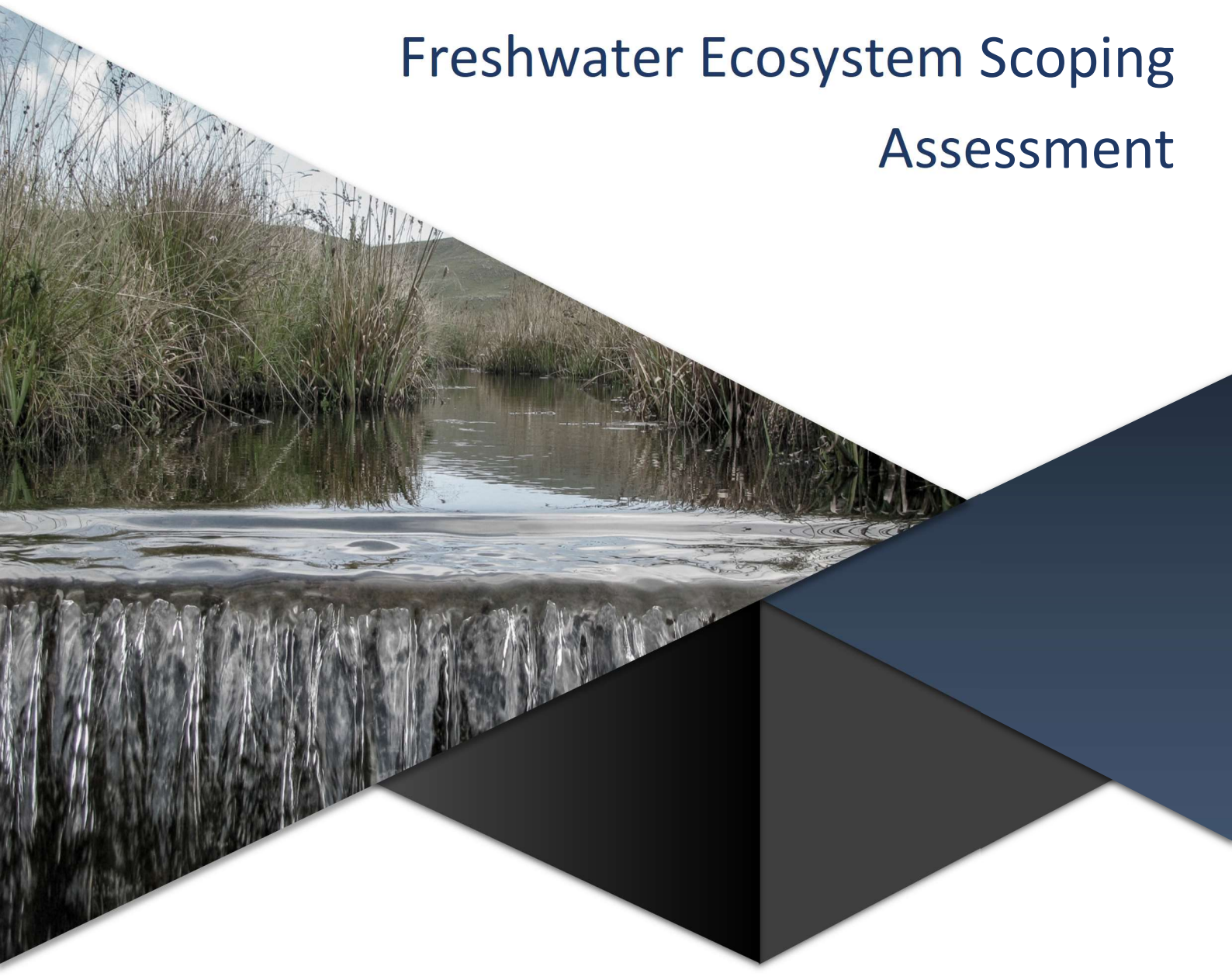
BCR COAL (PTY) LTD: VLAKFONTEIN COAL MINE

Freshwater Ecosystem Scoping Assessment



Land Matters
Environmental Consulting

Ecology International
Sustainability through Collaboration

BCR COAL (PTY) LTD: VLAKFONTEIN COAL MINE

Freshwater Ecosystem Scoping Assessment

Project Ref No. 220040

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I, **BYRON GRANT**, in my capacity as a specialist consultant, hereby declare that I -

- act as an independent consultant;
- will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- declare that there are no circumstances that may compromise my objectivity in performing such work;
- do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- based on information provided to me by the project proponent and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional ability;
- undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study for which I am registered; and
- as a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member.

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- do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
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- as a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member.

08 August 2022

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EXECUTIVE SUMMARY

Ecology International (Pty) Ltd and Land Matters Environmental Consulting (Pty) Ltd were appointed by Environmental Management Assistance (Pty) Ltd on behalf of BCR Coal (Pty) Ltd to to conduct a desktop freshwater ecosystem study for the proposed BCR Coal Vlakfontein Mine to inform the required Scoping Report (Phase 1) associated with the proposed establishment of the Vlakfontein Coal Mine. BCR Coal (Pty) Ltd is proposing the establishment of an open pit coal mining operation on Portion (Ptn) 2, Ptn 11 and Ptn 21 of farm Vlakfontein 108 IT and Ptn 1, 7, 14, and 12 of the farm Welgelegen 107 IT, within the Msukaligwa Municipality, Mpumalanga.

The outputs of the National Web Based Environmental Screening Tool site (Department of Forestry, Fisheries, and the Environment) screening tool indicated that the study site sensitivity is classified as 'very high' in terms of the aquatic biodiversity theme. The primary aim of Phase 1 of this assessment was therefore to confirm or dispute the site's current environmental sensitivity classification of 'very high' from an aquatic biodiversity perspective and provide a recommended plan of study for completion of the Environmental Impact Assessment phase (Phase 2).

Use was made of available literature and the latest spatial databases associated with the area of interest to identify threats and opportunities regarding freshwater ecosystem features relating to the proposed mining activities. These databases included (but were not limited to) the latest provincial conservation plan (the Mpumalanga Biodiversity Sector Plan), National Freshwater Ecosystem Priority Areas (NFEPA), Global Biodiversity Information Facility database, national and provincial freshwater ecosystem databases, as well as any other recent academic studies or national/provincial assessments associated with the area of interest.

The proposed BCR Coal Vlakfontein Mine is located within the Southern Temperate Highveld freshwater ecoregion. Aquatic biotas within this bioregion have mixed tropical and temperate affinities, sharing species between the Limpopo and Zambezi systems. The Southern Temperate Highveld freshwater ecoregion is considered to be bio-regionally outstanding in its biological distinctiveness and its conservation status is regarded as Endangered. Further to this the proposed BCR Coal Vlakfontein Mine falls within the Upper Vaal strategic water source area (SWSA). SWSAs are regarded as natural 'water factories', supporting growth and development needs that are often a far distance away. The Upper Vaal SWSA is considered to be a national priority.

The National Freshwater Ecosystem Priority Areas (NFEPA) spatial dataset was investigated. This is a dataset that aims to identify Freshwater Ecosystem Priority Areas (FEPAs) to meet national biodiversity goals for freshwater ecosystems; and develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers. Based on the outcomes of this dataset the proposed BCR Coal Vlakfontein Mine the majority (approximately 84 %) of the proposed BCR Coal Vlakfontein Mine study area falls within a catchment classified as a FEPA catchment. FEPA catchments achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species. The site is located within a FEPA catchment as a result of the likely use of the

area as a fish sanctuary for the Chubbyhead Barb and the Goldie Barb. The associated catchment further supports representative riverine and wetland ecosystem types and wetland clusters. The wetlands are classified as FEPA wetlands as they are located within a sub quaternary catchment that is often utilised by Wattled Cranes, Grey Crowned Cranes, and/or Blue Cranes. The wetlands furthermore have PES classifications of A/B (unmodified to largely natural).

An investigation of the Mining and Biodiversity Guidelines dataset revealed that the proposed BCR Coal Vlakfontein Mine falls within areas classified as being of 'high and highest biodiversity importance' as well as legally protected from mining, and thus posing the highest risk for the proposed activity from a biodiversity perspective. The 'highest biodiversity importance' category includes biodiversity priority areas where mining is not legally prohibited, but where there is a very high risk that due to their potential biodiversity significance and importance to ecosystem that mining projects will be significantly constrained or may not receive the necessary authorisations.

A further investigation of the Mpumalanga Biodiversity Sector Plan (MBSP) was undertaken. This is a comprehensive environmental inventory and spatial plan that is intended to guide conservation and land use decisions in support of sustainable development. According to the latest revision of the freshwater component of the MBSP the proposed BCR Coal Vlakfontein Mine footprint is classified as an Ecological Support Area (ESA) on the basis of wetlands and wetland clusters. ESAs are areas that are not essential for meeting biodiversity, targets, but that play an important role in supporting the functioning of protected areas or CBAs and for delivering ecosystem services

Watercourses directly associated with the study area include several unnamed tributaries of the upper reaches of the Vaal River. The reaches can be classified as having lower foothill characteristics, including a lower gradient mixed bed alluvial channel with sand and gravel dominating the bed. Reach types expected include pool-riffle or pool-rapid, and sand bars are also expected to be common in the pools. Of additional relevance is that the reach of the Vaal River associated with the proposed BCR Coal Vlakfontein Mine is classified within the latest National Biodiversity Assessment as being free flowing. Both of the identified watercourses are considered to be Critically Endangered and poorly protected. According to the Department of Water and Sanitation (2014), both the reach of the Vaal Rive immediately downstream of the proposed BCR Coal Vlakfontein Mine, as well as the Unnamed Tributary associated with the eastern extent of the MRA, are considered to be in a moderately modified ecological state (Ecological Category C). For the Vaal River reach, the ecological importance and the ecological sensitivity are estimated to be 'moderate' and 'high', respectively, while those of the Unnamed Tributary are both estimated to be 'moderate'.

In order to delineate wetland systems within the proposed BCR Coal Vlakfontein Mine site, the NFEPA wetland map, the National Wetland Map 5 (NWM5) and the Mpumalanga Highveld Wetlands database were examined. The NWM5 database revealed similar findings to the NFEPA database and a number of wetlands were delineated at a desktop level. These are classified as seep wetlands, floodplain wetlands, channelled valley bottom wetlands and depressions. All wetland features associated with the proposed BCR Coal Vlakfontein Mine footprint are classified within the latest National Biodiversity Assessment as Critically Endangered, poorly protected or not protected at all,

and at high risk to loss, with only the associated depressional (pan) systems being classified as Least Concern and at a moderate risk to loss(Van Deventer et al., 2019). The Mpumalanga Highveld Wetlands database furthermore revealed similar results, with all of the water resources within the study area classified as wetland systems. These are classified as channelled valley bottom wetlands, floodplain wetland systems, seeps and depressions.

Based on the identification of wetland systems utilising the available wetland mapping databases, a further investigation of historic and current aerial imagery for the site was undertaken. The results of this aerial imagery investigation were combined with the results from the wetland mapping databases and utilised to delineate all wetlands within the proposed BCR Coal Vlakfontein Mine study area.

The wetlands were then classified and separated into hydrogeomorphic (HGM) units. The wetlands were classified as 14 separate HGM units and these include channelled valley bottom, unchannelled valley bottom, seep and depression wetlands. The HGM units were assessed with regards to their health according to the Wet-Health methodology. A level 1B assessment (desktop scale) was conducted, with the results of this assessment being utilised to gain a general understanding of the health and condition of the wetlands within the BCR Coal Vlakfontein Mine area. Level 1B assessments take into consideration existing land cover data, as well as an examination of historic and current aerial imagery of the HGM unit and its associated catchment. A number of impacts were identified on the wetland systems. These impacts pertain largely to the use of the area for agricultural activities, including cultivation, the construction of numerous dams, and the construction of dirt roads to access cultivated fields. However, additional impacts within the catchments included the N17 road, which passes through the study area, the Mooifontein Coal Mine and low-density rural housing. The impacts described above were noted on a small-scale through the investigation of the aerial imagery of the site. The wetland systems as a whole appear to be intact and functional. All HGM units were therefore categorised as Largely Natural (Ecological Category B), or Moderately Modified (Ecological Category C).

A further investigation was conducted on the presence of aquatic faunal species potentially associated with the proposed BCR Coal Vlakfontein Mine site. One Mollusc, two Odonata, and two Fish species were identified.

The proposed BCR Coal Vlakfontein Mine will involve both the operations of the open-cast coal mine as well as the development of associated infrastructure. The entire site as well as neighbouring sites will be impacted by the activities of the mine. Potential impacts to the freshwater ecosystems within the site as well as downstream of the site are associated with (i) the direct loss of wetland features; (ii) erosion and sedimentation of wetlands and watercourses (iii) water quality deterioration, (iv) loss of biodiversity, and (v) encroachment of alien invasive plant species.

Following the freshwater ecosystem desktop assessment of the proposed BCR Coal Vlakfontein Mine, the site has been confirmed as being located within an area that has a very high sensitivity for aquatic biodiversity. Given the verified ‘very high’ classification of the proposed mining site for aquatic biodiversity, phase 2 of the assessment must include a full Aquatic Biodiversity Specialist Assessment

as well as a full Wetland Impact Assessment. These assessments must include field investigations of the proposed BCR Coal Vlakfontein Mine site and adhere to the reporting requirements as per the Government Notice No. 320 published in the Government Gazette 43110.

Based solely on the outcomes of the thorough desktop assessment of the of the freshwater ecosystem assessment and in consideration of the associated freshwater ecosystem characteristics, it is the opinion of the authors that the mine is not supported from a freshwater ecosystem perspective. It must be noted that the opinion given in this report should be utilised as preliminary 'red flags' for the proposed activity within the site. The opinion of the authors could change depending on the outcomes of Phase 2 of the assessment, and in particular the findings of the field-based investigation. This information is not yet known and is thus a limitation to the reasoned opinion given. Furthermore, the opinion does not take into consideration any proposed mitigation measures or layout changes that could reduce to impact of the mining activities on the freshwater ecosystems identified, as feasibility of proposed mining extents are to be carefully considered based on the outcomes of the various desktop assessments conducted for the proposed project. Assessment of feasible alternatives will therefore be conducted as part of Phase 2 of the proposed plan of study.

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ACRONYMS

CBA	Critical Biodiversity Area
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
DD	Data Deficient
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EN	Endangered
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Area
IUCN	International Union for Conservation of Nature
LC	Least Concern
MBA	National Biodiversity Assessment
MPSP	Mpumalanga Biodiversity Sector Plan
NFEPA	National Freshwater Ecosystem Priority Areas project
NPAES	National Protected Area Expansion Strategy
NT	Near Threatened
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SWSA	Strategic Water Source Area
VU	Vulnerable
WMA	Water Management Area

1. INTRODUCTION

1.1 Project Description

BCR Coal (Pty) Ltd has proposed an open pit mining operation, hereafter referred to as the BCR Coal Vlakfontein Mine, on Portions 2, 11 and 21 of farm Vlakfontein 108 IT, and Portions 1, 7, 14, and 12 of farm Welgelegen 107 IT, in the Msukaligwa Municipality, Mpumalanga.

The surface sub-outcrop of the coal seams is planned to be mined using an advancing open pit mining method which allows for concurrent filling of the pit. The pit will be used to develop portals which will allow the remainder of the ore to be exploited using underground mining methods. The open pit planned is to apply a conventional opencast truck and shovel mining philosophy including the following steps:

- Removal of topsoil and storage thereof at a designated position;
- Removal of the overburden;
- Drilling and blasting to break the hard overburden;
- Dumping of waste in the pit behind the advancing face (where possible), with the remainder placed at the designated waste rock stockpile (separate from the topsoil);
- Drilling and blasting of the coal seams; and
- Loading and hauling of the ore for stockpiling at the Run-of-Mine (ROM) pad and for transport to the preferred Washing Plant.

The open pit mining philosophy is based on a contractor-operated operation. A production shift cycle operating nine (9) hours a day, six (6) days a week will be adopted. The open pit layout and the Life of Mine (LOM) schedule is presented in Figure 1.

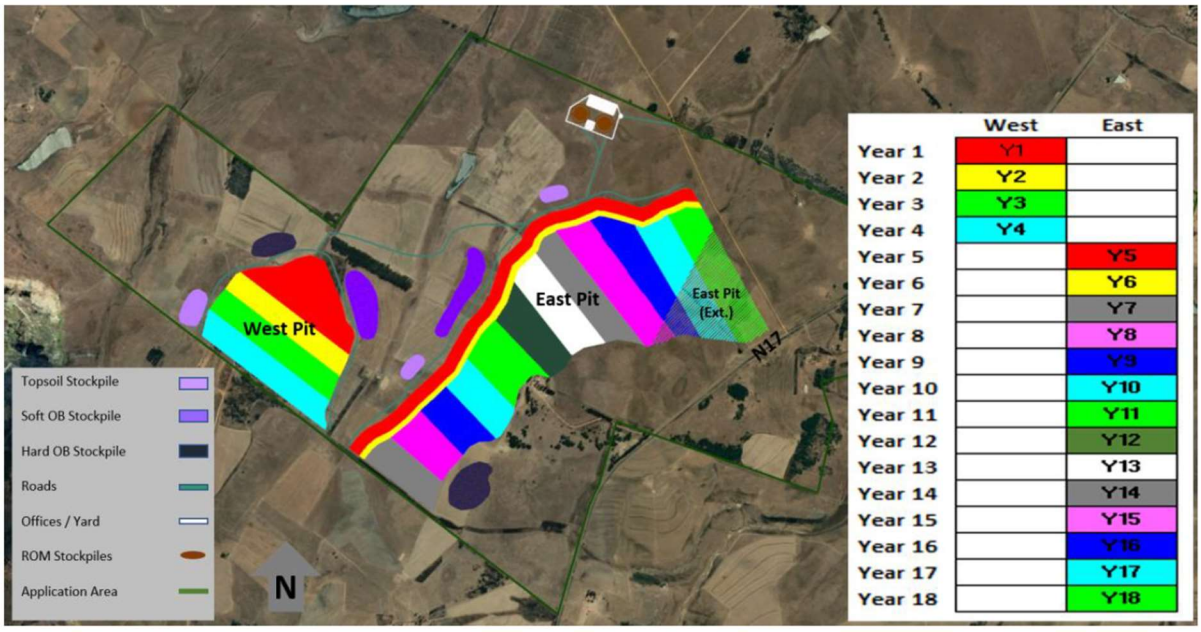

Figure 1: Open pit layout and the LOM schedule for the proposed BCR Coal Vlakfontein Mine

The project footprint will require support facilities and infrastructure in order to operate. The infrastructure requirements are:

- Access and haul roads (with necessary security), including the upgrading of the access point to mining area;
- Contractor's yard with septic/chemical ablution facilities;
- Offices;
- Weighbridge, workshop and stores (with septic/chemical ablution facilities);
- Diesel facilities and a hardstand;
- Power and water;
- Stockpiles (topsoil, overburden (waste), subsoil/softs, ROM);
- Crushing and screening facility;
- Surface water management measures (stormwater diversion berms and trenches; pollution control dams etc.);
- Medical station; and
- Diesel generator.

BCR Coal (Pty) Ltd appointed Environmental Management Assistance (Pty) Ltd (EMA) to facilitate the relevant environmental processes in support of the proposed mining activities. EMA subsequently appointed Ecology International (Pty) Ltd and Land Matters Environmental Consulting (Pty) Ltd to conduct a desktop freshwater ecosystem study for the proposed BCR Coal Vlakfontein Mine to inform the required Scoping Report (Phase 1).

The outputs of the National Web Based Environmental Screening Tool site (Department of Forestry, Fisheries, and the Environment) screening tool indicated that the study site sensitivity is classified as 'very high' in terms of the aquatic biodiversity theme (Figure 2). The primary aim of Phase 1 of this assessment was therefore to confirm or dispute the site's current environmental sensitivity classification of 'very high' from an aquatic biodiversity perspective and provide a recommended plan of study for completion of the Environmental Impact Assessment phase (Phase 2). This was undertaken according to the protocols for a specialist Aquatic Biodiversity Assessment as per Government Notice No. 320; Government Gazette No. 43110 of 2020.

1.2 Assumptions and Limitations

To inform the site sensitivity verification process, extensive use was made of available literature and the latest spatial databases associated with the area of interest to identify threats and opportunities regarding freshwater ecosystem features relating to the proposed mining activities. Such databases included (but were not limited to) the latest provincial conservation plan (the Mpumalanga Biodiversity Sector Plan), National Freshwater Ecosystem Priority Areas (NFEPA), Global Biodiversity Information Facility database, national and provincial freshwater ecosystem databases, as well as any other recent academic studies or national/provincial assessments associated with the area of interest. Available datasets and provisional mining plans were then used to conduct a high-level impact assessment to determine the potential for impacts on the associated freshwater ecosystems.

Given the desktop nature of the present study, the results presented relied upon the availability of desktop spatial information pertaining to the natural features associated with the study area and did not rely on site-based observations. The accuracy of the information presented is thus strongly dependant on the accuracy of the spatial datasets interrogated, as well as the interpretation of vegetation units as well as impacts to wetland systems from available aerial imagery.

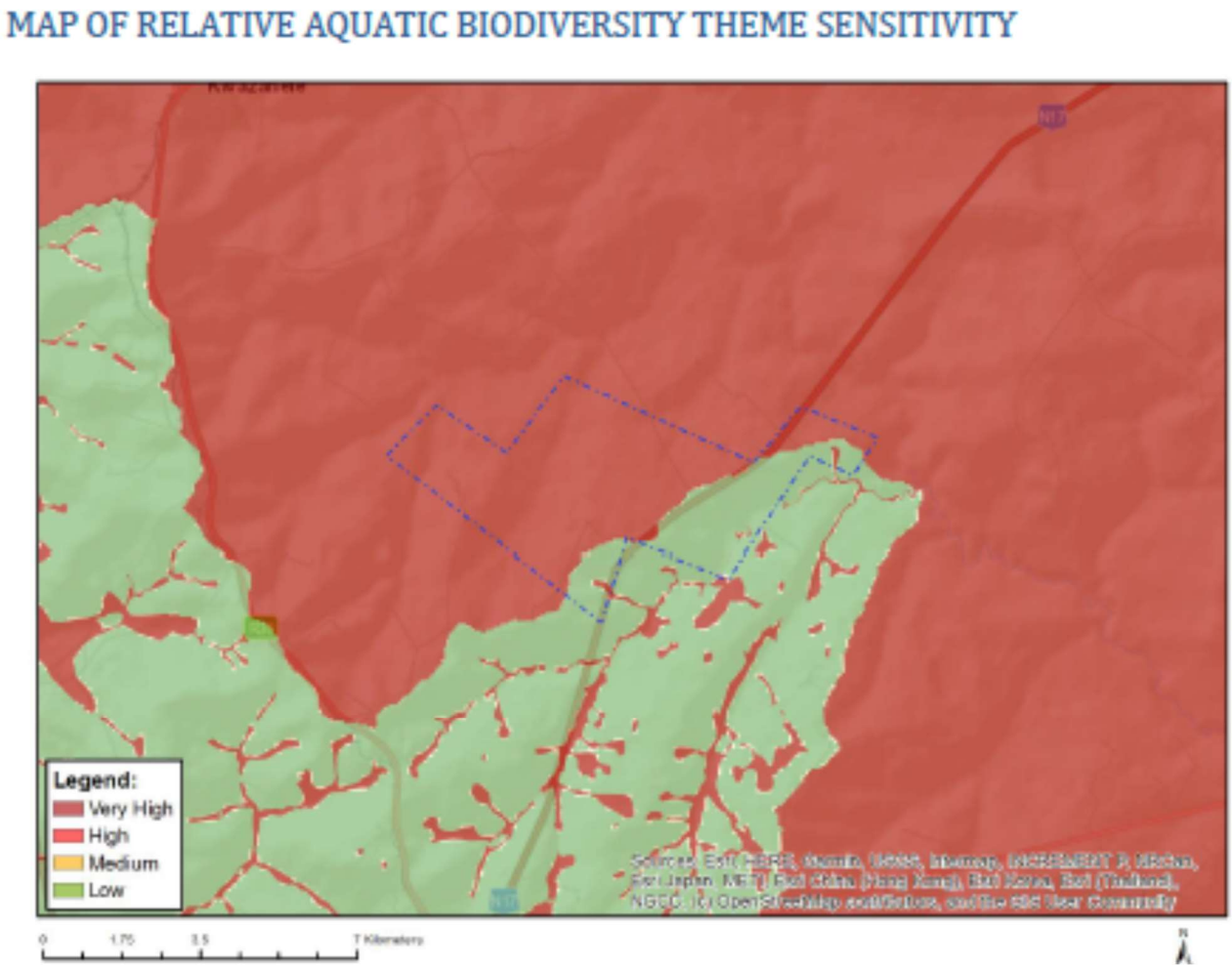

Figure 2: Aquatic biodiversity theme sensitivities identified (Department of Environmental Affairs, 2022)

2. PHYSICAL CHARACTERISTICS

2.1 Location

The proposed BCR Coal Vlakfontein Mine is located approximately 12 km south-east of the town of Breyten, approximately 20 km south-west of the town of Chrissiesmeer, and approximately 16 km north-east of the town of Ermelo, in the province of Mpumalanga. More specifically, the proposed mine is located on Portions 2, 11 and 21 of farm Vlakfontein 108 IT, and Portions 1, 7, 14, and 12 of farm Welgelegen 107 IT, in the Msukaligwa Municipality and encompasses an area of approximately 1,300 ha in extent (Figures 3 and 4).

2.2 Climate

The area is characterised with early- to mid-summer rainfall, receiving a mean annual rainfall of approximately 743 mm/annum. Mean annual temperatures within the area range from 12 °C to 18 °C, with potential evaporation of approximately 1,814 mm/annum and a mean annual surface runoff of approximately 62 mm/annum (Kleynhans et al., 2007; Macfarlane et al., 2008).

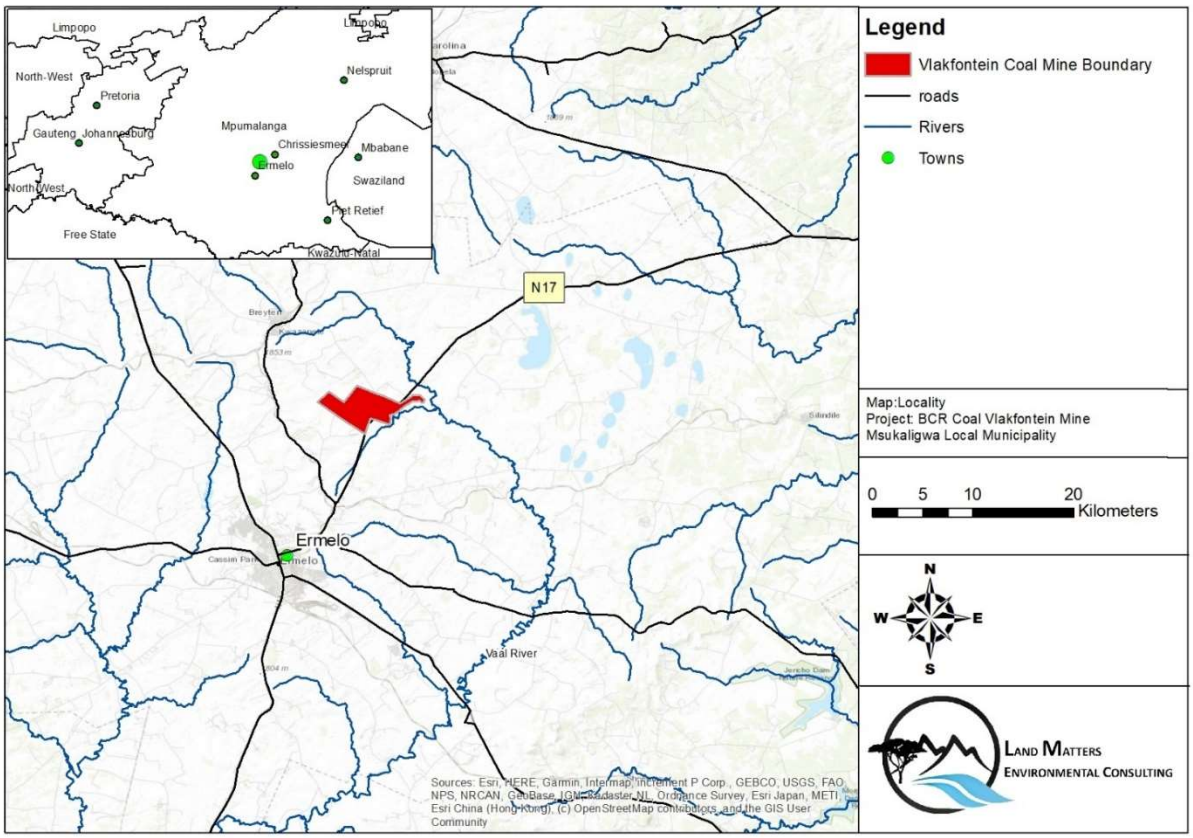

Figure 3: Locality of the proposed BCR Coal Vlakfontein Mine

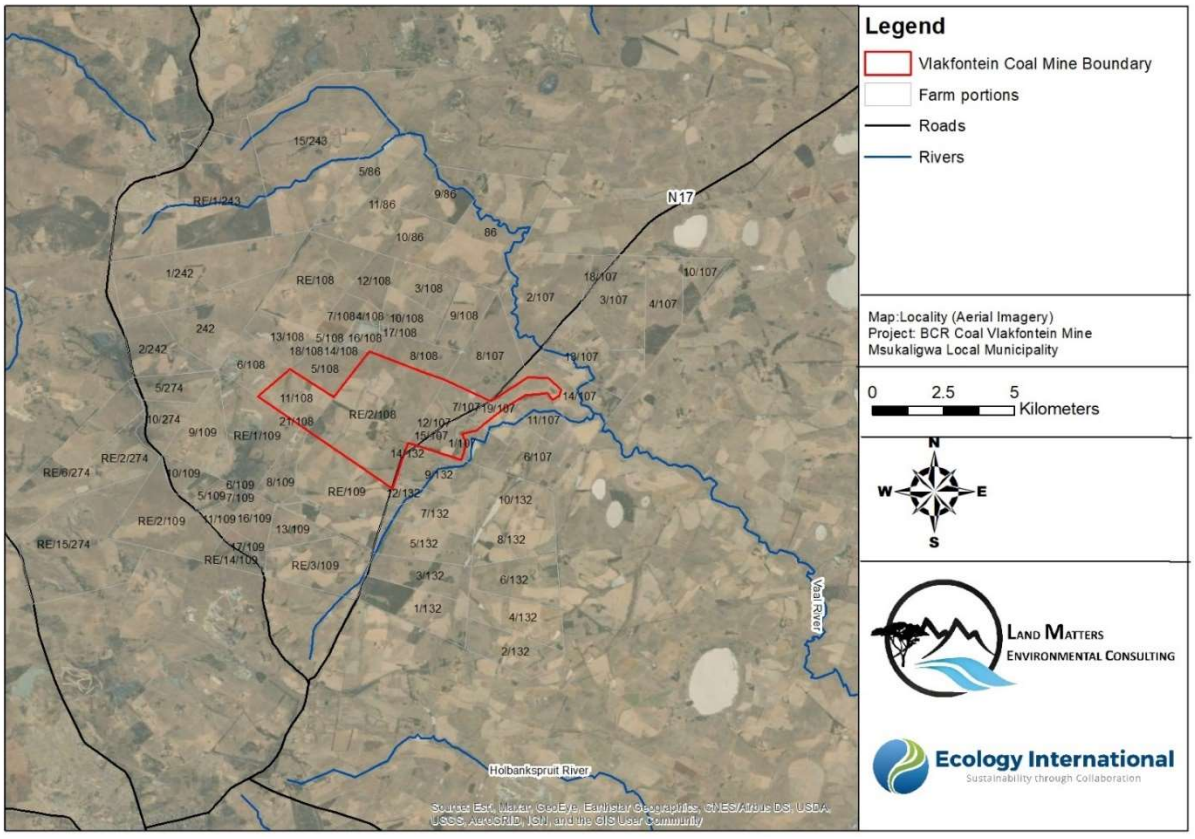

Figure 4: Aerial imagery of the proposed BCR Coal Vlakfontein Mine

2.3 Geology & Topography

Water resources in South Africa are the products of erosional and depositional processes, as well as the presence of geological influences controlled by the variable environment across the country. South Africa is a semi-arid country with differences in rainfall patterns, topography, and geology. The geological characteristic of an area influences the topography, soil types and textures, vegetation communities and faunal assemblages present. Geological features of the area are dominated by sedimentary rocks comprising shale and sandstone of the Vryheid Formation and Ermelo Sub-basin of the Karoo Supergroup.

The proposed BCR Coal Vlakfontein Mine is located within an area characterised by rolling hills which give rise to wetlands and watercourses. The study site ranges in altitude from approximately 1670 m above sea level in the north-eastern portion to 1760 m above sea level in the more southern and western portions (Figure 5). Slopes are generally gentle to moderate and range from 2 % to 10 %, with averages of 2.5 %.

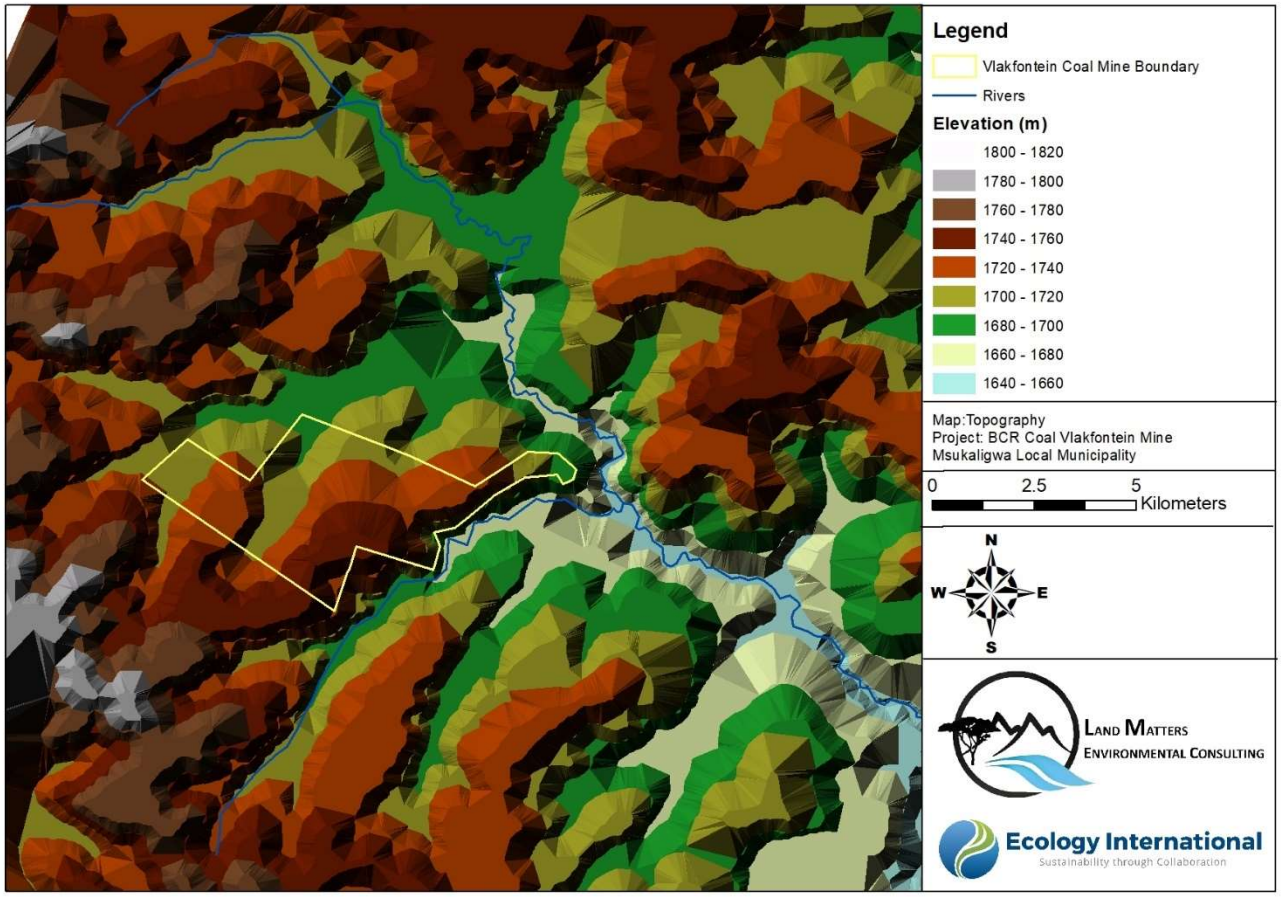

Figure 5: Topography (elevation) of the proposed BCR Coal Vlakfontein Mine

3. FRESHWATER ECOSYSTEM CHARACTERISTICS

3.1 Protected Areas

According to the Department of Environmental Affairs' Protected Area Database (DEA, 2021), no formally Protected Areas are directly associated with the proposed BCR Coal Vlakfontein Mine. However, the Chrissiesmeer Protected Environment (declared in 2014) is located approximately 6 km north-west of the proposed BCR Coal Vlakfontein Mine, and the site itself does fall within a Priority Focus Area for the National Protected Areas Expansion Strategy of 2018 (Figure 6). Given Mpumalanga's up-to-date and comprehensive systematic conservation plan, the prioritisation of areas for Protected Areas expansion was focused on

meeting biodiversity targets for ecosystems, species, and process areas. Key issues in the selection of Priority Focus Areas also included landscape connectivity and securing of threatened ecosystems. However, these areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine-scale planning, which may identify a range of different priority sites based on local requirements, constraints and opportunities (Government of South Africa, 2008).

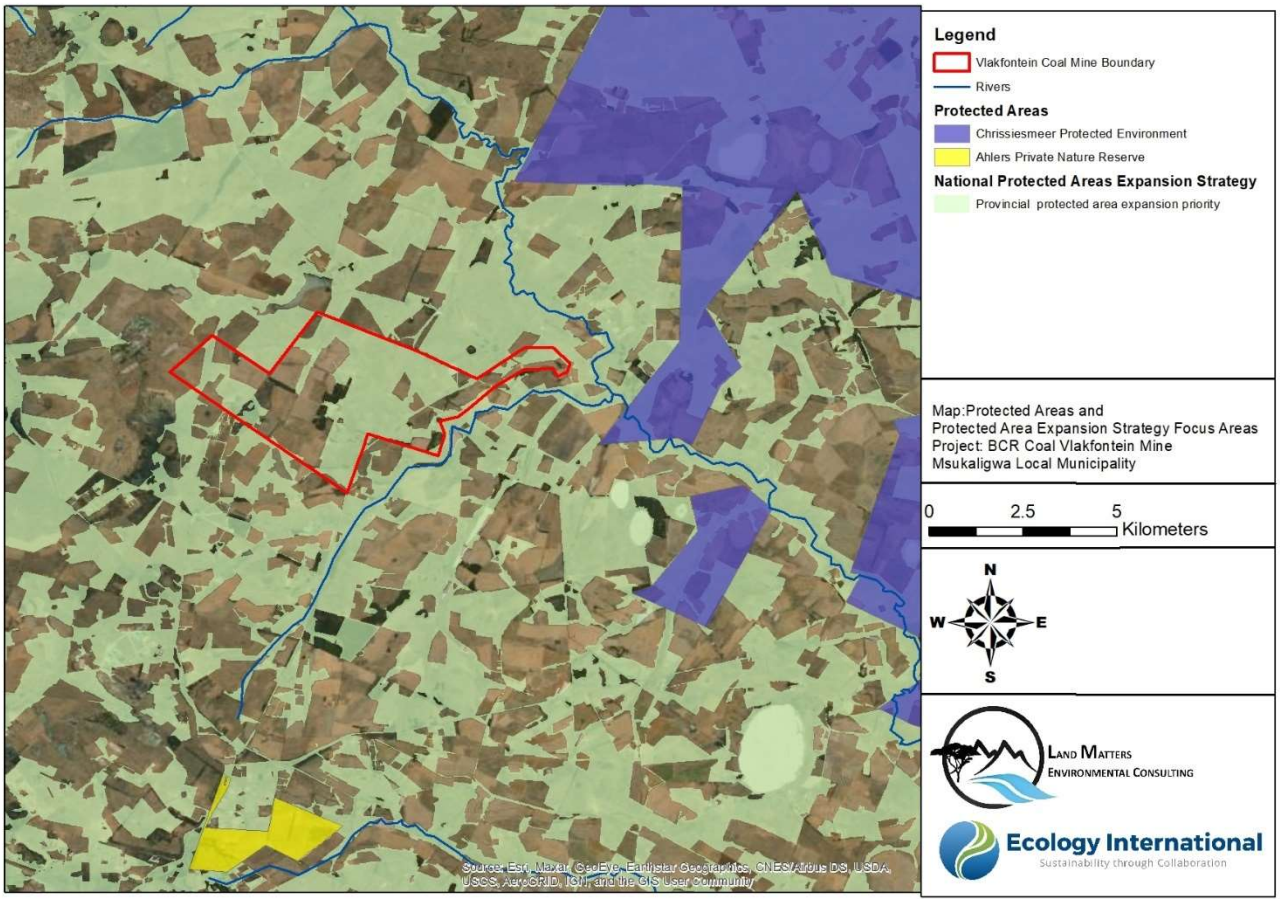

Figure 6: Protected Areas and Protected Area Expansion Strategy focus areas associated with the proposed BCR Coal Vlakfontein Mine

3.2 Mining and Biodiversity Guidelines

Published in 2013, the Mining and Biodiversity Guidelines provides a tool to facilitate the sustainable development of South Africa's mineral resources in a way that enables regulators, industry, and practitioners to minimise the impact of mining on the country's biodiversity and ecosystem services. It provides the mining sector with a practical, user-friendly manual for integrating biodiversity considerations into the planning processes and managing biodiversity during the operational phases of a mine, from exploration through to closure. From a business perspective, the document explains the value for mining companies of adopting a risk-based approach to managing biodiversity. The early identification and assessment of mining impacts on biodiversity provides an opportunity to put in place environmental management plans and actions that reduce risks to biodiversity, people and business (Department of Environmental Affairs et al., 2013).

The purpose of the Mining and Biodiversity Guidelines was to identify and categorize biodiversity priority areas sensitive to the impacts of mining to support mainstreaming of biodiversity issues in decision making

in the mining sector. In order to do this, a composite raster layer was developed based on a large number of individual biodiversity spatial datasets held by SANBI, distinguishing between four categories of biodiversity priority areas in relation to their importance from a biodiversity and ecosystem service point of view as well as the implications for mining in these areas. The guidelines therefore provide explicit direction in terms of where mining-related impacts are legally prohibited, where biodiversity priority areas may present high risks for mining projects, and where biodiversity may limit the potential for mining. The spatial outputs of the guidelines associated with the proposed BCR Coal Vlakfontein Mine are presented in Figure 7.

Based on the outputs of the Mining and Biodiversity Guidelines, the proposed BCR Coal Vlakfontein Mine falls within areas classified as being of 'high and highest biodiversity importance' as well as legally protected from mining, and thus posing the highest risk for the proposed activity from a biodiversity perspective. The proposed BCR Coal Vlakfontein Mine study area also falls immediately adjacent to an area classified within the Mining and Biodiversity Guidelines as being legally protected. The 'highest biodiversity importance' category includes biodiversity priority areas where mining is not legally prohibited, but where there is a very high risk that due to their potential biodiversity significance and importance to ecosystem services (e.g. water flow regulation and water provisioning) that mining projects will be significantly constrained or may not receive the necessary authorisations. These areas include (Department of Environmental Affairs et al., 2013):

1. Critically Endangered (CR) and Endangered (EN) ecosystems, recognised as threatened ecosystems in terms of the Biodiversity Act.
2. Critical Biodiversity Areas (CBAs), or areas of equivalent status such as irreplaceable and highly significant areas from provincial spatial biodiversity plans.
3. River and wetland Freshwater Ecosystem Priority Areas (FEPAs), and a 1 km buffer of these specific river and wetland FEPAs.
4. Ramsar sites.

The importance of the biodiversity features in these areas and the associated ecosystem services (e.g. water flow regulation and water provisioning) is sufficiently high that, if their existence and condition are confirmed, the likelihood of a fatal flaw for new mining projects is very high. These areas are viewed as necessary to ensure protection of biodiversity, environmental sustainability, and human well-being. Mining in such areas may be out of place within the framework of national environmental management policies, norms and standards (Department of Environmental Affairs et al., 2013).

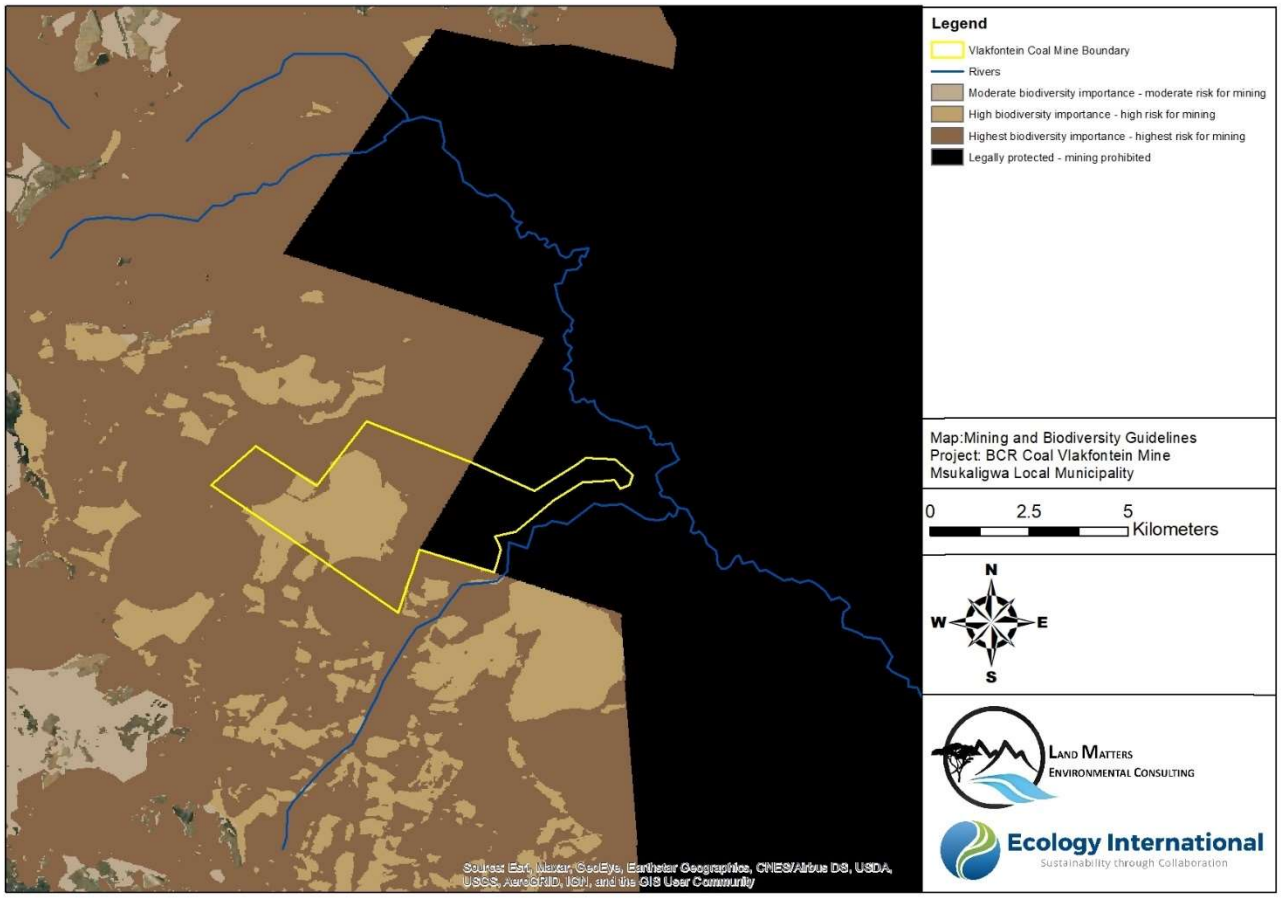

Figure 7: Outputs of the Mining and Biodiversity Guidelines associated with the proposed BCR Coal Vlakfontein Mine

3.3 Freshwater Ecoregions of the World

The proposed BCR Coal Vlakfontein Mine is located within the Southern Temperate Highveld freshwater ecoregion, which is delimited by the South African interior plateau sub-region of the Highveld aquatic ecoregion, of which the main habitat type, in terms of watercourses, is regarded as Savannah-Dry Forest Rivers. Aquatic biotas within this bioregion have mixed tropical and temperate affinities, sharing species between the Limpopo and Zambezi systems. The Southern Temperate Highveld freshwater ecoregion is considered to be bio-regionally outstanding in its biological distinctiveness and its conservation status is regarded as Endangered. The ecoregion is defined by the temperate upland rivers and seasonal pans (Nel et al., 2004; Darwall et al., 2009; Scott, 2013).

3.4 Strategic Water Source Areas

Strategic Water Source Areas (SWSAs) are landscapes where a relatively large volume of runoff produces water for the majority of South Africa. Strategic water source areas can be regarded as natural 'water factories', supporting growth and development needs that are often a far distance away. Deterioration of water quality and quantity in these areas can have a disproportionately large negative effect on the functioning of downstream ecosystems and the overall sustainability of growth and development in the regions they support (Nel et al., 2013)

Based on the fine-scale delineation of SWSAs for surface water in South Africa (Lötter & Le Maitre, 2021), the proposed BCR Coal Vlakfontein Mine falls within the Upper Vaal SWSA which is considered to be of national priority (Figure 8).

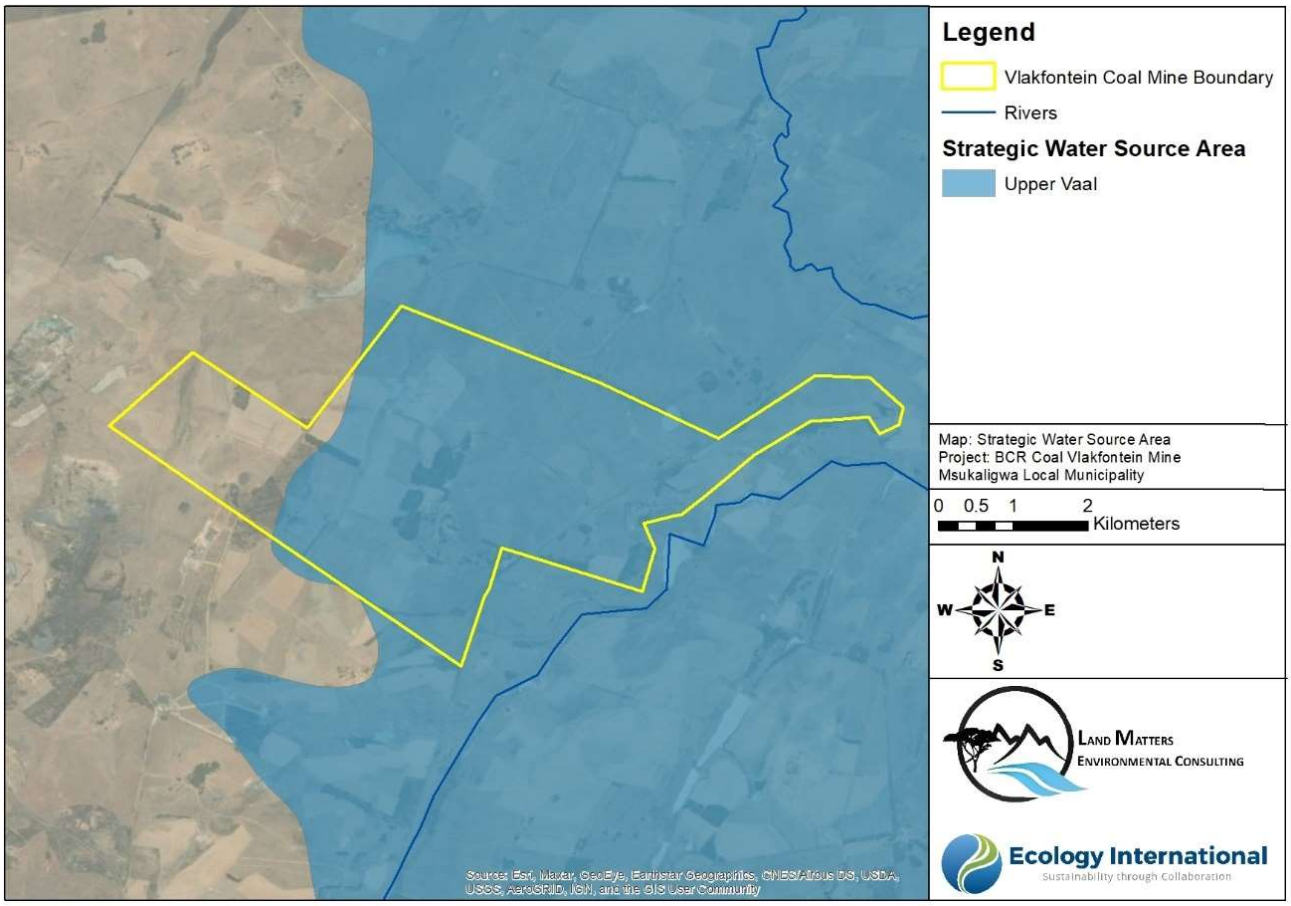

Figure 8: Strategic Water Source Area for the proposed BCR Vlakfontein Mine area

3.5 National Ecoregional Typing

Ecoregional typing at a national level is based on spatially variable combinations of causal factors including physiography, climate, geology, soils and potential natural vegetation. Accordingly, the study area is located primarily within the Highveld Ecoregion, and more specifically within Level II Ecoregion 11.02.

3.6 National Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas (NFEPA) project represents a multi-partner project between the Council for Scientific and Industrial Research (CSIR), South African National Biodiversity Institute (SANBI), Water Research Commission (WRC), Department of Water Affairs (DWA; now Department of Water and Sanitation, or DWS), Department of Environmental Affairs (DEA), Worldwide Fund for Nature (WWF), South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). More specifically, the NFEPA project aims to:

- Identify Freshwater Ecosystem Priority Areas (hereafter referred to as 'FEPAs') to meet national biodiversity goals for freshwater ecosystems; and
- Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers.

According to the outputs of the NFEPA project, the majority (approximately 84 %) of the proposed BCR Coal Vlakfontein Mine study area falls within a catchment classified as a FEPA catchment. FEPA catchments

achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species and were identified as rivers that are currently in a good condition (Ecological Category A or B). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources (Driver et al., 2011).

Interrogation of the FEPA dataset indicated that the FEPA status was largely as a result of the catchment being classified as a fish sanctuary for two fish species, namely *Enteromius cf. oraniensis* (Chubbyhead Barb; previously *Enteromius anoplus s.l.)* and *Enteromius sp. pallidus cf. 'north'* (Goldie Barb), the latter of which is in need of taxonomic revision and both of which are in need of a revised assessment of their threat status.

The associated catchment further supports representative riverine and wetland ecosystem types and wetland clusters (Figure 9). River ecosystem types comprise distinct combinations of Level 1 ecoregions, flow descriptions, and slope categories, and are used for representing the diversity of rivers across the country. Within the context of the NFEPA project, river ecosystem types were regarded as coarse-filter surrogates of biodiversity, conserving the diversity of many common and widespread species, and their associated habitats.

In addition, the reach of the Vaal River downstream of the proposed BCR Coal Vlakfontein Mine is considered to be a free-flowing river which, according to Driver et al. (2011), are rivers that flow undisturbed from their source to the confluence with a larger river or to the sea without any major dams and are a rare feature in the South African landscape and part of our natural heritage. Dams prevent water from flowing down a river and disrupt ecological functioning, with serious knock-on effects for downstream river reaches and users.

Several wetland systems were identified within the project site as well as one FEPA wetland cluster identified in the eastern section. Wetland clusters are groups of wetlands embedded in a relatively natural landscape, allowing for important ecological processes such as migration of frogs and insects between wetlands. The FEPA wetlands include channelled valley bottom systems and depressions. The wetlands are classified as FEPA wetlands (Figure 9) as they are located within a sub quaternary catchment that is often utilised by Wattled Cranes (*Bugeranus carunculatus*), Grey Crowned Cranes (*Balearica regulorum*) and/or Blue Cranes (*Anthropoides paradiseus*). The wetlands furthermore have PES classifications of A/B (unmodified to largely natural).

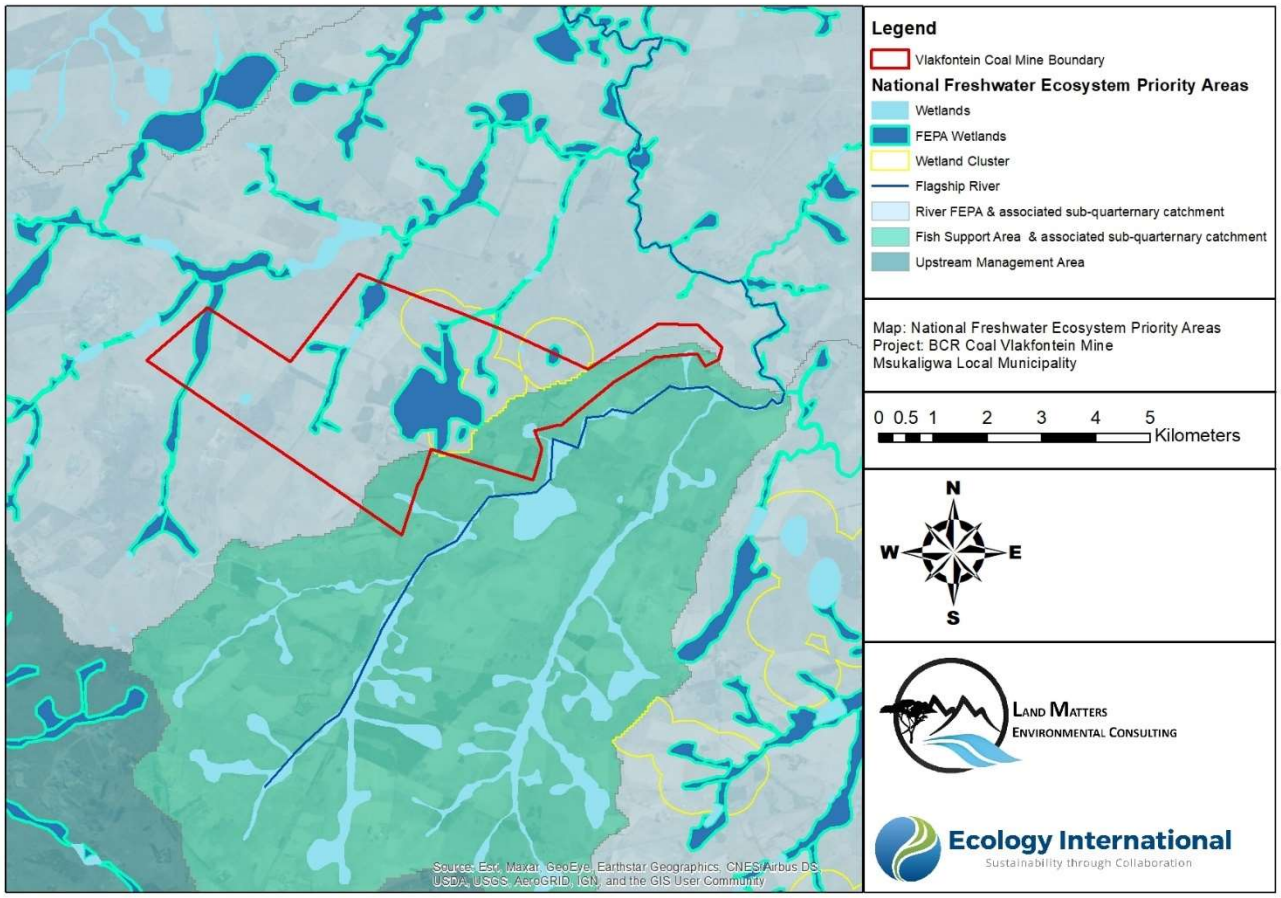

Figure 9: Wetlands within the study site as indicated by the NFEPA database (2011)

3.7 Mpumalanga Biodiversity Sector Plan

The Mpumalanga Biodiversity Sector Plan (MBSP) is a comprehensive environmental inventory and spatial plan that is intended to guide conservation and land use decisions in support of sustainable development (Lötter & Ferrar, 2006; Mpumalanga Tourism and Parks Agency, 2014). The MBSP maps the distribution of the Province's known biodiversity into several categories for both the terrestrial and freshwater realms. These are ranked according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each biodiversity feature.

According to the latest revision of the freshwater component of the MBSP (Mpumalanga Tourism and Parks Agency, 2019), the watercourses/wetlands and wetland clusters associated with the proposed BCR Coal Vlakfontein Mine footprint are classified as Ecological Support Areas (ESAs) on the basis of wetlands and wetland clusters (Figure 10). ESAs are areas that are not essential for meeting biodiversity, targets, but that play an important role in supporting the functioning of protected areas or CBAs and for delivering ecosystem services. In the terrestrial assessment they support landscape connectivity and strengthen resilience to climate change. ESAs need to be maintained in at least a functional and often natural state, supporting the purpose for which they were identified. They include features such as riparian habitat surrounding rivers or wetlands, migration corridors for over-wintering sites for Blue Cranes, and so on (Mpumalanga Tourism and Parks Agency, 2014).

In an attempt to make the land-use guidelines of the MBSP more useful to the broader planning community (particularly those in the municipal system), the categories obtained by the MBSP were integrated with the

existing zonation definitions used in other planning schemes, so far as possible, making it easier for biodiversity priorities to be adequately represented in existing spatial planning systems, including the Spatial Planning and Land Use Management Act (Act 16 of 2013). Based on the land-use guidelines of the MBSP, opencast mining is expected to compromise the biodiversity objective determined for the area in question and according to Mpumalanga Tourism and Parks Agency (2014) is not permissible. In contrast, underground mining within the study area, while still considered to potentially compromise the biodiversity objective, are permissible under certain conditions, although proximity to the associated watercourse needs to be taken into consideration due to identified sensitivities (Mpumalanga Tourism and Parks Agency, 2014).

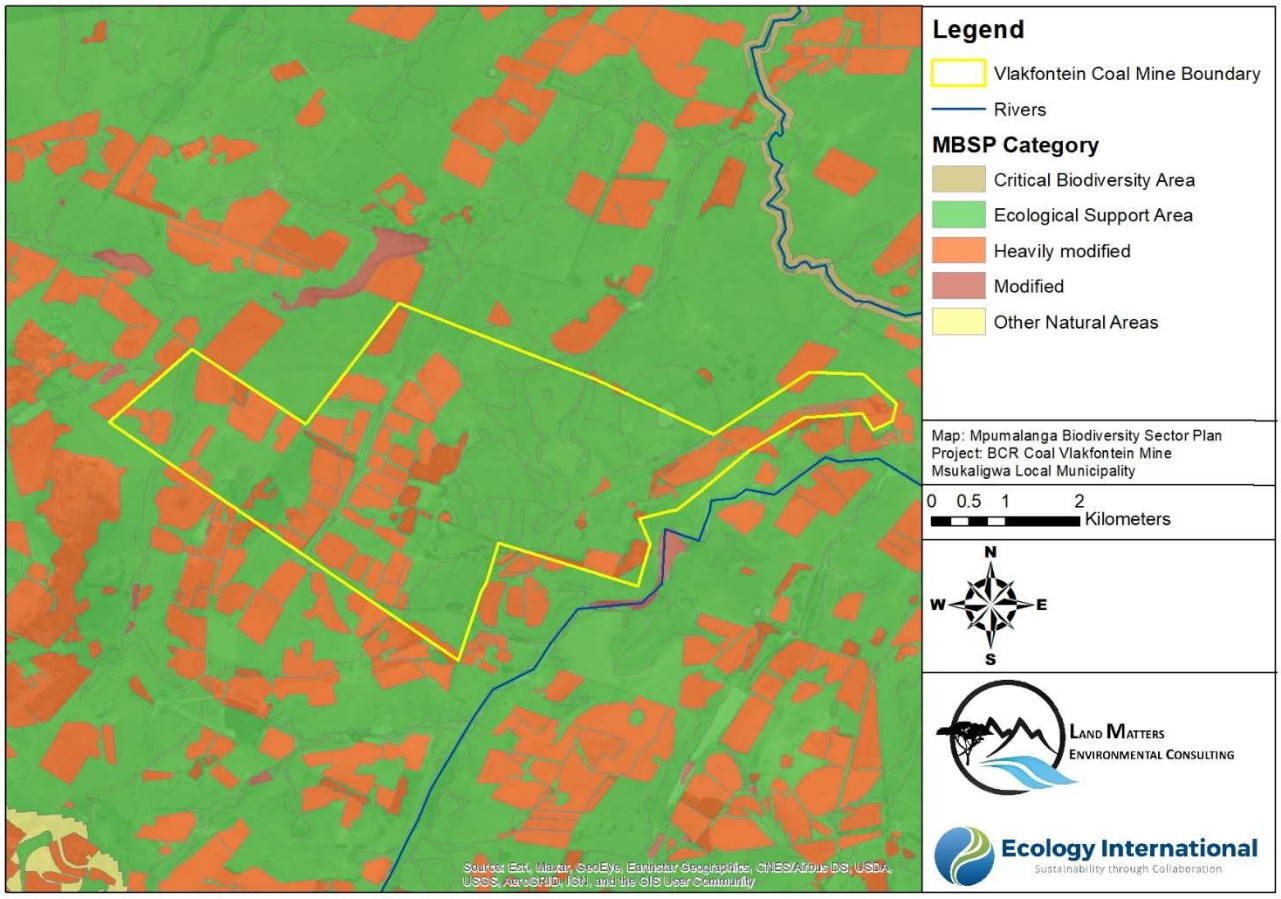

Figure 10: Mpumalanga Biodiversity Sector Plan outputs for freshwater ecosystems associated with the proposed BCR Coal Vlakfontein Mine (Mpumalanga Tourism and Parks Agency, 2014; updated 2019)

3.8 Associated Water Resources

The NWRS-1 (National Water Resource Strategy, Version 1) originally established 19 Water Management Areas (WMAs) within South Africa and proposed the establishment of the 19 Catchment Management Agencies to correspond to these areas. In rethinking the management model and based on viability assessments with respect to water resources management, available funding, capacity, skills and expertise in regulation and oversight, as well as to improve integrated water systems management, the original 19 designated WMAs have been consolidated into 9 WMAs. As such, the proposed BCR Coal Vlakfontein Mine is located within the newly revised Vaal Major WMA, which now includes the Upper, Middle and Lower Vaal catchments. Accordingly, the main rivers of the WMA include the Wilge, Liebenbergsvlei, Mooi, Renoster, Vals, Sand, Vet, Harts, Molopo and Vaal rivers. More specifically, the proposed BCR Coal Vlakfontein Mine is

located within Quaternary Catchment C11A which comprises the extreme upper reaches and the source of the Vaal River.

3.8.1 Riverine Features

Watercourses directly associated with the study area include several unnamed tributaries of the upper reaches of the Vaal River (Figure 11). According to the topography of the Vaal River reach associated with the study area, as well as the unnamed tributary associated with the eastern extent of the proposed Mineral Rights Area, the reaches can be classified as having lower foothill characteristics, including a lower gradient mixed bed alluvial channel with sand and gravel dominating the bed. Reach types expected include pool-riffle or pool-rapid, and sand bars are also expected to be common in the pools (after Rowntree & Wadeson, 1999). Of additional relevance is that the reach of the Vaal River associated with the proposed BCR Coal Vlakfontein Mine is classified within the latest National Biodiversity Assessment as being free flowing. Both of the identified watercourses are considered to be Critically Endangered and poorly protected (Van Deventer et al., 2019).

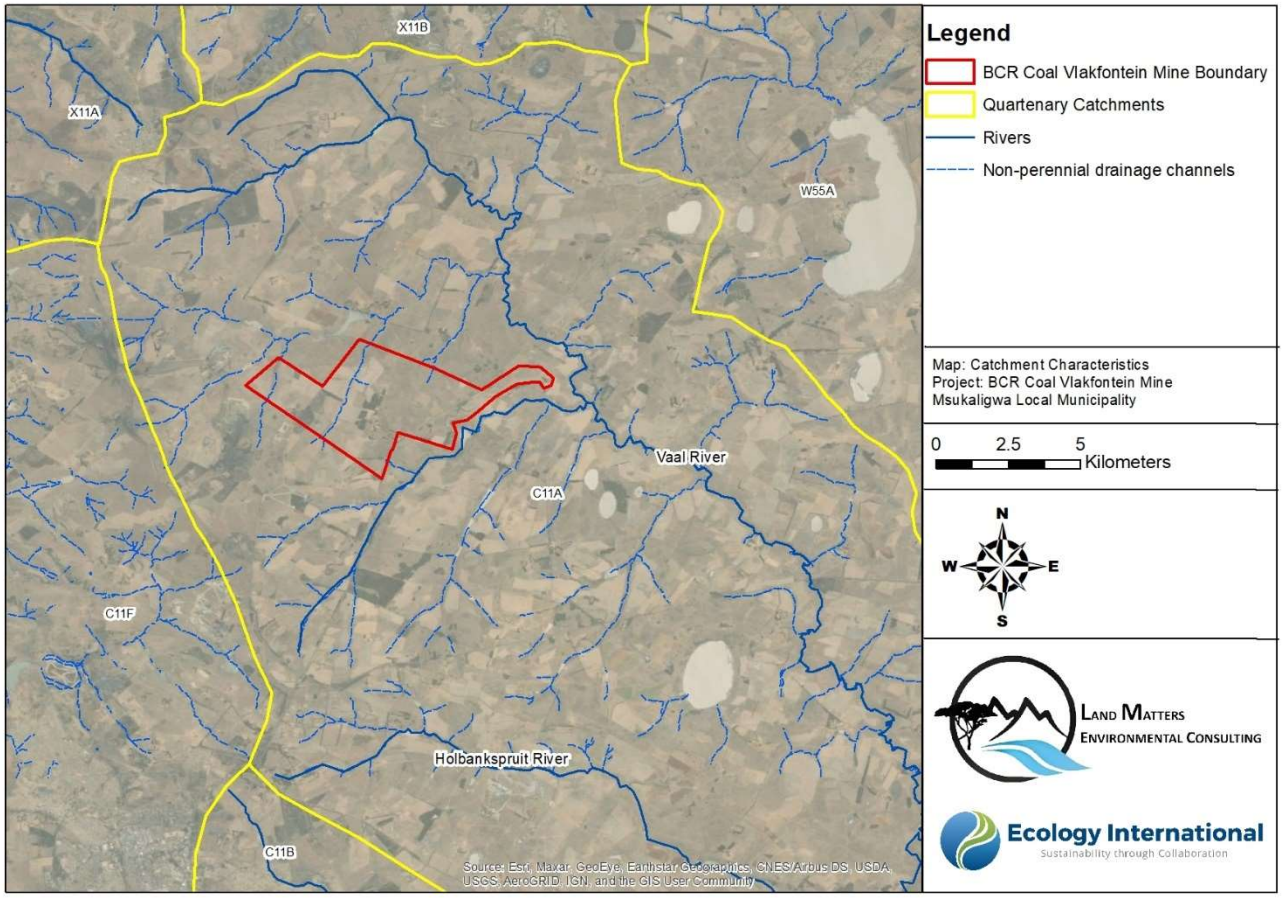

Figure 11: Catchment characteristics associated with the proposed BCR Coal Vlakfontein Mine

Present Ecological State, Ecological Importance & Ecological Sensitivity

According to the Department of Water and Sanitation (2014), both the reach of the Vaal River (Reach C11A-01460) immediately downstream of the proposed BCR Coal Vlakfontein Mine, as well as the Unnamed Tributary associated with the eastern extent of the MRA (Reach C11A-01544), are considered to be in a moderately modified ecological state (Ecological Category C). For the Vaal River reach, the ecological

importance and the ecological sensitivity are estimated to be 'moderate' and 'high', respectively, while those of the Unnamed Tributary are both estimated to be 'moderate'. Table 1, Table 2 and Table 3 provide a summary of the determinants of the Present Ecological State (PES), ecological importance, and ecological sensitivity of the two watercourses.

Table 1: Present Ecological State of reach of the Vaal River immediately downstream of the proposed BCR Coal Vlakfontein Mine and the unnamed tributary associated with the eastern extent of the proposed Mineral Rights Area, according to the Department of Water and Sanitation (2014)

Present Ecological State		
	Vaal River (Reach C11A-01460)	**Unnamed Tributary associated with Eastern Extent of MRA (Reach C11A-01544)**
Instream habitat continuity modification	Moderate	Moderate
Rip/wetland zone continuity modification	Small	Moderate
Potential instream habitat mod act.	Large	Moderate
Riparian-wetland zone mod	Moderate	Large
Potential flow mod act.	Moderate	Moderate
Potential physico-chemical mod activities	Large	Small
Ecological Category	**C (Moderately Modified)**	**C (Moderately Modified)**

Table 2: Ecological importance of reach of the Vaal River immediately downstream of the proposed BCR Coal Vlakfontein Mine and the Unnamed Tributary associated with the eastern extent of the proposed Mineral Rights Area, according to the Department of Water and Sanitation (2014)

Ecological Importance		
	Vaal River (Reach C11A-01460)	**Unnamed Tributary associated with Eastern Extent of MRA (Reach C11A-01544)**
Invert representivity (per secondary catchment)	Very High	Very High
Invert rarity (per secondary catchment)	Very High	Very High
Fish representivity (per secondary catchment)	Moderate	Very Low
Fish rarity (per secondary catchment)	Low	Low
Ecological importance: riparian-wetland-instream vertebrates (excl. fish)	High	High
Riparian-wetland natural veg rating based on % natural veg in 500m	Very High	High
Riparian-wetland natural veg importance based on expert rating	Low	Low
Riparian-wetland zone migration link	Very High	High
Riparian-wetland zone habitat integrity class	High	Moderate
Habitat diversity	Low	Low
Habitat size (length)	Low	High
Instream migration link class	High	High
Instream habitat integrity class	Moderate	High
Mean Ecological Importance Rating Class	**Moderate**	**Moderate**

Table 3: Ecological sensitivity of reach of the Vaal River immediately downstream of the proposed BCR Coal Vlakfontein Mine and the Unnamed Tributary associated with the eastern extent of the proposed Mineral Rights Area, according to the Department of Water and Sanitation (2014)

Ecological Sensitivity		
	Vaal River (Reach C11A-01460)	**Unnamed Tributary associated with Eastern Extent of MRA (Reach C11A-01544)**
Fish physico-chemical sensitivity	Moderate	Moderate
Fish no-flow sensitivity	Moderate	Moderate
Invertebrate physico-chemical sensitivity	Very High	Very High
Invertebrate velocity sensitivity	Very High	Very High
Riparian-wetland-instream vertebrates (excl. fish) intolerance to water level/flow changes	High	Low
Riparian-wetland vegetation intolerance to water level changes	High	High
Stream size sensitivity to modified flow/water level changes	Low	Low
Mean Ecological Sensitivity Rating Class	**High**	**Moderate**

3.8.2 Wetland Features

Three separate wetland mapping databases were utilised for this desktop assessment. These included both national and provincial databases, namely:

- the National Freshwater Ecosystem Priority Areas (NFEPA) project (see Section 3.6),
- the more recent National Wetland Map 5 (van Deventer et al, 2018) database, as well as the
- provincial Mpumalanga Highveld Wetlands database.

As an additional database to the NFEPA database, the more recent National Wetland Map 5 (van Deventer et al, 2018) database was utilised to assess the project area. The National Wetland Map 5 (NWM5) forms part of the National Biodiversity Assessment (2018) within the category of the Inland Aquatic (Freshwater) Realm. This project is a multi-partner project through the CSIR and SANBI. The NWM5 has significantly improved the representation of inland wetland ecosystem types. The representation of the extent of inland wetlands has improved by 123%, whereas the incorrect representation of terrestrial ecosystems as wetlands has been reduced (Van Deventer et al, 2018).

The National Wetland Map 5 database yielded a number of wetlands located throughout the proposed BCR Coal Vlakfontein Mine site. These are classified as seep wetlands, floodplain wetlands, channelled valley bottom wetlands and depressions (Figure 12). All wetland features associated with the proposed BCR Coal Vlakfontein Mine footprint are classified within the latest National Biodiversity Assessment as Critically Endangered, poorly protected or not protected at all, and at high risk to loss, with only the associated depressional (pan) systems being classified as Least Concern and at a moderate risk to loss (Van Deveter et al., 2019).

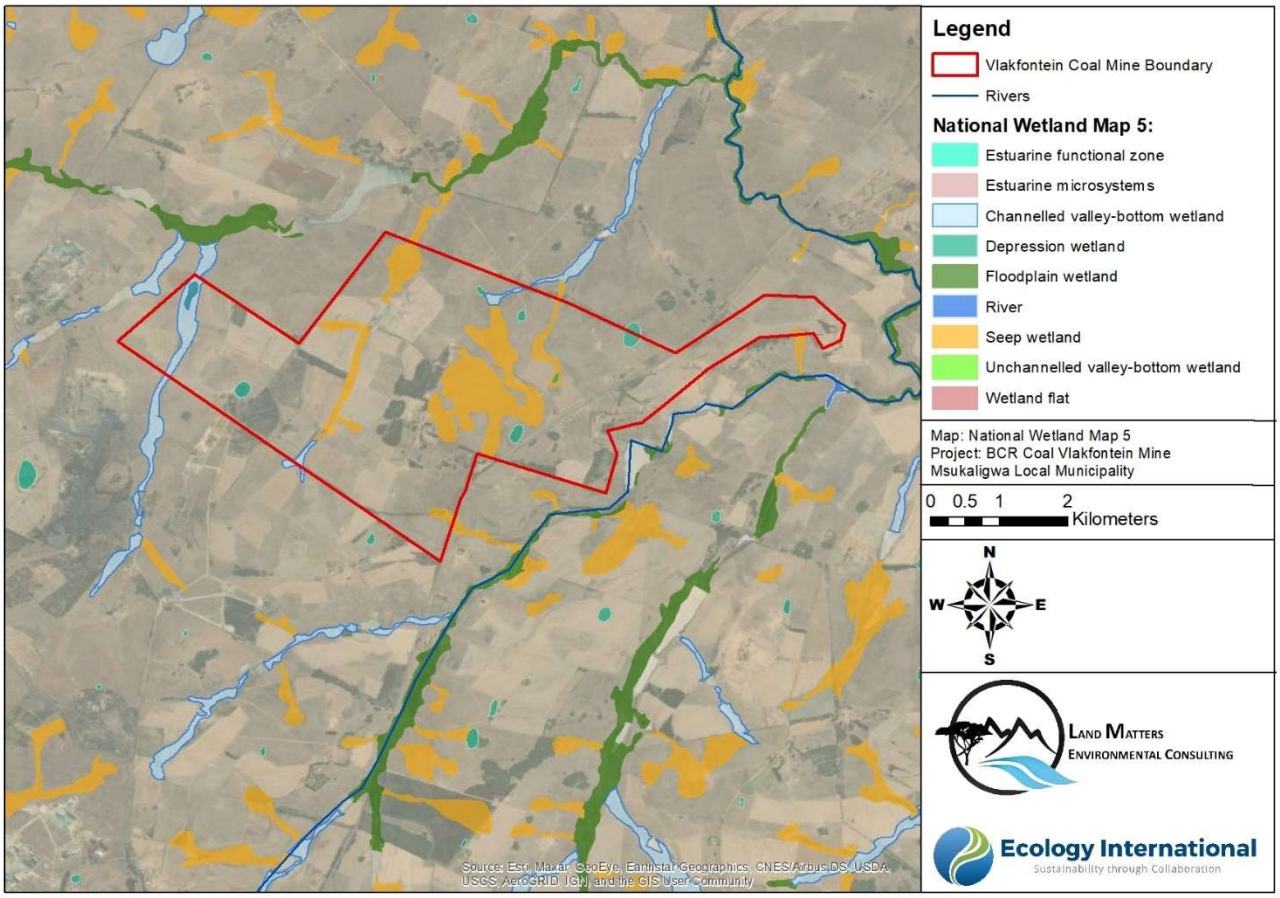

Figure 12: Wetlands within the BCR Coal Vlakfontein Mine study area as indicated by the NWM 5 (2018)

Further, SANBI undertook a wetland mapping exercise for the Mpumalanga Highveld region in order to expand on the detailed wetland delineations undertaken in adjacent catchments, for inclusion into the NFEPA project (Mbona et al., 2015). Mpumalanga Tourism and Parks Agency (MPTA) recognises that wetlands are specialised systems that perform various ecological functions and play an integral role in biodiversity conservation. The project seeks to map the extent, distribution, condition, and type of freshwater ecosystems in the Mpumalanga Highveld coal belt. The delineations were based on identifying wetlands on Spot 5 imagery within the Mpumalanga Highveld boundary and supported by Google Earth imagery, 1:50 000 contour lines, 1:50 000 river lines, data from previous studies in the area, and data from the original NFEPA wetlands layer. Hydrogeomorphic (HGM) units were identified at a desktop level and confirmed by means of ground-truthing. These refined layers will eventually be incorporated into the atlas of high-risk freshwater ecosystems and guidelines for wetland offsets, currently being developed by SANBI, in order to improve the scientific robustness of these tools (Mbona et al., 2015).

According to Mbona et al. (2015), all of the water resources within the study area are classified as wetland systems based on the revised wetland mapping inventory for the Mpumalanga Highveld region. These are classified as channelled valley bottom wetlands, floodplain wetland systems, seeps and depressions (Figure 13).

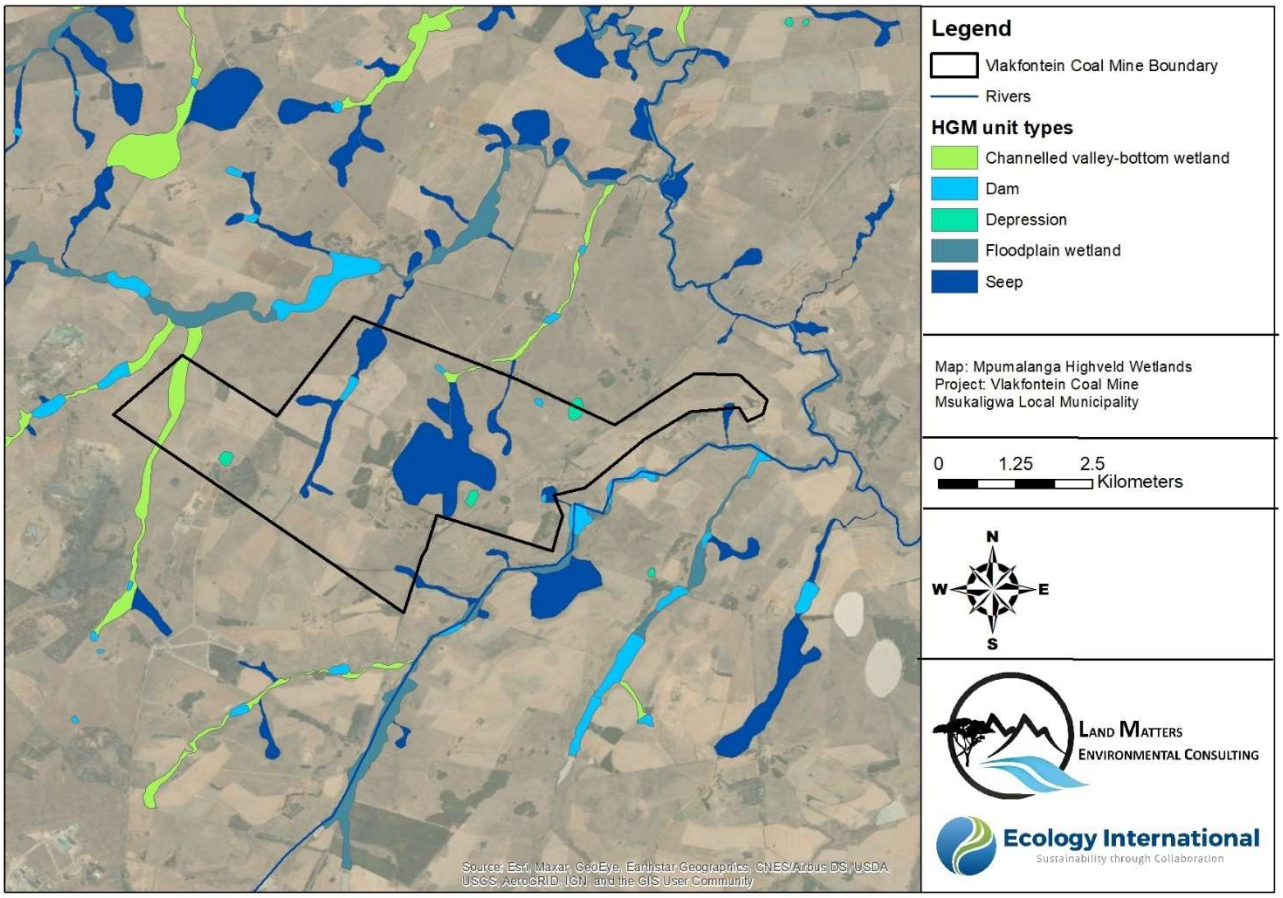

Figure 13: Wetlands within the study area as indicated by the Mpumalanga Highveld Wetland database

Wetland Delineation

The South African classification system categorises wetland systems based on the characteristics of different hydrogeomorphic areas (HGM) units. An HGM unit is a recognisable physiographic wetland-unit based on the geomorphic setting, water source of the wetland and the water flow patterns (Macfarlane et al., 2009). There are five broad recognised wetland systems based on the abovementioned system and these are depicted in Figure 14. The classification of these wetlands is then further refined as per the 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa' (Ollis et al., 2013).

Based on the identification of wetland systems utilising the available wetland mapping databases, a further investigation of historic and current aerial imagery for the site was undertaken. The results of this aerial imagery investigation were combined with the results from the wetland mapping databases and utilised to delineate all wetlands within the proposed BCR Coal Vlakfontein Mine study area. The wetlands were then classified as per the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis et al., 2013), with channelled valley bottom, unchannelled valley bottom, seep and depression wetlands all classified within the proposed BCR Coal Vlakfontein Mine study area (Figure 19).

Further to this the wetlands were categorised into separate HGM units. Fourteen (14) separate HGM units were delineated within the proposed BCR Coal Vlakfontein Mine study area (Figure 20). The characteristics of each wetland type is described in the proceeding paragraphs.

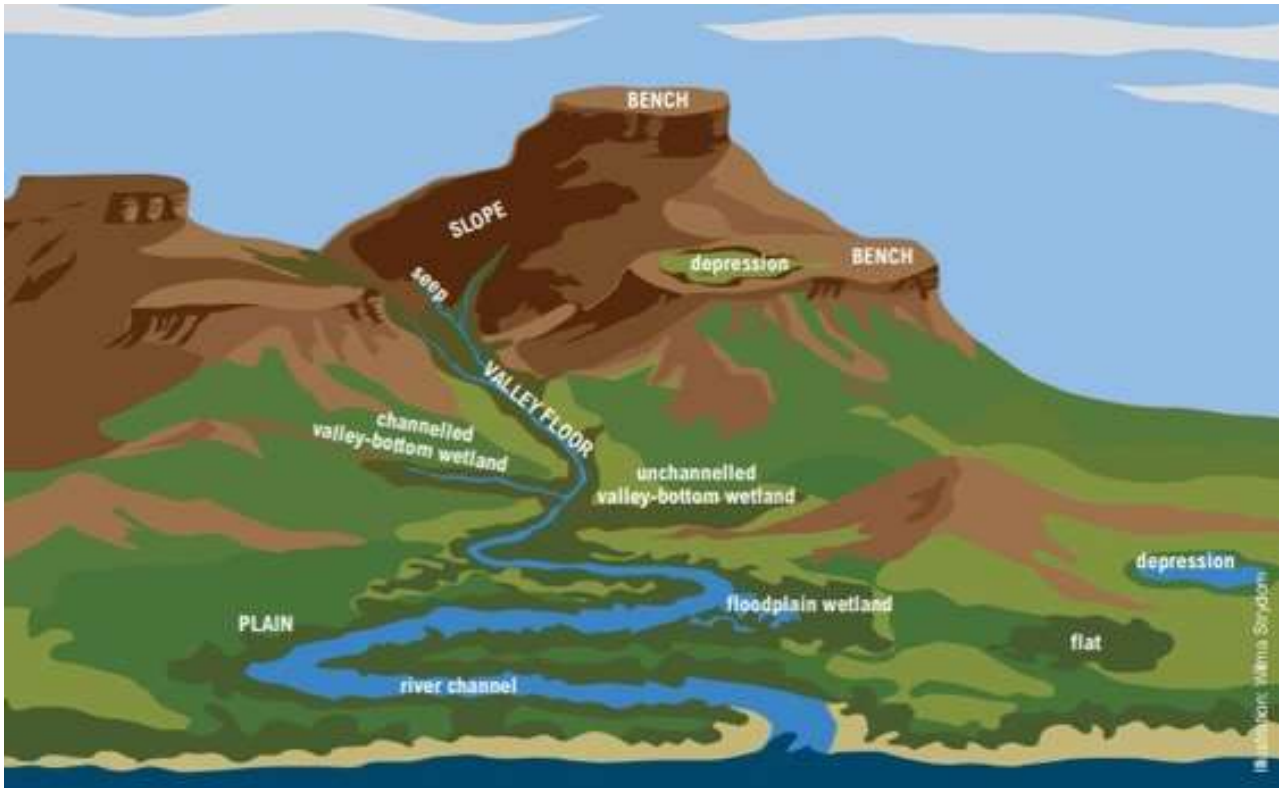

Figure 14: Diagrammatic representation of common wetland systems identified in South Africa

Seepage wetlands (Figure 17) are characterised by their association with topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to seep down-slope as subsurface interflow. Water movement through the seep is primarily attributed to interflow, with diffuse overland flow often being significant during and after rainfall events (Kotze et al., 2009; Ollis et al., 2013). 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.

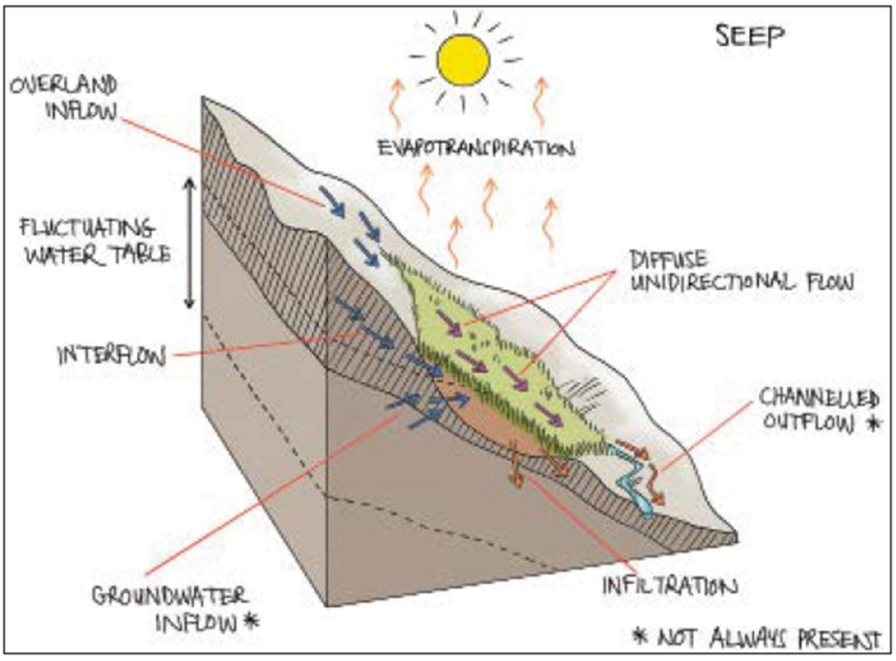

Figure 15: Diagrammatic representation of a seepage wetland

Channelled valley bottom wetlands (Figure 16) are characterised by their location on valley floors and the presence of a river or stream channel flowing through the wetland (but lacking characteristic floodplain features). This may be gently sloped and characterised by the net accumulation of alluvial deposits or have steeper slopes and be characterised by the net loss of sediment. Dominant water inputs to these wetlands are derived from the channels flowing through the wetland, either as surface flows resulting from flooding or as subsurface flow. Water generally moves through the wetland as diffuse surface flow although occasionally as short-lived concentrated flows during flood events (Ollis et al., 2013).

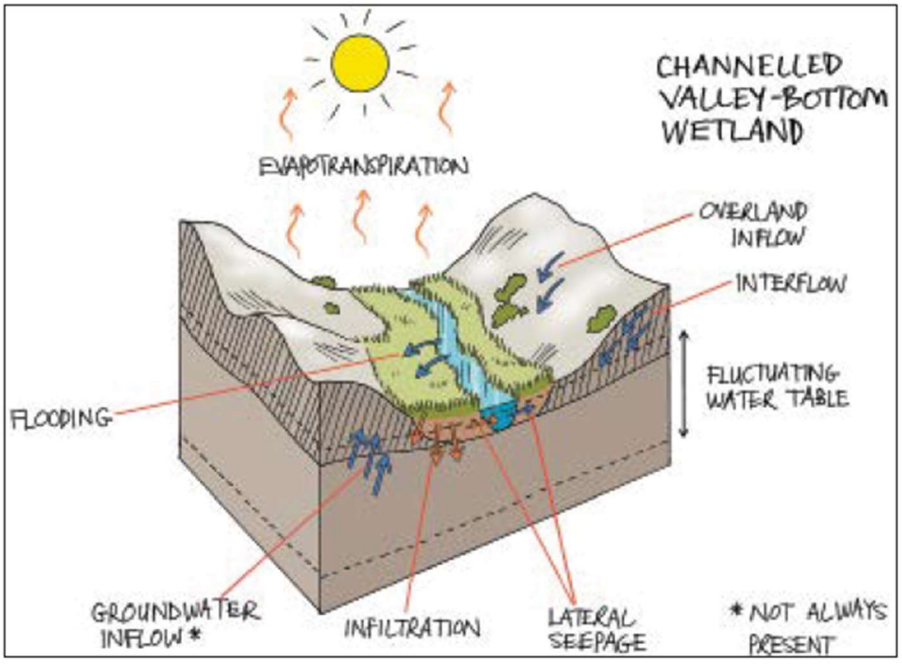

Figure 16: Diagrammatic representation of a channelled valley bottom wetland

Unchannelled valley bottom wetlands (Figure 17) are characterised by their location on valley floors and the absence of distinct channel banks and the prevalence of diffuse flows. These wetlands are generally formed when a river or stream channel loses confinement and spreads out over a wider area causing the concentrated flow associated with a river channel to change to diffuse flow (Ollis et al., 2013). Dominant water inputs to these wetlands are derived from the channels flowing through the wetland, either as surface flows resulting from flooding or as subsurface flow. Water generally moves through the wetland as diffuse surface flow, although occasionally as short-lived concentrated flows during flood events (Ollis et al., 2013).

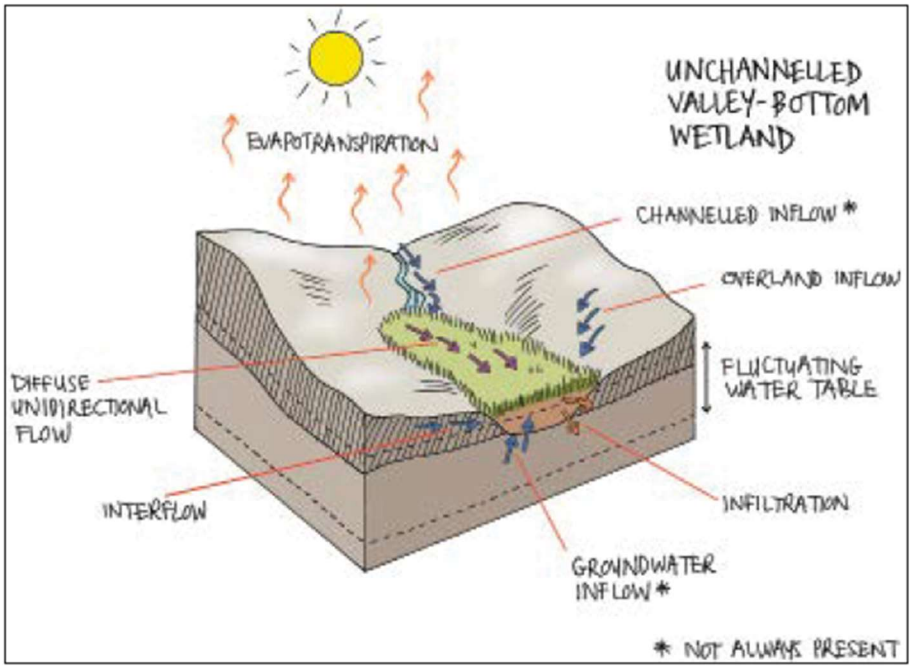

Figure 17: Diagrammatic representation of an unchannelled valley bottom wetland

Depressional wetlands (Figure 18) have closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates. They may be flat-bottomed, or round bottomed and have any combination of inlets and outlets or lack them completely. Most depressions occur either where the water table intercepts the land surface, or in semi-arid settings where a lack of sufficient water inputs prevents areas where water accumulates from forming a connection with the open drainage network.

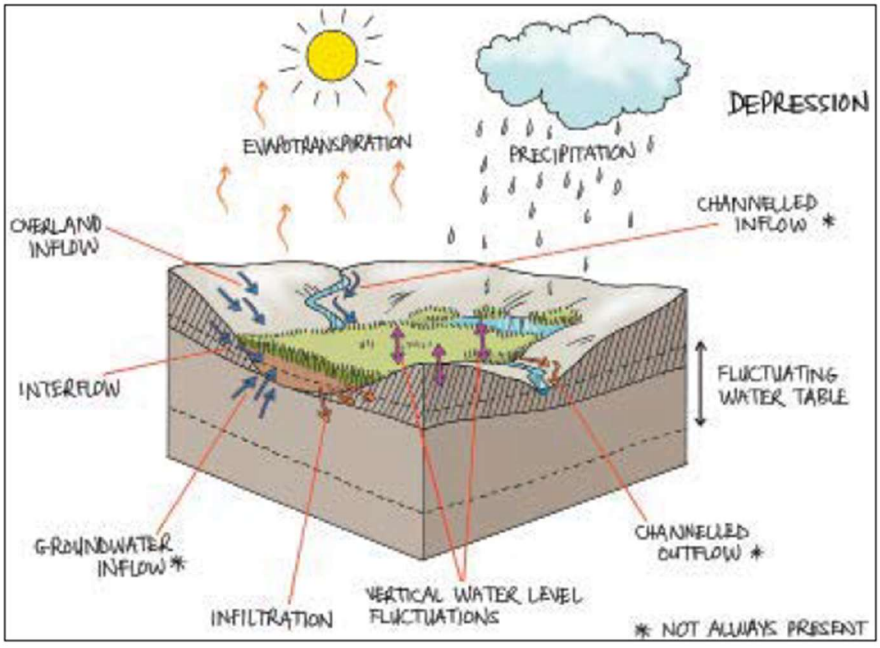

Figure 18: Diagrammatic representation of a depressional wetland

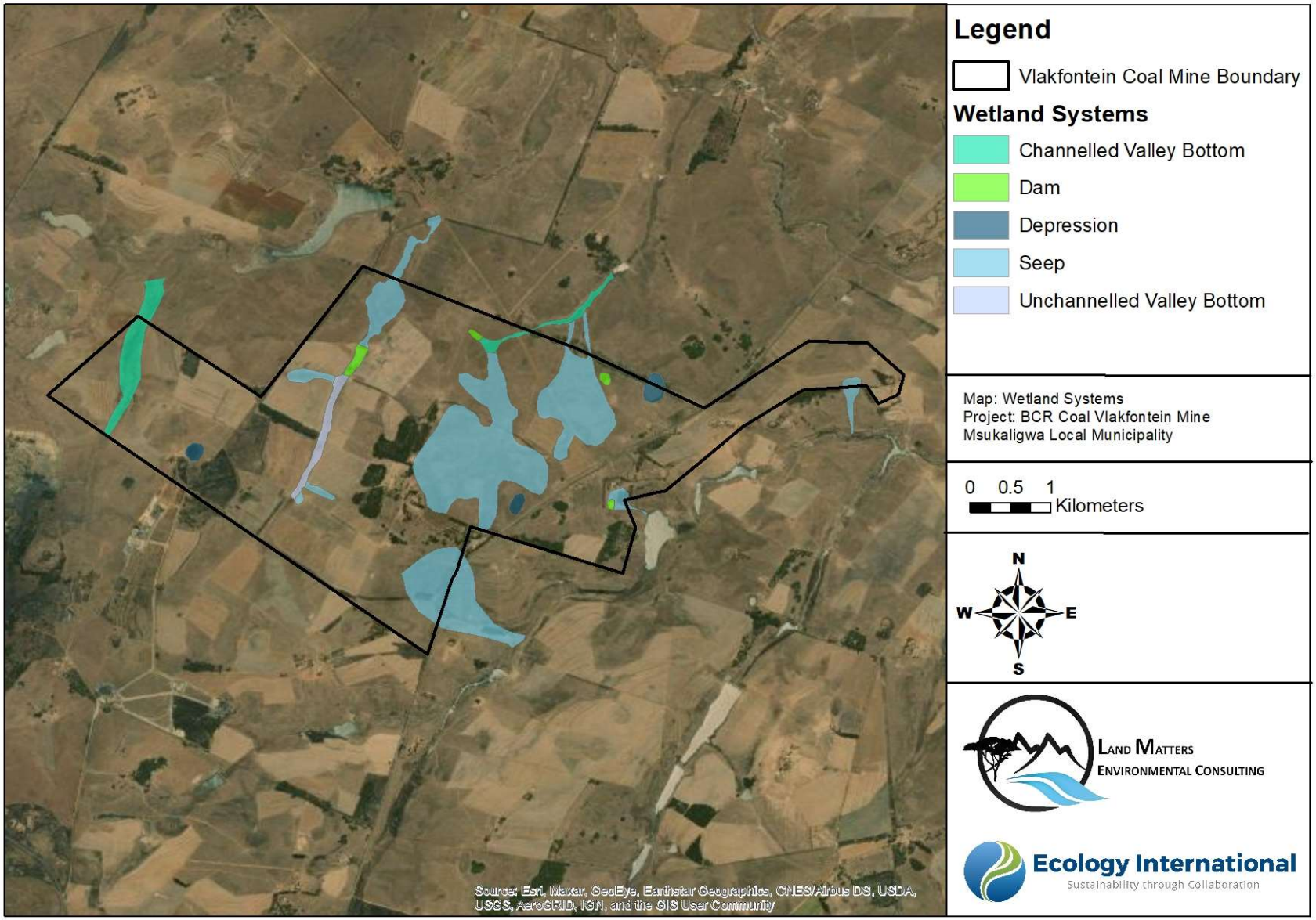

Figure 19: Wetland systems delineated at a desktop level within the proposed BCR Coal Vlakfontein Mine area

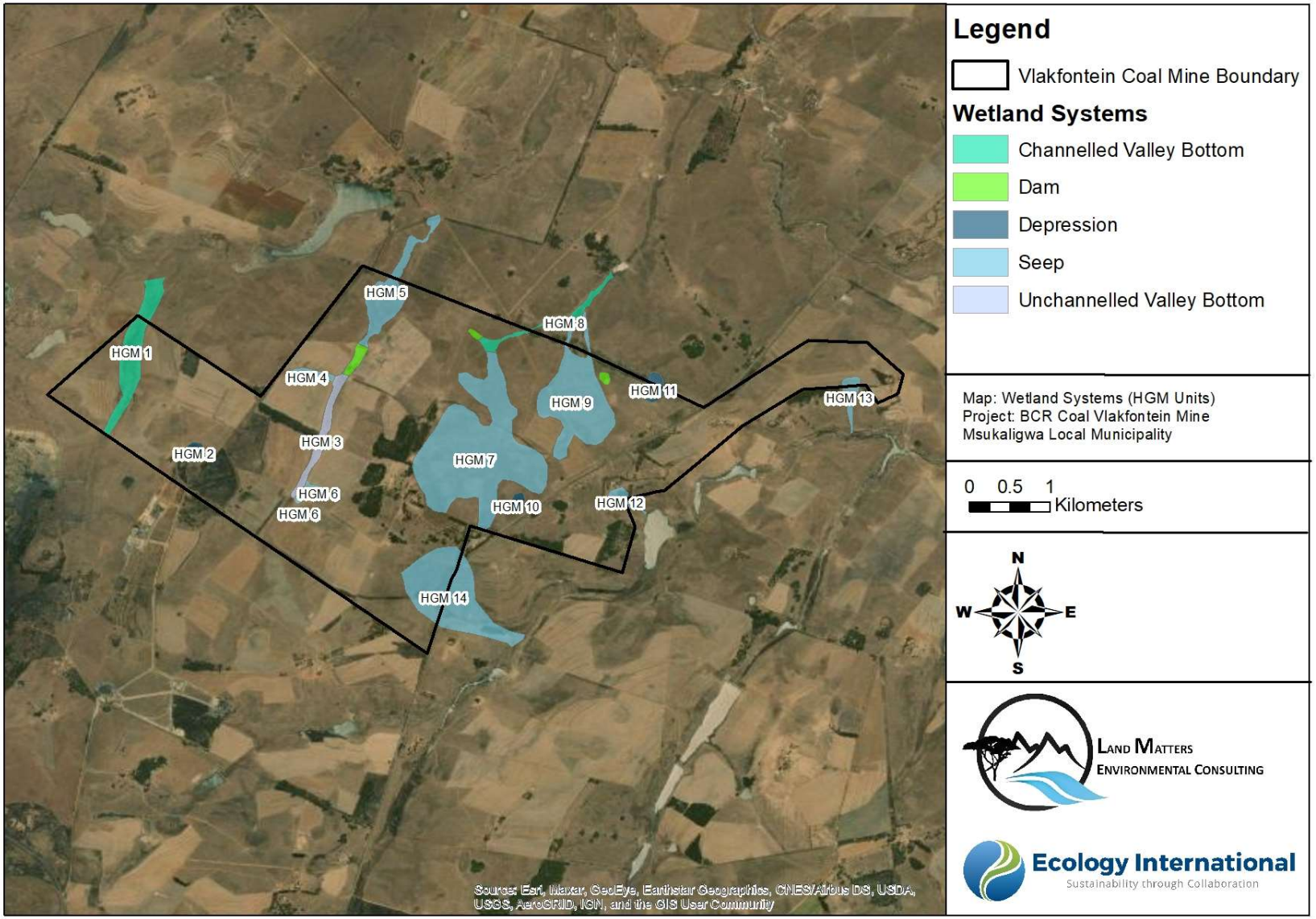

Figure 20: HGM units delineated within the proposed BCR Coal Vlakfontein Mine area

Present Ecological State

The HGM units were assessed with regards to their health according to the Wet-Health methodology[1]. A level 1B assessment (desktop scale) was conducted, with the results of this assessment being utilised to gain a general understanding of the health and condition of the wetlands within the BCR Coal Vlakfontein Mine area. Level 1B assessments take into consideration existing land cover data, as well as an examination of historic and current aerial imagery of the HGM unit and its associated catchment.

Through an investigation of the aerial imagery of the study area, several impacts were noted both within the wetland systems as well as their respective catchments. These impacts pertain largely to the use of the area for agricultural activities, including cultivation, the construction of numerous dams, and the construction of dirt roads to access cultivated fields. However, additional impacts within the catchments included the N17 road, which passes through the study area, the Mooifontein Coal Mine and low-density rural housing.

Cultivation of wetland systems decreases their health and functional integrity as it causes the mixing of the soil profile, thus altering the bulk density, pH, and nutrient status, as well as changing the microtopography. This results in knock-on effects on the geomorphological setting and flow dynamics of the wetland. The negative effect on the soil health is often amplified by the input of fertilisers which increases the quantity of nitrates and phosphates within the wetland systems. Over-saturation of these nutrients from any irrigation practices leads to their leaching from the soils into downstream wetlands and watercourses, negatively affecting the water quality. Furthermore, the cultivation of certain wetlands and their catchment areas has removed the historic vegetation, with shorter, less robust species becoming dominant. These species offer less resistance to stormwater flow and therefore an increase in velocity of overland flow during storm events. This leads to the formation of erosion gullies. Small scale erosion was noted in the aerial imagery of the study area. The formation of erosion gullies leads to the deposition of sediment within wetland systems, affecting the geomorphology of these water resources and impacting the growth of vegetation.

Agricultural earthen dams were also observed within the study area. The damming of wetland systems has long-term negative impacts on the hydrology, geomorphology, and vegetation dynamics of these systems. Dams cause a decrease in the quantity of water reaching downstream wetland areas as well as an increase in flooding of the upstream wetland systems, leading to changes in the hydrological flow through the channels as surface flow and through the soil profile as subsurface flow. Further to this, dams act as sediment sinks, reducing the sediment load of water released downstream. This results in water that is regarded as ‘sediment hungry’, having an increased capacity for erosion. Sedimentation of wetlands is also destructive to many faunal species as this affects their habitat, breeding and feeding cycles.

The Mooifontein Coal is situated upstream of HGM 1. Coal mines within the catchment of wetland systems, cause impacts relating to pollution, sediment deposition, disruption to hydrological flow as well as the geomorphic setting of wetlands. No large-scale erosion was noted in the aerial imagery of HGM 1, however any water quality issues pertaining to the function of HGM 1 could not be determined due to the desktop

[1] The current size of the delineated wetlands was recorded. It must be noted that this is not the entire size of the wetland but rather the portion of the system delineated within the study area.

approach to the study. Impacts to HGM 1 from the upstream coal mine would need to be identified during Phase 2 of the investigation.

The impacts described above were noted on a small-scale through the investigation of the aerial imagery of the site. The wetland systems as a whole appear to be intact and functional. All HGM units were therefore categorised as Largely Natural (Ecological Category B), or Moderately Modified (Ecological Category C). A summary of the PES scores obtained for the desktop-based assessment following application of the Wet-Health Level 1B approach is provided in Table 4.

Table 4: Summary of PES scores following evaluation from the Level 1B Wet-Health assessment

HGM Unit	Wetland Type	Hydrology	Geomorphology	Water Quality	Vegetation	PES Score (Category)
1	Channelled Valley Bottom	3.30	1.70	1.30	5.30	2.9 (C)
2	Depression	1.8	1.2	0.4	2.1	1.4 (B)
3	Unchannelled Valley Bottom	2.9	1.4	1.6	4.3	2.6 (C)
4	Seep	2.71	2.06	1.68	4.41	2.7 (C)
5	Seep	2.79	1.18	1.53	4.49	2.5 (C)
6	Seep	3.0	2.0	1.8	4.8	2.9 (C)
7	Seep	1.5	0.7	1.5	2.8	1.6 (B)
8	Channelled Valley Bottom	2.2	1.2	1.4	3.7	2.1 (C)
9	Seep	2.0	1.5	1.6	3.5	2.1 (C)
10	Depression	1.2	1.3	1.3	1.7	1.3 (B)
11	Depression	1.1	1.3	1.1	1.2	1.2 (B)
12	Seep	2.7	1.1	1.5	4.4	2.4 (C)
13	Seep	2.8	1.5	1.8	4.5	2.7 (C)
14	Seep	1.7	1.9	1.4	3.1	2.0 (C)

3.9 Aquatic Biodiversity

Data pertaining to the presence of aquatic faunal species potentially associated with the proposed BCR Coal Vlakfontein Mine was obtained from Darwall et al. (2009), Department of Water and Sanitation (2014), and various scientific collection databases including the Global Biodiversity Information Facility, Freshwater Biodiversity Information System, South African Institute for Aquatic Biodiversity, Albany Museum, and from the provincial records of Mpumalanga Tourism and Parks Agency. Based on the results obtained, the following is the estimated aquatic faunal diversity that could be associated with the proposed BCR Coal Vlakfontein Mine (Appendix A):

- Approx. six (6) species of fish, two (2) of which have not yet been evaluated in terms of the IUCN Red Listed categories;
- Approx. eighty-eight (88) species of Odonata (Dragonflies and Damselflies), two (2) of which are of conservation concern;
- Approx. two (2) species of crab, neither of which of conservation concern; and
- Approx. seventeen (17) species of mollusc, one (1) of which is listed as Data Deficient.

Table 5 provides a list of aquatic species of conservation concern occurring or potentially occurring within the proposed BCR Coal Vlakfontein Mine study area.

It should be noted that two (2) of the fish species identified as being associated with the reach of the Vaal River associated with the proposed BCR Coal Vlakfontein Mine represent species which are in need of taxonomic revision and/or a revised assessment of their threat status, namely *Enteromius cf. oraniensis* (Orange River Chubbyhead Barb) and *Enteromius sp. pallidus cf. 'north'* (Goldie Barb), both of which have not been adequately assessed in terms of the IUCN Red List categories. Review of collection records obtained for the larger study area from the South African Institute for Aquatic Biodiversity (SAIAB) confirms collection of both species within the Vaal River downstream of the proposed BCR Coal Vlakfontein Mine on the farm Welgelegen 107 IT.

While the conservation status of the *Enteromius anoplus* species complex itself has been determined to be of Least Concern (Woodford, 2017), the very recent studies of Kambikambi et al. (2021) have described several new species from the complex, with more new species descriptions expected. Consequently, the results obtained by Kambikambi et al. (2021) indicate that the current IUCN Red List assessment of *E. anoplus* is obsolete. It is, therefore, clear that further studies are required to understand the geographic ranges and thus conservation status of the unique populations of this *Enteromius* group to determine the significance of those specimens that may be present within the reach of the Vaal River associated with the proposed BCR Coal Vlakfontein Mine. Accordingly, the conservation status for the *Enteromius cf. oraniensis* population which is the only Chubbyhead Barb described from the species complex within the larger Orange River Catchment (and within which the Vaal River falls), is also considered Data Deficient.

Similarly, according to Chakona et al. (2015), genetic analyses of *Enteromius pallidus* collected from the currently known distribution of the species within South Africa grouped specimens into two distinct lineages, namely a southern lineage from where the original type specimen was collected, and a northern lineage. Further, the deep genetic divergence between the northern and southern lineages of *E. pallidus* suggests a

long history of isolation, raising two taxonomic possibilities. The first possibility is that the northern lineage of *E. pallidus* may represent an undescribed species. A second possibility is that the 'true' *E. pallidus* is confined to coastal rivers of the Eastern Cape, and the northern lineage belongs to a different, but known species or species complex. However, further research is required to resolve this taxonomic uncertainty between the two genetically distinct lineages to determine implications on conservation priorities. Accordingly, the species is regarded as not having a formal conservation status until such time as taxonomic resolution and a re-assessment of the population extent has been determined.

Table 5: Aquatic species of special concern potentially associated with the proposed BCR Coal Vlakfontein Mine

Species	Common Name	Red List Category	Assessment	Endemism
Mollusca				
Burnupia caffra	-	DD	Regional - South Africa	Not endemic
Odonata				
Chlorocypha consueta	Southern Red Jewel	RE	Regional - South Africa	Not endemic
Diplacodes pumila	Dwarf Percher	EN	Regional - South Africa	Endemic
Lestes uncifer	Sickle Spreadwing	NT	Regional - South Africa	Not endemic
Fish				
Enteromius cf. oraniensis	Orange River Chubbyhead Barb	NE	N/A	Endemic
Enteromius sp. pallidus cf. 'north'	Goldie Barb	NE	N/A	Endemic

* EN = Endangered; DD = Data Deficient; NE = Not Evaluated; NT = Near Threatened; RE = Regionally Extinct;

4. PROVISIONAL IDENTIFICATION & DESCRIPTION OF POTENTIAL IMPACTS

Any activities associated with a natural system, whether historic, current, or proposed, will impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was to identify potential impacts associated with the proposed BCR Coal Vlakfontein Mine area.

Site establishment, mining, and its related activities can have the following types of impacts:

- *Direct impacts* are those impacts directly linked to the project (e.g. clearing of land). These can be temporary or remain as residual impacts;
- *Indirect impacts* are those impacts resulting from the project that may occur beyond or downstream of the boundaries of the project site and/or after the project activity has ceased (e.g. migration of pollutants from road surfaces);
- *Induced impacts* are impacts that are not directly attributable to the project, but are anticipated to occur because of the presence of the project (e.g. impacts of associated expansion of residential settlements with increased pressure on biodiversity);
- *Cumulative impacts* are those impacts from the project combined with the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity or natural resources (e.g. a number of roads in the same catchment or ecosystem type collectively affected water quality or flow).

Many of the above impacts are not only a result of the direct impact on a particular species, but rather due to what is known as the '*Edge Effect*', which can be explained as follows:

> Ecosystems consist of a mosaic of many different patches. The size of natural patches affects the number, type and abundance of species they contain. At the periphery of natural patches, influences of neighbouring environments become apparent; this then is the '*Edge Effect*'.

Patch edges may be subjected to degradation due factors such as increased levels of heat, dust, desiccation, disturbance, invasion of exotic species and other negative agents. Edges seldom contain species that are rare, habitat specialists or species that require larger tracts of undisturbed core habitat to survive in the long term. Fragmentation due to development reduces core habitat and greatly extends edge habitat, which causes a shift in the species composition, which in turn puts great pressure on the dynamics and functionality of ecosystems (Perlman & Milder, 2005).

4.1 Nature of Impacts

4.1.1 Direct loss of wetland features

The presence of numerous wetland features within the proposed BCR Coal Vlakfontein Mine area is likely to result in the direct loss of some wetland systems. The proposed activity is further expected to result in impacts to drivers of wetland features adjacent to and/or downstream of the proposed mining areas, resulting in the degradation and loss of ecosystem services provided by wetlands.

4.1.2 Erosion and sedimentation of wetlands and watercourses adjacent to and downstream of proposed mining activities

While the placement of various infrastructure associated with the proposed BCR Coal Vlakfontein Mine may not result in the direct loss of wetland habitat, activities associated with the establishment of the mine are likely to impact the adjacent and downstream wetlands through the clearing of natural vegetation, altered overland flow and sediment transport. Further, the use of heavy machinery within the construction footprint will lead to soil compaction, which increases the bulk density and therefore reduces the infiltration rate of stormwater into the soil profile. This leads to increase in overland flow and the increased likelihood of erosion gully formation and associated deposition of sediment within the associated wetlands. In addition, the presence of bare soil associated with stockpiles during mining activities will result in a change in the stormwater runoff volume and velocity entering adjacent wetland systems.

4.1.3 Water quality deterioration

Mismanagement of mine-generated waste and pollutants (including hydrocarbons, construction waste, hazardous chemicals, etc.) is likely to result in these substances or their derivatives entering and polluting the aquatic environments either directly through surface runoff during rainfall events, or subsurface water movement. An increase in pollutants will lead to changes in the water quality of the remaining wetlands and watercourses, affecting their ability to act as ecological corridors and provide ecosystem services within the larger landscape. The linked nature of the wetland systems to downstream water resources will result in

pollutants being carried downstream from the mine construction site having consequences on further downstream users.

Various stockpiles will be likely be located within the area, including overburden, topsoil, throw out and emergency stockpiles, and will be characterised by bare soil and steep side slopes that generate significant surface run-off. Run-off from these stockpiles is likely to be sediment rich, while carbonaceous stockpiles (if any) might also generate acid rock drainage as pyrites in the overburden are exposed to oxygen. Where uncontrolled run-off from these stockpiles enters adjacent wetlands, water quality deterioration is likely to result, including increases in turbidity, sulphates, and metal concentrations (e.g. aluminium and Iron), and a drop in pH.

If no mitigation measures are implemented following the completion of mining activities, the void of the opencast pits will be filled with unconsolidated material of differing physical properties. If there is an elevated pyrite content associated with fill material, these voids would start to generate sulphates and acid when the void fills with water. The mine drainage water exiting the mine area at the decant point then leads to the establishment of an acid and/or sulphate-rich seep, resulting in downstream water quality deterioration. This is of particular concern given the classification of the study area as being a SWSA, and origin of the Vaal River and mitigation measures would need to address this potential impact.

4.1.4 Loss of Biodiversity

Mining activities, including blasting, is expected to result in the loss of biodiversity features within the immediate area, and as result, a depauperate aquatic biodiversity assemblage downstream of the proposed mining activities. This impact is of particular relevance given that currently undescribed fish species of potential conservation concern are known to be present within the reach of the Vaal River downstream of the proposed BCR Coal Vlakfontein Mine and may utilise the watercourses associated with the proposed mine for spawning or breeding purposes. The blasting associated with mining therefore has the potential to disrupt spawning or breeding behaviour through generation of vibrations and movement of aquatic habitat. Noise generated through mining activities is further expected to result in a localised decrease in amphibian species as a result of decreased mate attraction during breeding periods.

The further likelihood of acid or sulphate-rich decant emanating from the filled void is further likely to result of a loss of aquatic diversity within the Vaal River system, resulting in the dominance of aquatic biota having a high tolerance to modified water quality, with the diatom assemblage expected to be dominated by species with a high affinity for industrially-impacted waters and a high proportion of valve deformities.

4.1.5 Invasive alien plant species encroachment

Alien invasive trees and shrubs are expected to increase within the area as these species tend to invade areas that have been disturbed (e.g. on stockpiles and excavated or eroded areas). Such disturbed areas are likely to act as seed areas that will ultimately facilitate the invasion of associated watercourses and riparian areas. Alien species generally out-compete indigenous species for water, light, space and nutrients as they are adaptable to changing conditions and are able to easily invade a wide range of ecological niches, posing an

ecological threat as they alter habitat structure, lower biodiversity (both number and "quality" of species), change nutrient cycling and productivity, and modify food webs.

5. CONCLUSION

5.1 Summary of Desktop Verification Outcome

The desktop investigation of the study area for the proposed BCR Coal Vlakfontein Mine has confirmed the classification of the study area as being located within an area regarded as being of very high sensitivity from the perspective of the aquatic ecosystem (Table 6). As such, a detailed aquatic biodiversity specialist assessment as well as a detailed wetland specialist assessment would be required as part of the Environmental Impact Assessment phase of the study.

Table 6: Screening tool results for the proposed BCR Coal Vlakfontein Mine study area

SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
FRESHWATER IMPACT ASSESSMENT			
Very high	**Very High**	Aquatic Biodiversity Specialist Assessment; & Wetland Specialist Assessment	Section 1.1

5.2 Potential Red Flags

For the purpose of determining possible fatal flaws associated with the proposed project, the definition of the term "fatal flaw" is taken to mean a major defect or deficiency in a project proposal that should result in environmental authorisation being refused, and from a biodiversity perspective, a residual negative impact that would have a Very High significance rating (Department of Forestry Fisheries and the Environment, 2021). In this respect, residual impacts in this category cannot be fully compensated by offsets because of the high threat status or irreplaceability of affected biodiversity or ecosystem services. Impacts in this category would generally be unacceptable and could lead to:

- irreversible and irreplaceable loss of ecosystem or species such as impacts on –
    - Critical Biodiversity Areas: Irreplaceable (CBA 1), especially where the feature(s) driving the designation as a CBA 1 is significantly negatively affected or will be compromised beyond its Biodiversity Target;
    - protected areas, and more particularly, the natural or near natural parts of protected areas;
    - Critically Endangered ecosystems outside of CBAs;
    - confirmed habitats of Critically Endangered species, where those areas have not been included in CBA1s;
    - Ramsar sites;
- irreplaceable loss of key ecological corridors recognised as important for evolutionary processes and climate change adaptation where no spatial options to safeguard these processes exist; and
- irreversible or irreplaceable loss of highly valued ecological infrastructure at national or provincial scale and/or where there is a high level of dependence on the associated ecosystem services by local communities for livelihoods and health, and no feasible substitutes.

According to the 2018 National Biodiversity Assessment, all wetland features associated with the proposed BCR Coal Vlakfontein Mine footprint as well as the watercourses adjacent to the proposed mine are classified as Critically Endangered, thus impacts on such features are likely to present as having a very high significance, and thus constituting a fatal flaw.

Further, under the draft National Biodiversity Offset Guideline (Department of Forestry Fisheries and the Environment, 2021), the freshwater ecosystem attributes (e.g. various FEPA designations, location in a Strategic Water Source Area, associated Ecological Support Areas from a freshwater ecosystem perspective, located within a short distance from a protected area and within protected area expansion zones, etc.) if assessed individually would at present qualify as reaching the threshold of major potential concern according to the guidelines, and thus not constitute a "fatal flaw". However, taken together, the likely impact when combined would likely present a very high impact significance, thus constituting a fatal flaw. It should further be understood that the National Biodiversity Offset Guideline on which the above is based is currently in draft formal and not formally promulgated, and as such is subject to change.

In addition, previous communication with the Department of Water and Sanitation indicated that the department was in the process of proposing an amendment to Chapter 3 of the National Water Act to include general prohibitions and restrictions within SWSAs for various activities including opencast and underground mining (Atwaru, 2020), thereby acknowledging the importance of such areas on water security at a national level and adding additional weight to the potential for very high impact significance. As such, the location of approximately 84% of the study area (including all of the larger proposed eastern pit and much of the proposed western pit) within the designated Upper Vaal SWSA is alone likely to present a significant limiting factor in the environmental application process as well as presenting as a potential fatal flaw, as loss of such areas are likely to impact strategically important ecological infrastructure assets at the national level that supply water to sustain the downstream population, economy activity and agricultural activities. It should be further understood that offsetting the ecosystem services associated with Strategic Water Source Areas is unlikely to be feasible given the inherent properties associated with such features.

From a spatial biodiversity perspective, Mpumalanga Tourism and Parks Agency undertook a planning exercise to incorporate biodiversity priorities into land-use planning and decision-making by multiple land-use sectors, ultimately resulting in a set of land-use guidelines. The overall purpose of these land-use guidelines is to promote the effective management of biodiversity as required in Section 41(a) of the Biodiversity Act (Act 10 of 2004, as amended) and in terms of the National Environmental Management Act (Act 107 of 1998, as amended). The guidelines provide advice on which land-uses and activities are most compatible with maintaining the ecological integrity of CBAs and ESAs, and other parts of the landscape, based on the desired management objectives for the land and the anticipated impact of each land-use activity on biodiversity patterns and ecological processes. These guidelines are intended primarily to guide planning and decision-making in terrestrial and freshwater CBAs and ESAs on land outside of protected areas (Mpumalanga Tourism and Parks Agency, 2014).

In review of the biodiversity categories developed by the Mpumalanga Tourism and Parks Agency from the perspective of freshwater ecosystems, the designation of the watercourses associated with the proposed

BCR Coal Vlakfontein Mine as ESAs poses several challenges to the activity proposed (i.e. opencast coal mining). Based on the land-use guidelines of the MBSP, opencast mining is expected to compromise the biodiversity objective determined for the area in question, and accordingly is not permissible by the Mpumalanga Tourism and Parks Agency (2014).

Of further relevance to the present study is the potential and/or confirmed presence of undescribed fish species within the Vaal River which will receive water from the proposed BCR Coal Vlakfontein Mine in the event of discharge of mine-affected water and/or decant following closure of the mine. These species, once considered extensions of a known species, have recently been acknowledged to be novel species that are yet to be fully described taxonomically, and their distribution and relationship with other similar species determined, which is reflected in the FEPA designation of the catchment. As underestimation of species diversity has been identified as a major impediment to the implementation of effective conservation strategies to prevent biodiversity loss (Bickford et al., 2007), failure to consider such species within the context of the proposed activity is likely to pose a significant concern to the environmental application process.

5.3 Plan of Study for Environmental Impact Assessment

Based on the results obtained during the present study, it was determined that both aquatic and wetland specialist studies will be required to inform the Environmental Impact Assessment. In this regard, all aquatic and wetland studies are to ensure compliance with the procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (Act 107 of 1998) and Water Use Licence Application process. Given the high sensitivities of the freshwater ecosystems associated with the proposed BCR Coal Vlakfontein Mine, it was further determined that such specialist studies are to be conducted at a detailed level, and that an aquatic and/or wetland compliance statement are not deemed to be applicable on the basis of the sensitivities identified during the present exercise.

A detailed Terms of Reference for the aquatic and wetland assessments is provided below and should be read together with the minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (Act 107 of 1998), as well as the Natural Scientific Professions Act (Act 27 of 2003).

5.3.1 Aquatic Specialist Assessment

In addition to the general requirements for specialist studies, the following are deemed applicable to aquatic specialist assessments:

- Ideally, two (2) seasonal aquatic studies are to be conducted for the purpose of establishing a baseline for the associated aquatic ecosystem and to inform a monitoring approach to be undertaken should the proposed mine receive authorisation. Where the aquatic assessment is to be conducted during a single season only, a single comprehensive aquatic ecosystem assessment is to be conducted following sufficient summer rainfall and inundation of the associated watercourses for a period of at least six (6) weeks prior to the study commencing. As such, it is expected that unless significant early summer rainfall occurs within the upper catchment, studies of the associated aquatic ecosystem are

expected to take place within the early part of the summer period (i.e. between November and December);

- Aquatic macroinvertebrates sampled within the study area, specifically Odonata, are to be identified to the lowest possible taxonomic level (i.e. lower than Family level) in order to determine the possible presence of species of conservation concern;
- A detailed ichthyofaunal assessment is to be undertaken within the reach of the Vaal River and Unnamed Tributary both upstream and downstream of the watercourses originating from the proposed Mineral Rights Area. During the assessment, the relative density and diversity of fish species is to be investigated for each site, with specific attention given to the presence of species of conservation concern and as-yet undescribed species;
- All aquatic data collection is to be done in a manner that is non-destructive, unless the relevant permits are obtained from the Mpumalanga Tourism and Parks Agency. Any samples collected on-site are to be lodged with the South African Institute for Aquatic Biodiversity (SAIAB);
- Potential spawning habitat for identified species of conservation concern, Protected and/or endemic species is to be identified;
- Determination of the PES of the associated watercourses is to be determined by the EcoStatus approach (i.e. by means of the Macro-Invertebrate Response Assessment Index, Fish Response Assessment Index, etc.);
- A detailed monitoring programme is to be developed as part of the assessment, that will take effect immediately upon authorisation so as to allow for collection of suitable pre-mining data that will inform the monitoring of potential impacts;
- The aquatic specialist must provide input into a biodiversity management plan to be developed for the mine, with specific consideration given to the identified sensitivities;
- The identified aquatic specialist who is to conduct the aquatic assessment is to have expertise in aquatic macroinvertebrate identification below family level, have expertise in fish taxonomy and identification, and have expertise in the application of the EcoStatus suite of indices.
- Ideally, the identified aquatic specialist is to have >10 years' experience in conducting aquatic assessments. Where this is not possible, the specialist is to have at least 5 years' experience in conducting specialist aquatic assessments, with proven competence in freshwater fish assessments.

5.3.2 Wetland Specialist Assessment

In addition to the general requirements for specialist studies, the following are deemed applicable to the wetland specialist assessment:

- Wetlands within the study area as well as within 1 km of the study area are to be delineated using the guidelines as published by the DWAF (2005) entitled "A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas". However, a pragmatic approach should be taken if any problematic soil types are encountered, and the delineation of wetlands in such soil types supported;
- The wetland delineation component of the specialist report should include the following information as a minimum:
    - A description of how and when the delineation was done;
    - A description of the catchment, landscape, landscape position, topography (slopes – concave, convex, flat etc., and slope changes), vegetation, soils and hydrological conditions

including a summary of the available information used to determine the extent of wetland habitat;
    - Review of historical imagery and anecdotal evidence;
    - Site maps identifying the boundary of the wetland within the study area, plus an indication if the wetland extends outside the site boundary, albeit only at a desktop level if access is restricted or difficult in those areas, and the location of all data collection points recorded during the study. This should also include information on the type and date of imagery used to support the delineation;
    - All sample points used by the delineator to determine the boundary of the wetland must be recorded using a Global Positioning System (GPS). The GPS used during the study and the accuracy of the GPS should be stipulated in the reporting to highlight potential inaccuracies in the boundaries presented on the map;
- All delineated wetlands are to be classified according to Ollis et al. (2013);
- All delineated wetlands to be assessed in terms of health and functionality (hydrological, ecological and ecosystem services) using recognised tools (e.g. Wet-Health, Wet-EcoServices, Wet-IHI, etc.), taking cognisance of recent findings regarding the limitations of such tools on certain hydrogeomorphic types;
- Consideration should at all times be given to the drivers and responses of wetland formation/support for delineated wetlands when considering potential impacts associated with the proposed mining activity. In this regard, the wetland specialist is to take cognisance of the findings obtained from the hydropedological assessment of the site in determining the potential impact on landscape-level wetland drivers;
- The wetland specialist is to take further cognisance of the findings of the soil, floral and groundwater assessments completed for the study as all these studies may contribute to and/or support the findings of the wetland assessment;
- Ideally, the identified wetland specialist conducting the assessment is to have >10 years' experience in conducting wetland specialist assessments. Where this is not possible, the specialist is to have at least 5 years' experience in conducting specialist wetland assessments. Additional expertise in soil science is mandatory given the potential for problematic soils to be present within the study area.

5.4 Acceptability of the Proposed Activity

Based on information obtained during the desktop site sensitivity verification assessment, it is concluded that the proposed BCR Coal Vlakfontein Mine is likely to result in a direct loss of wetlands determined to be in a largely natural state and identified as being FEPAs within a designated SWSA and Fish Sanctuary. While it is acknowledged that some mining activities are already located within the catchment of HGM 1, such activities were determined to fall outside the boundaries of the designated SWSA and not directly located within wetlands identified as being FEPAs. It should also be noted that it is understood that the Department of Water and Sanitation were in the process of proposing an amendment to Chapter 3 of the National Water Act to include general prohibitions and restrictions within SWSAs for various activities including opencast and underground mining (Atwaru, 2020), thereby acknowledging the importance of such areas on water security at a national level.

In addition, according to the Resource Quality Objectives set for the Upper Vaal (Department of Water and Sanitation, 2016), the Recommended Ecological Category (REC) determined for the catchment within which the proposed mine is to be located is set as an Ecological Category B, and is reflected as such within the numerical limits set for instream habitat, aquatic macroinvertebrates, fish, riparian vegetation, hydrology and water quality. In addition, the Resource Quality Objective set for the catchment state that '*salt concentrations must be maintained to meet quality requirements for agriculture and to maintain the ecosystem wellbeing*', an objective that will be unlikely to be achieved should additional mining activities impact the water quality and quantity within the catchment through mining of wetlands and inadvertent or unintentional release of mine-affected water into the catchment.

Based solely on the outcomes of the thorough desktop assessment of the of the freshwater ecosystem assessment and in consideration of the associated freshwater ecosystem characteristics, it is the opinion of the authors that the mine is not supported from a freshwater ecosystem perspective. It must be noted that the opinion given in this report should be utilised as preliminary 'red flags' for the proposed activity within the site. The opinion of the authors could change depending on the outcomes of Phase 2 of the assessment, and in particular the findings of the field-based investigation. This information is not yet known and is thus a limitation to the reasoned opinion given. Furthermore, the opinion does not take into consideration any proposed mitigation measures or layout changes that could reduce the impact of the mining activities on the freshwater ecosystems identified, as feasibility of proposed mining extents are to be carefully considered based on the outcomes of the various desktop assessments conducted for the proposed project. Assessment of feasible alternatives will therefore be conducted as part of Phase 2 of the proposed plan of study.

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APPENDIX A: FRESHWATER FAUNAL SPECIES POTENTIALLY ASSOCIATED WITH THE STUDY AREA

Molluscs

Species	Common Name	Red List Category	Assessment	Endemism
Africanogyrus coretus		LC	Global	Non-endemic
Biomphalaria pfeifferi		LC	Global	Non-endemic
Bulinus africanus		LC	Regional - South Africa	Non-endemic
Bulinus forskalii		LC	Regional - South Africa	Non-endemic
Bulinus reticulatus		LC	Regional - South Africa	Non-endemic
Bulinus tropicus		LC	Regional - South Africa	Non-endemic
Burnupia caffra		DD	Regional - South Africa	Non-endemic
Ceratophallus natalensis		LC	Regional - South Africa	Non-endemic
Corbicula fluminalis		LC	Regional - South Africa	Non-endemic
Eupera ferrunginea		LC	Regional - South Africa	Non-endemic
Galba truncatula		LC	Regional - South Africa	Non-endemic
Gyraulus costulatus		LC	Regional - South Africa	Non-endemic
Lymnaea columella		Introduced	Regional - South Africa	Non-endemic
Lymnaea natalensis		LC	Regional - South Africa	Non-endemic
Lymnaea trunculata		LC	Regional - South Africa	Non-endemic
Melanoides tuberculata		LC	Regional - South Africa	Non-endemic
Unio caffra		LC	Regional - South Africa	Endemic

Crabs

Species	Common Name	Red List Category	Assessment	Endemism
Potamonautes calcaratus		LC	Regional - South Africa	Endemic
Potamonautes sidneyi	Natal/Sidney's River Crab	LC	Regional - South Africa	Endemic

Odonata

Species	Common Name	Red List Category	Assessment	Endemism
Acisoma panorpoides	Asian Pintail	LC	Global	Non-endemic
Aethriamanta rezia	Pygmy Basker	LC	Global	Non-endemic
Africallagma glaucum	Swamp Bluet	LC	Global	Non-endemic
Africallagma sinuatum	Sprite Bluet	LC	Global	Non-endemic
Agriocnemis exilis	Little Wisp	LC	Global	Non-endemic
Agriocnemis pinheyi	Pinhey's Wisp	LC	Global	Non-endemic
Anaciaeschna triangulifera	Evening Hawker	LC	Global	Non-endemic
Anax ephippiger	Vagrant Emperor	LC	Global	Non-endemic
Anax imperator	Emperor Dragonfly	LC	Global	Non-endemic
Anax speratus	Orange Emperor	LC	Global	Non-endemic
Anax tristis	Black Emperor	LC	Global	Non-endemic
Azuragrion nigridorsum	Sailing Azuret	LC	Global	Non-endemic
Brachythemis lacustris	Red Groundling	LC	Global	Non-endemic
Brachythemis leucosticta	Banded Groundling	LC	Global	Non-endemic
Bradinopyga cornuta	Flecked Wall-skimmer	LC	Global	Non-endemic
Ceratogomphus pictus	Common Thorntail	LC	Global	Non-endemic
Ceriagrion glabrum	Common Waxtail	LC	Global	Non-endemic
Chlorocypha consueta	Southern Red Jewel	RE	Regional - South Africa	Non-endemic
Crenigomphus hartmanni	Clubbed Talontail	LC	Global	Non-endemic
Crocothemis erythraea	Common Scarlet-darter	LC	Global	Non-endemic
Crocothemis sanguinolenta	Little Scarlet	LC	Global	Non-endemic
Diplacodes lefebvrii	Black Percher	LC	Global	Non-endemic
Diplacodes luminans	Barbet Percher	LC	Global	Non-endemic
Diplacodes pumila	Dwarf Percher	EN	Regional - South Africa	Endemic
Elattoneura glauca	Grey Threadtail	LC	Global	Non-endemic

Gynacantha manderica	Little Dusk-hawker	LC	Global	Non-endemic
Hemistigma albipunctum	African Pied-spot	LC	Global	Non-endemic
Ictinogomphus ferox	Common Tiger	LC	Global	Non-endemic
Ischnura senegalensis	Tropical Bluetail	LC	Global	Non-endemic
Lestes dissimulans	Cryptic Spreadwing	LC	Global	Non-endemic
Lestes pallidus	Pallid Spreadwing	LC	Global	Non-endemic
Lestes plagiatus	Highland Spreadwing	LC	Global	Non-endemic
Lestes tridens	Spotted Spreadwing	LC	Global	Non-endemic
Lestes uncifer	Sickle Spreadwing	NT	Regional - South Africa	Non-endemic
Lestes virgatus	Smoky Spreadwing	LC	Global	Non-endemic
Lestinogomphus angustus	Spined Fairytail	LC	Global	Non-endemic
Mesocnemis singularis	Savanna Brook-damsel	LC	Global	Non-endemic
Nesciothemis farinosa	Eastern Blacktail	LC	Global	Non-endemic
Notiothemis jonesi	Eastern Elf	LC	Global	Non-endemic
Notogomphus praetorius	Yellowjack Longlegs	LC	Global	Non-endemic
Onychogomphus supinus	Gorge Claspertail	LC	Global	Non-endemic
Orthetrum abbotti	Abbott's Skimmer	LC	Global	Non-endemic
Orthetrum caffrum	White-lined Skimmer	LC	Global	Non-endemic
Orthetrum chrysostigma	Epaulet Skimmer	LC	Global	Non-endemic
Orthetrum icteromelas	Spectacled Skimmer	LC	Global	Non-endemic
Orthetrum julia	Julia Skimmer	LC	Global	Non-endemic
Orthetrum machadoi	Highland Skimmer	LC	Global	Non-endemic
Orthetrum stemmale	Bold Skimmer	LC	Global	Non-endemic
Orthetrum trinacria	Long Skimmer	LC	Global	Non-endemic
Palpopleura jucunda	Yellow-veined Widow	LC	Global	Non-endemic
Palpopleura lucia	Lucia Widow	LC	Global	Non-endemic
Palpopleura portia	Portia Widow	LC	Global	Non-endemic

Pantala flavescens	Globe Wanderer	LC	Global	Non-endemic
Paragomphus cognatus	Boulder Hooktail	LC	Global	Non-endemic
Paragomphus elpidius	Corkscrew Hooktail	LC	Global	Non-endemic
Paragomphus genei	Common Hooktail	LC	Global	Non-endemic
Phaon iridipennis	Glistening Demoiselle	LC	Global	Non-endemic
Phyllomacromia contumax	Two-banded Cruiser	LC	Global	Non-endemic
Pinheyschna subpupillata	Stream Hawker	LC	Global	Non-endemic
Platycypha caligata	Dancing Jewel	LC	Global	Non-endemic
Pseudagrion commoniae	Black Sprite	LC	Global	Non-endemic
Pseudagrion gamblesi	Great Sprite	LC	Global	Non-endemic
Pseudagrion hageni	Painted Sprite	LC	Global	Non-endemic
Pseudagrion hamoni	Swarthy Sprite	LC	Global	Non-endemic
Pseudagrion kersteni	Powder-faced Sprite	LC	Global	Non-endemic
Pseudagrion massaicum	Masai Sprite	LC	Global	Non-endemic
Pseudagrion salisburyense	Slate Sprite	LC	Global	Non-endemic
Pseudagrion spernatum	Upland Sprite	LC	Global	Non-endemic
Pseudagrion sublacteum	Cherry-eye Sprite	LC	Global	Non-endemic
Rhyothemis semihyalina	Phantom Flutterer	LC	Global	Non-endemic
Sympetrum fonscolombii	Red-veined Darter	LC	Global	Non-endemic
Tholymis tillarga	Evening Skimmer	LC	Global	Non-endemic
Tramea basilaris	Keyhole Glider	LC	Global	Non-endemic
Tramea limbata	Voyaging Glider	LC	Global	Non-endemic
Trithemis aconita	Halfshade Dropwing	LC	Global	Non-endemic
Trithemis annulata	Violet-marked Darter	LC	Global	Non-endemic
Trithemis arteriosa	Red-veined Dropwing	LC	Global	Non-endemic
Trithemis donaldsoni	Twig Dropwing	LC	Global	Non-endemic
Trithemis dorsalis	Lake Dropwing	LC	Global	Non-endemic

Trithemis furva	Navy Dropwing	LC	Global	Non-endemic
Trithemis kirbyi	Kirby's Dropwing	LC	Global	Non-endemic
Trithemis pluvialis	Russet Dropwing	LC	Global	Non-endemic
Trithemis stictica	Jaunty Dropwing	LC	Global	Non-endemic
Urothemis edwardsii	Blue Basker	LC	Global	Non-endemic
Zosteraeschna minuscula	Friendly Hawker	LC	Global	Non-endemic
Zygonoides fuelleborni	Southern Riverking	LC	Global	Non-endemic
Zygonyx natalensis	Blue Cascader	LC	Global	Non-endemic
Zygonyx torridus	Ringed Cascader	LC	Global	Non-endemic

Fish

Species	Common Name	Red List Category	Assessment	Endemism	Provincial
Enteromius cf. oraniensis	Orange River Chubbyhead Barb	NE	-	Endemic	-
Enteromius sp. pallidus cf. 'north'	Goldie Barb	NE	-	Endemic	-
Enteromius paludinosus	Straightfin Barb	LC	National	Non-endemic	LC
Clarias gariepinus	Sharptooth Catfish	LC	National	Non-endemic	LC
Pseudocrenilabrus philander	Southern Mouthbrooder	LC	National	Non-endemic	LC
Tilapia sparrmanii	Banded Tilapia	LC	National	Non-endemic	LC

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