) Steud.*	LC
POACEAE	*Pogonarthria squarrosa (Roem. & Schult.) Pilg.*	LC
POACEAE	*Schizachyrium sanguineum (Retz.) Alston*	LC
POACEAE	*Setaria nigrirostris (Nees) T.Durand & Schinz*	LC
POACEAE	*Setaria pumila (Poir.) Roem. & Schult.*	LC
POACEAE	*Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. sphacelata*	LC
POACEAE	*Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. torta (Stapf) Clayton*	LC
POACEAE	*Setaria verticillata (L.) P.Beauv.*	LC
POACEAE	*Sporobolus congoensis Franch.*	LC
POACEAE	*Sporobolus discosporus Nees*	LC
POACEAE	*Sporobolus fimbriatus (Trin.) Nees*	LC
POACEAE	*Sporobolus stapfianus Gand.*	LC
POACEAE	*Themeda triandra Forssk.*	LC
POACEAE	*Trachypogon spicatus (L.f.) Kuntze*	LC
POACEAE	*Tragus berteronianus Schult.*	LC

Family	Species	Threat status
POACEAE	*Trichoneura grandiglumis (Nees) Ekman*	LC
POACEAE	*Triraphis andropogonoides (Steud.) E.Phillips*	LC
POACEAE	*Tristachya leucothrix Trin. ex Nees*	LC
POACEAE	*Tristachya rehmannii Hack.*	LC
POACEAE	*Urochloa panicoides P.Beauv.*	
POLYGALACEAE	*Polygala gracilenta Burtt Davy*	LC
POLYGALACEAE	*Polygala hottentotta C.Presl*	LC
POLYGALACEAE	*Polygala transvaalensis Chodat subsp. transvaalensis*	LC
POLYGALACEAE	*Polygala uncinata E.Mey. ex Meisn.*	LC
POLYGONACEAE	*Fallopia convolvulus (L.) Holub*	Not Evaluated
POLYGONACEAE	*Oxygonum dregeanum Meisn. subsp. canescens (Sond.) Germish. var. canescens*	LC
POLYGONACEAE	*Persicaria lapathifolia (L.) Gray*	Not Evaluated
POLYGONACEAE	*Polygonum aviculare L.*	Not Evaluated
POLYGONACEAE	*Rumex crispus L.*	Not Evaluated
POLYGONACEAE	*Rumex sagittatus Thunb.*	LC
PORTULACACEAE	*Anacampseros filamentosa (Haw.) Sims subsp. filamentosa*	LC
PORTULACACEAE	*Anacampseros subnuda Poelln. subsp. subnuda*	LC
PORTULACACEAE	*Portulaca quadrifida L.*	LC
PORTULACACEAE	*Talinum caffrum (Thunb.) Eckl. & Zeyh.*	LC
POTAMOGETONACEAE	*Potamogeton schweinfurthii A.Benn.*	LC
PROTEACEAE	*Protea caffra Meisn. subsp. caffra*	LC
PTERIDACEAE	*Pteris vittata L.*	LC
RANUNCULACEAE	*Clematis brachiata Thunb.*	LC
RHAMNACEAE	*Helinus integrifolius (Lam.) Kuntze*	LC
RHAMNACEAE	*Ziziphus mucronata Willd. subsp. mucronata*	LC

Family	Species	Threat status
RHAMNACEAE	*Ziziphus zeyheriana Sond.*	LC
RICCIACEAE	*Riccia albolimbata S.W.Arnell*	
RICCIACEAE	*Riccia atropurpurea Sim*	
RICCIACEAE	*Riccia okahandjana S.W.Arnell*	
ROSACEAE	*Agrimonia procera Wallr.*	LC
ROSACEAE	*Rubus rigidus Sm.*	LC
RUBIACEAE	*Anthospermum hispidulum E.Mey. ex Sond.*	LC
RUBIACEAE	*Anthospermum rigidum Eckl. & Zeyh. subsp. rigidum*	LC
RUBIACEAE	*Kohautia caespitosa Schnizl. subsp. brachyloba (Sond.) D.Mantell*	LC
RUBIACEAE	*Kohautia cynanchica DC.*	LC
RUBIACEAE	*Pachystigma pygmaeum (Schltr.) Robyns*	LC
RUBIACEAE	*Pavetta zeyheri Sond. subsp. zeyheri*	LC
RUBIACEAE	*Pentanisia angustifolia (Hochst.) Hochst.*	LC
RUBIACEAE	*Pygmaeothamnus chamaedendrum (Kuntze) Robyns var. chamaedendrum*	LC
RUBIACEAE	*Pygmaeothamnus zeyheri (Sond.) Robyns var. zeyheri*	LC
RUBIACEAE	*Richardia brasiliensis Gomes*	Not Evaluated
RUBIACEAE	*Rubia horrida (Thunb.) Puff*	LC
RUTACEAE	*Zanthoxylum capense (Thunb.) Harv.*	LC
SALICACEAE	*Dovyalis zeyheri (Sond.) Warb.*	LC
SALICACEAE	*Salix babylonica L. var. babylonica*	Not Evaluated
SANTALACEAE	*Osyris lanceolata Hochst. & Steud.*	LC
SANTALACEAE	*Thesium magalismontanum Sond.*	LC
SANTALACEAE	*Thesium procerum N.E.Br.*	LC
SANTALACEAE	*Thesium transvaalense Schltr.*	LC
SANTALACEAE	*Thesium utile A.W.Hill*	LC

Family	Species	Threat status
SCROPHULARIACEAE	*Chaenostoma leve (Hiern) Kornhall*	LC
SCROPHULARIACEAE	*Jamesbrittenia atropurpurea (Benth.) Hilliard subsp. atropurpurea*	LC
SCROPHULARIACEAE	*Limosella longiflora Kuntze*	LC
SCROPHULARIACEAE	*Limosella maior Diels*	LC
SCROPHULARIACEAE	*Manulea paniculata Benth.*	LC
SCROPHULARIACEAE	*Mimulus gracilis R.Br.*	LC
SCROPHULARIACEAE	*Nemesia fruticans (Thunb.) Benth.*	LC
SCROPHULARIACEAE	*Selago densiflora Rolfe*	LC
SCROPHULARIACEAE	*Zaluzianskya elongata Hilliard & B.L.Burtt*	LC
SCROPHULARIACEAE	*Zaluzianskya katharinae Hiern*	LC
SINOPTERIDACEAE	*Cheilanthes hirta Sw. var. hirta*	LC
SINOPTERIDACEAE	*Cheilanthes viridis (Forssk.) Sw. var. viridis*	LC
SINOPTERIDACEAE	*Pellaea calomelanos (Sw.) Link var. calomelanos*	LC
SOLANACEAE	*Cestrum laevigatum Schltdl.*	Not Evaluated
SOLANACEAE	*Datura ferox L.*	Not Evaluated
SOLANACEAE	*Datura stramonium L.*	Not Evaluated
SOLANACEAE	*Solanum lichtensteinii Willd.*	LC
SOLANACEAE	*Solanum nigrum L.*	Not Evaluated
SOLANACEAE	*Solanum pseudocapsicum L.*	Not Evaluated
SOLANACEAE	*Solanum retroflexum Dunal*	LC
SOLANACEAE	*Solanum sisymbriifolium Lam.*	Not Evaluated
SOLANACEAE	*Solanum supinum Dunal var. supinum*	LC
SOLANACEAE	*Solanum villosum Mill. subsp. villosum*	Not Evaluated
SOLANACEAE	*Withania somnifera (L.) Dunal*	LC
THYMELAEACEAE	*Gnidia burchellii (Meisn.) Gilg*	LC
THYMELAEACEAE	*Gnidia kraussiana Meisn. var. kraussiana*	LC
THYMELAEACEAE	*Gnidia sericocephala (Meisn.) Gilg ex Engl.*	LC
TYPHACEAE	*Typha capensis (Rohrb.) N.E.Br.*	LC

Family	Species	Threat status
URTICACEAE	*Didymodoxa caffra (Thunb.) Friis & Wilmot-Dear*	LC
VERBENACEAE	*Chascanum adenostachyum (Schauer) Moldenke*	LC
VERBENACEAE	*Chascanum pinnatifidum (L.f.) E.Mey. var. pinnatifidum*	LC
VERBENACEAE	*Lantana rugosa Thunb.*	LC
VERBENACEAE	*Lippia scaberrima Sond.*	LC
VERBENACEAE	*Priva meyeri Jaub. & Spach var. meyeri*	LC
VERBENACEAE	*Verbena bonariensis L.*	Not Evaluated
XYRIDACEAE	*Xyris capensis Thunb.*	LC
ZYGOPHYLLACEAE	*Tribulus terrestris L.*	LC