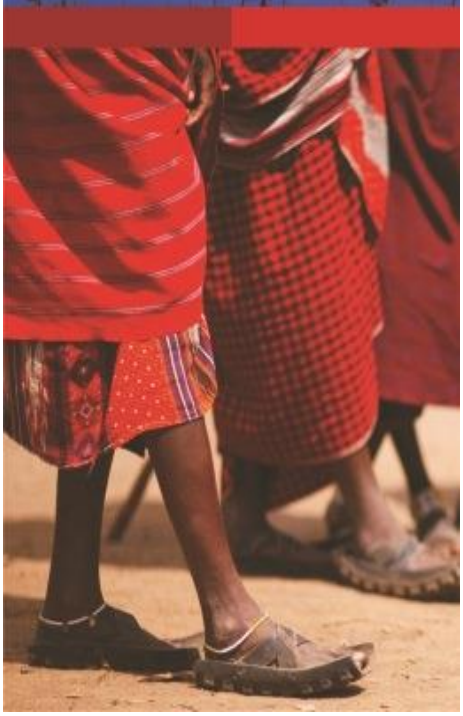

DIGBY WELLS
ENVIRONMENTAL

Wetland Delineation for the undermined areas at Matla Mine 2

Wetland Sensitivity Mapping and Impact Assessment (Draft)

Project Number:

EXX4884

Prepared for:

Exxaro Resources

exxaro
POWERING POSSIBILITY

January 2018

Digby Wells and Associates (South Africa) (Pty) Ltd
Co. Reg. No. 2010/008577/07. Turnberry Office Park, 48 Grosvenor Road, Bryanston, 2191. Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 069 6801, info@digbywells.com, www.digbywells.com

This document has been prepared by Digby Wells Environmental.

Report Type:	**Wetland Sensitivity Mapping and Impact Assessment (Draft)**
Project Name:	**Wetland Delineation for the undermined areas at Matla Mine 2**
Project Code:	**EXX4884**

Name	Responsibility	Signature	Date
Kathryn Roy	Wetland Specialist and Report Writer		8 January 2018
Kieren Bremner	Wetland Specialist, Report Writer and Report Reviewer		8 January 2018
Danie Otto (Pr.Sci.Nat.)	Senior Specialist and Reviewer		

DECLARATION OF INDEPENDENCE

Digby Wells and Associates (South Africa) (Pty) Ltd

Contact person: Kieren Bremner

Digby Wells House
Turnberry Office Park
48 Grosvenor Road
Bryanston
2191

Tel: 011 789 9495
Fax: 011 789 9498
E-mail: kieren.bremner@digbywells.com

I, Kieren Bremner, as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Exxaro Resources, other than fair remuneration for work performed, specifically in connection with the Matla Mine 2 wetland delineation and impact assessment.

Full name:	Kieren Jayne Bremner
Title/ Position:	Aquatic and Wetlands Ecologist
Qualification(s):	MSc Aquatic Health
Experience (years):	10

EXECUTIVE SUMMARY

Digby Wells Environmental [DWE] (hereinafter Digby Wells) was appointed by Exxaro Resources (hereinafter Exxaro) to conduct a wetland assessment including sensitivity mapping of wetlands in areas earmarked for future underground mining, as well as an updated wetland sensitivity map and wetland integrity assessment of wetland habitat in the vicinity of Panels 6, 7 and 8 associated with Matla Mine 2, where rehabilitation measures have commenced.

Wetland Delineations and Sensitivity Mapping

Fourteen hydro-geomorphic (HGM) wetland units were identified in the vicinity of the Matla Mine 2 project area comprising of two Channelled Valley Bottom Wetlands, two Un-channelled Valley Bottom wetlands, three Hillslope Seeps and seven Depressions.

Present Ecological State (PES)

The wetlands within the Project Area exhibit a variety of PES values, ranging from *Seriously Modified* (Category E), to *Largely Natural* (Category B) HGM Unit 8 and 10 are classified as *Largely Natural* (Category B) wetlands. These pans have not been impacted on to a great extent. The geomorphological and hydrological regimes have not been altered significantly and very little disturbance was observed with regards to vegetation. Eight *Moderately Modified* (Category C) wetlands were identified (HGM units 2, 3, 4, 5, 6, 7, 9 and 11). These wetlands were mainly impacted on by cultivation and/or grazing with few geomorphological impacts. Two *Largely Modified (*Category D*)* wetlands are present in the Project Area - HGM Unit 1 and HGM Unit 12. The *Largely Modified* category is mainly attributed to the subsidence in the area. Two *Seriously Modified* (Category E) wetlands were present. HGM Unit 13 and HGM Unit 14 have been seriously impacted on through subsidence, which has altered the hydrology of the wetland significantly as the subsidence has occurred perpendicular to the flow of the original wetlands, unlike that of HGM Unit 12, where subsidence occurred parallel to the wetland, therefore not completely altering the hydrology. Some canals have been constructed through the crests of the subsidence areas of HGM 13 and 14 to allow water to flow in the same direction of the original wetlands nevertheless the flow has been significantly impacted on.

Ecological Importance and Sensitivity

EIS score for the wetlands ranged from *Low* (0.7) to *Very High* (3.1). Although the wetlands are modified, they do still provide predominantly *Moderate* to *Low* hydrological importance services (mostly ranging between 0.5 and 1.7), such as flood attenuation and assimilation of toxicants and nitrates. HGM Unit 2 is an exception, with a *High* score. The Ecological Importance and Sensitivity category is ranging from *Low* (0.7) to *Very High* (3.1). Some HGM units have been completely transformed and therefore provide little habitat for fauna and flora, whilst others HGM units such as HGM Unit 2, still have intact vegetation where red data species were observed. In general, the values are *Low* for 'Direct Human Benefits' (most ranging between 0.1 and 1) as these wetland mainly fall within the mine fences and

mining rights area and therefore are not utilised as they would be in a unrestricted area. HGM unit is the only exception (2.5) as it is contains standing water utilised for fish purposes.

Impact Assessment

Among the impacts associated with the proposed project are potential impacts to soil and water quality as a result of the ingress of hydrocarbons and mechanical spills associated with moving machinery required for stockpiling.

Larger impacts include compaction of soils, potential loss of natural vegetation and the increased potential for erosion and sedimentation in the operational footprint.

Any potential stockpiling within wetland areas has the potential to result in loss of stream connectivity, loss of refuge areas, alterations to the terrain profiles of the areas and the creation of preferential flow paths, which may result in sedimentation, alterations to the vegetation structure of the area, encourage alien vegetation encroachment and result in increased erosion and sedimentation potentials.

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

By far, the most significant impact likely to affect the wetland systems present is the impact of subsidence, which is likely to result in altered hydrology and loss of biodiversity as a result of altered terrain profiles and vegetation structures. In addition, subsidence is likely to result in fragmentation of the wetland systems present, in turn, resulting in a loss of surface water recharge to the systems further downstream as well as a loss in catchment yield.

Summary and Ecological Opinion

Due to the proposed location of the underground mining areas, mining is likely to affect selected wetland areas as a result of subsidence, with special mention of HGM Units 1, 2 and 4. Impacts were found to range in extent, including both high and low impacts. Surface impacts related to transport of waste and product, vehicle movement and any surface infrastructure were regarded as low and may be further reduced with adequate mitigation and management. In contrast, impacts related to the underground mining are considered high.

It is the opinion of the ecologist that should this mining project proceed, further impacts to the ecology of the wetlands are deemed possible.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

DOCUMENT GUIDE

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	5
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	5
b)	A declaration that the specialist is independent	Pg. ii
c)	An indication of the scope of, and the purpose for which, the report was prepared	3
cA)	An indication of the quality and age of base data used for the specialist report	1.1
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	7.5

No.	Requirement	Section in report
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	7
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	7
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	10
g)	An identification of any areas to be avoided, including buffers	9.1
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	9.1
i)	A description of any assumption made and any uncertainties or gaps in knowledge	7.6
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	10
k)	Any mitigation measures for inclusion in the EMPr	10
l)	Any conditions for inclusion in the environmental authorisation	10
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	10.2
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	10.1
(iA)	Regarding the acceptability of the proposed activity or activities	10.1
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

GLOSSARY OF TERMS

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

LIST OF ACRONYMS

AIP	Alien Invasive Management Plan
BRP	Bioregional Plan
CMA	Catchment Management Agencies
DMR	Department of Mineral Resources

DWA	Department of Water Affairs
DWAF	Department of Water and Forestry
DWE	Digby Wells Environmental
DWS	Department of Water and Sanitation
EC	Ecological Class
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMF	Environmental Management Framework
EMO	Environmental Management Officer
F	Facultative species
FD	Facultative dry-land species
FW	Facultative wetland species
GIS	Geographical Information System
Ha	Hectares
HGM	Hydro-geomorphic
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MRA	Mining Right Area
NEM:BA	National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystems Priority Areas
NWA	National Water Act, 1998 (Act No. 36 of 1998)
OW	Obligate wetland species
PES	Present Ecological State
REC	Recommended Ecological Category
RQIS	Resource Quality Information Services
SANBI	South African National Biodiversity Institute
SFI	Soil Form Indicator
SWI	Soil Wetness Indictor
TUI	Terrain Unit Indicator
WMA	Water Management Areas
WRC	Water Research Commission

WUL	Water Use Licence

1 Introduction

Digby Wells Environmental [DWE] (hereinafter Digby Wells) was appointed by Exxaro Resources (hereinafter Exxaro) to conduct a wetland assessment including wetland sensitivity mapping and an impact assessment, as part of the proposed underground mining area associated with Matla Mine 2, henceforth referred to as the "Project area" (Figure 1-1), as well as provide updated sensitivity mapping and an integrity assessment of the wetlands present in the vicinity of Panels 6, 7 and 8 where rehabilitation activities have commenced.

1.1 Project Background

The Matla Coal complex is located within the Highveld Coal Fields of Mpumalanga, South Africa. The operation is situated approximately 10 km from the Kriel and Matla Power stations. The coal mine is predominantly located within Blesbokspruit/Rietspruit River catchment areas, which forms part of the Upper Olifants River sub-management area and the Olifants Water Management Area.

The regional ecosystem services are threatened by coal mining of Mpumalanga's extensive coal reserves. Coal mining causes destruction of wetlands through direct impacts such as removal of habitat, alteration of flow and contamination of water, but also indirectly through the drawdown of groundwater resources during the dewatering process. Impacts on water resources are significant and include the leaching of acid mine drainage into streams and rivers causing acidification and salinisation by dissolved sulfates. Wetland systems cannot be regarded as isolated entities but rather as complex interlinking systems; furthermore it is estimated that South Africa contains over 10 000 km^2 of hydraulically interlinked coal mines (Ochieng et al. 2010).

.

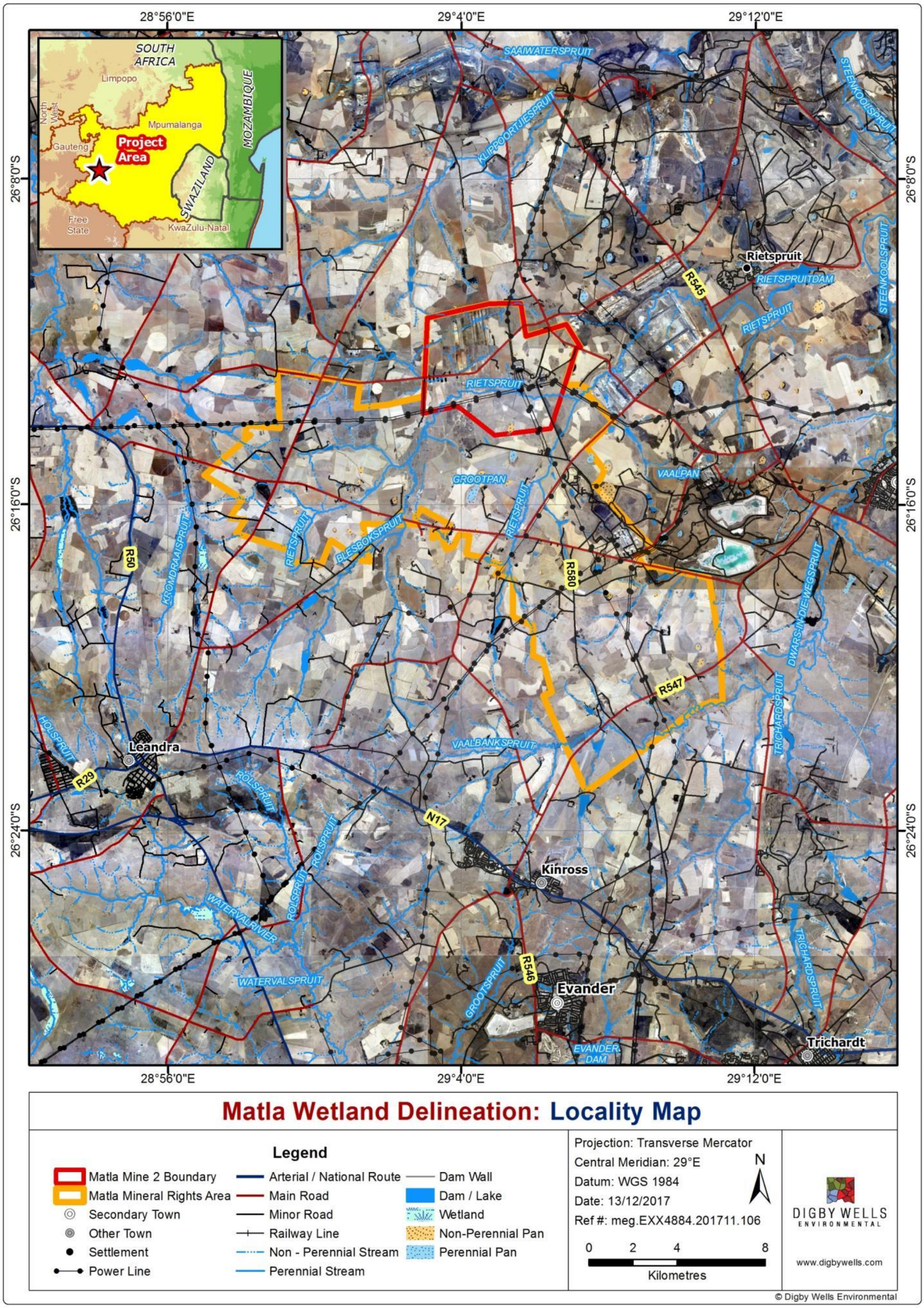

Figure 1-1: Local Setting

2 Terms of Reference

Digby Wells was commissioned by Exxaro to complete a Wetland Assessment for the proposed underground mining activities to take place at Malta's Mine 2, as well as for the wetlands in the vicinity of Panels 6, 7 and 8 where subsidence has occurred.

3 Scope of Work

The following actions are required for this Scope of Work:

- A description and characterisation of the identified wetland areas within the Matla Mine 2 boundary;
- Determination of the wetland ecological health, importance and sensitivity;
- Assessment of potential impacts to the wetlands from the activities; and
- Discussion of recommended mitigation measures to be taken into account.

4 Policy and Legal Framework

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

- Section 24 of the Constitution of the Republic of South Africa ,1996 (Act No. 108 of 1996);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA);
- Section 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- Department of Water and Forestry (DWAF) Guidelines for the Delineation of Wetlands (2005);
- Mining and Biodiversity Guideline (DEA *et al*., 2013);
- Wetland Management Series (published by Water Research Commission (WRC, 2007); and
- National Freshwater Ecosystems Priority Areas (NFEPA, Nel *et al.,* 2011).

5 Details of the Specialists

Kathryn Roy: Flora and Wetlands Consultant. Kathryn received a Bachelor of Science in Ecology and Environmental Science and an Honours degree in Environmental Management from the University of Cape Town. She also has received her MSc in Restoration Ecology through the University of KwaZulu-Natal. She joined Digby Wells in February 2016 to form part of the Mine Closure and Rehabilitation Department where she was responsible for

development of site specific rehabilitation plans, working closely with both the botany and soils specialists in Digby Wells. Her previous experience was gained in the Restoration Ecology Branch at the eThekwini Municipality in Durban.

Kieren Jayne Bremner: Wetlands Manager. Kieren completed an M.Sc (Aquatic Health) from the University of Johannesburg and has 10 years of consulting experience. In her early career she was exposed to various sectors of the Environmental Management field such as water use licensing, BAs, EIAs and public participation. During this time she was given the opportunity to initiate and manage various aquatic biomonitoring programmes within the mining and energy production sectors within South Africa. In 2009, Kieren began to focus largely on wetland and aquatic specialist assessments, gaining invaluable and extensive experience in the biomonitoring and water monitoring field in rivers and wetlands throughout South Africa. International countries of project experience include: Botswana, the Democratic Republic of Congo and Ghana. Kieren is registered by the SA RHP as an accredited aquatic biomonitoring specialist.

6 Aims and Objectives

The aim of the wetland study was to conduct an assessment on the wetland habitats associated with the Project area. This assessment determines the wetland boundaries and the baseline ecological state. This information is to inform the Project and relevant authorities on the risks associated with the wetland ecosystems (both historical and current) so that mitigation measures can be carried out according to best practice and to set a baseline against which to monitor impacts.

7 Methodology

7.1 Literature Review and Desktop Assessment

Wetlands are sensitive ecosystems that perform many complex functions. These functions include inter alia the maintenance of biodiversity and water quality, toxicant assimilation, carbon storage, streamflow regulation, flood attenuation, and various social benefits. (Wet-EcoServices Manual, 2008). The Ramsar Convention on Wetlands refers to wetlands as one of the most important life support systems on earth owing to the services provided.

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

- NFEPA (Nel *et al*., 2011);
- Mining and Biodiversity Guidelines;
- Water Management Areas (WMA) and Quaternary Catchments; and

- Mpumalanga Biodiversity Sector Plan.

7.1.1 National Freshwater Ecosystem Priority Areas

The NFEPA project provides a collated, nationally consistent information source of wetland and river ecosystems for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes (Nel *et al.* 2011). The spatial layers (FEPA's) include the nationally delineated wetland areas that are classified into hydrogeomorphic (HGM) NFEPA project types and ranked in terms of their biodiversity importance. These layers were assessed to evaluate the importance of the wetland areas located within the Project area.

Whilst being an invaluable tool, it is important to note that the NFEPA's were delineated and studied at a desktop and low resolution level. Thus, the wetlands delineated via the ground-truthing work done through this study may differ from the NFEPA data layers. The NFEPA assessment does, however, hold significance from a national perspective. As mentioned above, the NFEPA wetlands have been ranked in terms of importance in the conservation of biodiversity and Table 7-1 below indicates the criteria considered.

Table 7-1: NFEPA Wetland Classification Ranking Criteria

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

7.1.2 Mining and Biodiversity Guideline

The Mining and Biodiversity Guideline was developed collaboratively by the South African Biodiversity Institute (SANBI), the Department of Environmental Affairs (DEA), the Department of Mineral Resources (DMR), the Chamber of Mines and the South African Mining and Biodiversity Forum in 2013. The purpose of the guideline was to provide the mining sector with a manual to integrate biodiversity into the planning process thereby encouraging informed decision-making around mining development and environmental authorisations. The aim of the guideline is to explain the value for mining companies to consider biodiversity management throughout the planning process. The guideline highlights the importance of biodiversity in managing the social, economic and environmental risk of the proposed mining project. The country has been mapped into biodiversity priority areas including the four categories listed in Table 7-2 below, each with associated risks and implications.

Table 7-2: Mining and Biodiversity Guideline Categories (SANBI, 2013)

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

7.1.3 Mpumalanga Biodiversity Sector Plan (MBSP)

The MBSP is a spatial tool that forms part of the national biodiversity planning tools and initiatives that are provided for in national legislation and policy. The MBSP was published in 2014 by the Mpumalanga Tourism and Parks Agency (MTPA) and comprises a set of maps of biodiversity priority areas accompanied by contextual information and land-use guidelines for use in land-use and development planning, environmental assessment and regulation, and natural resource management. Strategically the MBSP enables the province to:

- Implement the NEM:BA, 2004 provincially, and comply with requirements of the National Biodiversity Framework, 2009 (NBF) and certain international conventions;
- Identify those areas of highest biodiversity that need to be considered in provincial planning initiatives, and
- Address threat of climate change (ecosystem-based adaptation).

The publication includes terrestrial and freshwater biodiversity areas that are mapped and classified in Protected Areas (PAs), Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) or Other Natural Areas (ONAs). Wetlands in Mpumalanga Province have been extensively degraded and, in many cases, irreversibly modified and lost through a combination of inappropriate land-use practices, development and mining. Wetlands represent ecosystems of high value for delivering, managing and storing good quality water for human use, and they are vulnerable to harmful impacts. It is therefore in the interest of national water security that all wetlands are protected by law. The management objectives of these areas are summarised below.

Table 7-3: Mpumalanga Biodiversity Sector Plan Categories

Map category	Definition	Desired management objectives
PA	Those areas that are proclaimed as protected areas under national or provincial legislation, including gazetted protected environments.	Areas that are meeting biodiversity targets and therefore must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity.
CBAs	Areas that are required to meet biodiversity targets, for species, ecosystems or ecological processes. CBA Wetlands are those that have been identified as FEPA wetlands that are important for meeting biodiversity targets for freshwater ecosystems.	Must be kept in a natural state, with no further loss of habitat. Only low-impact, biodiversity-sensitive land-uses are appropriate.
ESAs	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. ESAs Wetlands are those that are non-FEPA and ESA Wetland Clusters are clusters of wetlands embedded within a largely natural landscape that function as a unit, and allow for the migration of species such as frogs and insects between individual wetlands.	Maintain in a functional, near-natural state, but some habitat loss is acceptable. A greater range of land-uses over wider areas is appropriate, subject to an authorisation process that ensures the underlying biodiversity objectives are not compromised.
ONAs	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem.	An overall management objective should be to minimise habitat and species loss and ensure ecosystem functionality through strategic landscape planning. These areas offer the greatest flexibility in terms of management objectives and permissible land-uses, but some authorisation may still be required for high-impact land-uses.

Map category	Definition	Desired management objectives
Heavily or Moderately Modified Areas	Areas that have been modified by human activity to the extent that they are no longer natural, and do not contribute to biodiversity targets. These areas may still provide limited biodiversity and ecological infrastructural functions, even if they are never prioritised for conservation action.	Such areas offer the most flexibility regarding potential land-uses, but these should be managed in a biodiversity-sensitive manner, aiming to maximise ecological functionality and authorisation is still required for high-impact land-uses. Moderately modified areas (old lands) should be stabilised and restored where possible, especially for soil carbon and water-related functionality.

7.2 Wetland Identification, Delineation and Classification

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

- Terrain Unit Indicator – helps to identify those parts of the landscape where wetlands are more likely to occur;
- Soil Form Indicator – identifies the soil forms, which are associated with prolonged and frequent saturation;
- Soil Wetness Indicator – identifies the morphological “signatures” developed in the soil profile as a result of prolonged and frequent saturation; and
- Vegetation Indicator – identifies hydrophilic vegetation associated with frequently saturated soils.

7.2.1 Terrain Indicator

Terrain Unit Indicator (TUI) areas include depressions and channels where water would be most likely to accumulate. These areas are determined with the aid of topographical maps, aerial photographs and engineering and town planning diagrams (DWAF, 2005). The Hydro-geomorphic HGM Unit system of classification focuses on the hydro-geomorphic setting of wetlands which incorporates geomorphology; water movement into, through and out of the wetland; and landscape / topographic setting. Once wetlands have been identified, they are categorised into HGM Units as shown in Table 7-4.

Table 7-4: Description of the various HGM Units for Wetland Classification

Hydromorphic wetland type	Diagram	Description
Floodplain		Valley bottom areas with a well-defined stream channel stream channel, gently sloped and characterised by floodplain features such as oxbow depression and natural levees and the alluvial (by water) transport and deposition of sediment , usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.
Valley bottom with a channel		Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterised by the net loss of sediment. Water inputs from the main channel (when channel banks overspill) and from adjacent slopes.
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterised by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from the channel entering the wetland and also from adjacent slopes.
Hillslope seepage linked to a stream channel		Slopes on hillsides, which are characterised by colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.
Isolated hillslope seepage		Slopes on hillsides that are characterised by colluvial transport (transported by gravity) movement of materials. Water inputs are from sub-surface flow and outflow either very limited or through diffuse sub-surface flow but with no direct link to a surface water channel.
Pan/Depression		A basin-shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. It is inward draining). It may also receive subsurface water. An outlet is usually absent and so this type of wetland is usually isolated from the stream network.

7.2.2 Soil Form Indicator

Hydromorphic soils are taken into account for the Soil Form Indicator (SFI) which will display unique characteristics resulting from prolonged and repeated water saturation (DWAF, 2005). The continued saturation of the soils results in the soils becoming anaerobic and thus resulting in a change of the chemical characteristics of the soil. Iron and manganese are two

soil components which are insoluble under aerobic conditions and become soluble when the soil becomes anaerobic and thus begin to leach out into the soil profile. Iron is one of the most abundant elements in soils and is responsible for the red and brown colours of many soils.

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

7.2.3 Soil Wetness Indicator

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

7.2.4 Vegetation Indicator

As one moves along the wetness gradient from the centre of the wetland to the edge, and into adjacent terrestrial areas plant communities undergo distinct changes in species composition. Valuable information for determining the wetland boundary and wetness zone is derived from the change in species composition. A supplementary method for employing vegetation as an indicator is to use the broad classification of the wetland plants according to their occurrence in the wetlands and wetness zones (Kotze and Marneweck, 1999; DWAF, 2005). This is summarised in Table 7-5 below. When using vegetation indicators for delineation, emphasis is placed on the group of species that dominate the plant community, rather than on individual indicator species (DWAF, 2005). Areas where soils are a poor indicator (black clay, vertic soils), vegetation (as well as topographical setting) is relied on to a greater extent and the use of the wetland species classification as per Table 7-5 becomes more important. If vegetation was to be used as a primary indicator, undisturbed conditions and expert knowledge are required (DWAF, 2005). Due to this uncertainty, greater emphasis is often placed on the SWI to delineated wetland areas. In this assessment, where possible, the SWI has been relied upon to delineate wetland areas due to the high level of anthropogenic impacts characterising the wetlands and freshwater resources of the general

area. The identification of indicator vegetation species and the use of plant community structures have been used to validate these boundaries.

Table 7-5: Classification of Plant Species According to Occurrence in Wetlands (DWAF, 2005)

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

7.3 Wetland Ecological Health Assessment (WET-Health)

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

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

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial *extent* of the impact of individual activities and then separately assessing the *intensity* of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall *magnitude* of impact. The impact scores and Present State categories are provided in Table 7-6.

Table 7-6: Impact Scores and Present Ecological State Categories used by WET-Health

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

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (Table 7-7).

Table 7-7: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

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

Change Class	Description	HGM change score	Symbol
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

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

7.4 Ecological Importance and Sensitivity

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

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

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

These determinants are assessed for the wetlands on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. It is recommended that the highest of these three suites of scores be used to determine the overall Importance and Sensitivity category of the wetland system, as defined in Table 7-8.

Table 7-8: Interpretation of Overall EIS Scores for Biotic and Habitat Determinants

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

7.5 Impact Assessment Methodology

The aim of the Impact Assessment is to strive to avoid damage or loss of ecosystems and services that they provide, and where they cannot be avoided, to reduce and mitigate these impacts (DEA, 2013). Offsets that compensate for loss of habitat are regarded as a last resort, after all efforts have been made to avoid, reduce and mitigate. The mitigation hierarchy is described in Table 7-9.

Table 7-9: Mitigation Hierarchy

	**Avoid or Prevent**	Refers to considering options in project location, setting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services and people. This is the best option, but is not always possible. Where environmental and social factors give rise to unacceptable negative impacts, project activities should not take place. In such cases, it is unlikely to be possible or appropriate to rely on the latter steps in the mitigation.
	Minimise	Refers to considering alternatives in the project location, sitting, scale, layout, technology and phasing that would minimise impacts on biodiversity and associated ecosystem services. In cases where there are environmental constraints, every effort should be made to minimise impacts.
	Rehabilitate	Refers to rehabilitation of areas where impacts are unavoidable and measures are provided to return impacted areas to near natural state or an agreed land use after mine closure. Rehabilitation may, however, fall short of replicating the diversity and complexity of natural systems.
	Offset	Refers to measures over and above rehabilitation to compensate for the residual negative impacts on biodiversity after every effort has been made to avoid, or minimise and then rehabilitate the impacts. Biodiversity offsets can provide a mechanism to compensate for significant residual impacts on biodiversity.

The impact rating process is designed to provide a numerical rating of the various environmental impacts identified by use of the Input-Output model. As discussed above, it has to be stressed that the purpose of the EIA process is not to provide an incontrovertible rating of the significance of various aspects, but rather to provide a structured, traceable and defendable methodology of rating the relative significance of impacts in a specific context. This will give a greater understanding of the impacts of the proposed project and the issues that need to be addressed by mitigation. It will also provide the regulators information on which to base their decisions.

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

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

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

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts.

Table 7-10: Impact Assessment Parameter Ratings

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

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

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

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

DIGBY WELLS ENVIRONMENTAL

Table 7-11: Probability/Consequence Matrix

		Significance																																					
Probability	7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
	6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
	5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
	4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
	3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
	2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
	1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		Consequence																																					

Table 7-12: Significance Rating Description

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

7.6 Assumptions and Limitations

The following limitations were encountered during this study:

- The composition of the freshwater resources in the Project area prior to major disturbance/subsidence is unknown. For this reason, reference conditions are hypothetical, and are based on professional judgement and/or inferred from limited data available; and
- With ecology being dynamic and complex, as well as a result of restricted access to portions of the Project area, certain aspects, some of which may be important, may have been overlooked. However, wherever possible, it is expected that the Project area has been accurately assessed and considered, based on the field observations undertaken and the consideration of historical and existing studies and the desktop data available.

8 Baseline Environment

8.1 Drainage and Quaternary Catchment

The water resources of South Africa are divided into quaternary catchments, which are regarded as the principal water management units in the country (DWAF 2011). A quaternary catchment is a fourth order catchment in a hierarchical classification system in which the primary catchments are the major units. The primary drainages are further grouped into or fall under Water Management Areas (WMA) and Catchment Management Agencies (CMA). The Department of Water and Sanitation (DWS) has established nine WMAs and nine CMAs as contained in the National Water Resource Strategy 2 (2013) in terms of Section 5 subsection 5(1) of the National Water Act, 1998 (Act No. 36 of 1998). The establishment of these WMAs and CMAs is to improve water governance in different regions of the country, to ensure a fair and equal distribution of the Nations water resources, while making sure that the resource quality is sustained.

Figure 8-1 indicates the water resource management classification associated with the Project area. The Project area falls within the Olifants Water Management Area (WMA 2) and it is associated with primary drainage B. The quaternary catchment is B11D.

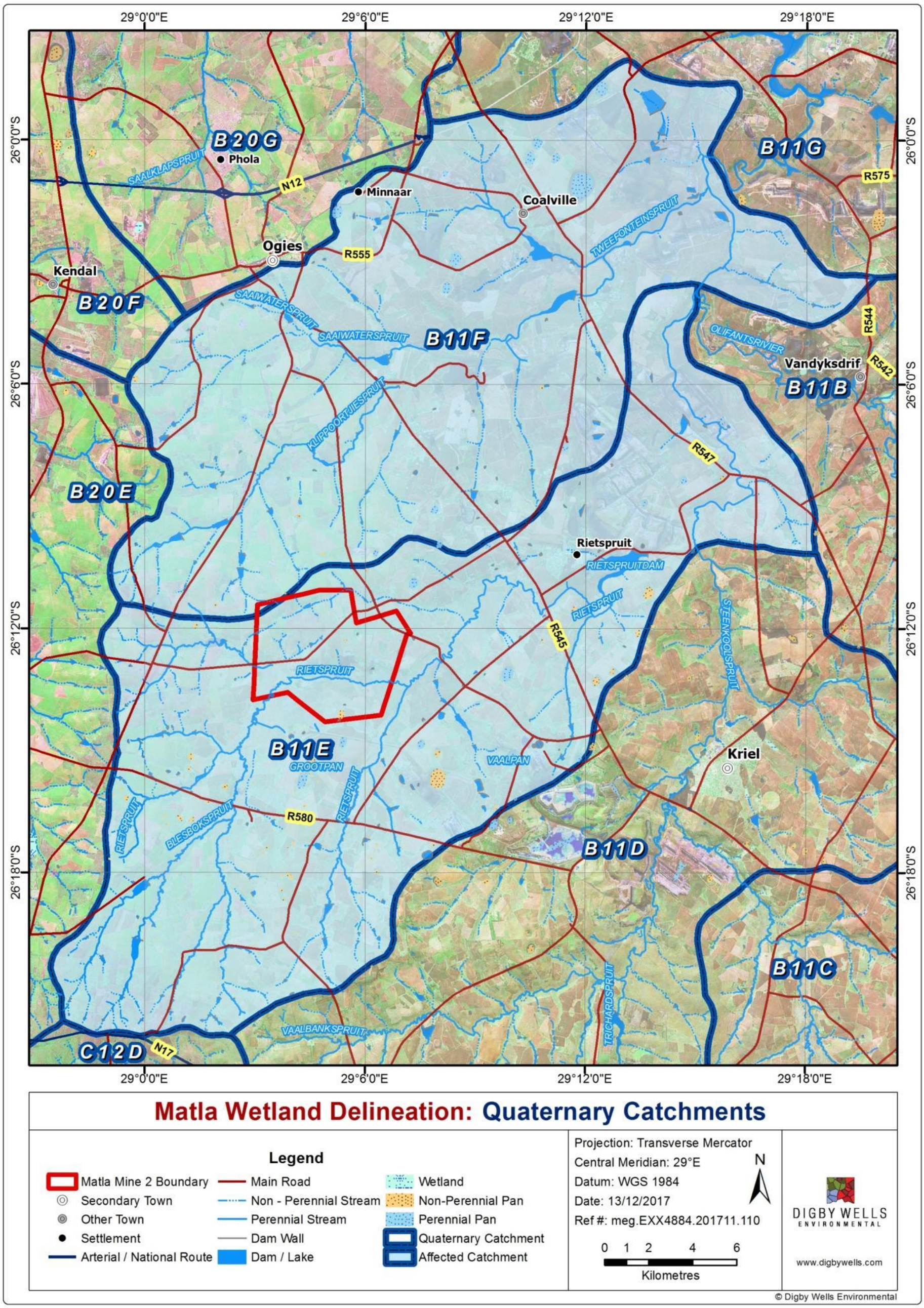

Figure 8-1: Quaternary Catchments

8.2 National Freshwater Ecosystem Priority Areas (NFEPA)

The NFEPA project provides information of wetland and river ecosystems for integrating into freshwater ecosystem and biodiversity planning and decision-making processes. The assessor considered the strategic spatial priorities for conserving the country's freshwater ecosystems and supporting sustainable use of water resources contained therein to evaluate the importance of the wetland areas located within the Matla Mine 2 area (Nel *et al.* 2011). Figure 8-2 demonstrates the distribution of NFEPA wetlands within the Project area. The wetland types that dominate the landscape are Valley Floor and Seep wetlands. The largest wetland present is associated with the Rietspruit that traverses the Project area.

The NFEPA wetlands have been ranked in terms of importance in the conservation of biodiversity. The Project wetlands are mostly of rank 2, followed by Rank 6.

Rank 2 wetlands are important wetlands that fall within 500 m of an IUCN threatened frog point locality or threatened water-bird point locality. Alternatively they fall mostly within a sub-quaternary catchment that has sightings or breeding areas for threatened Wattled Cranes, Grey Crowned Cranes and Blue Cranes or has been identified by experts at the regional review workshops as containing wetlands of exceptional Biodiversity importance, with valid reasons documented or as containing wetlands that are good, intact examples from which to choose.

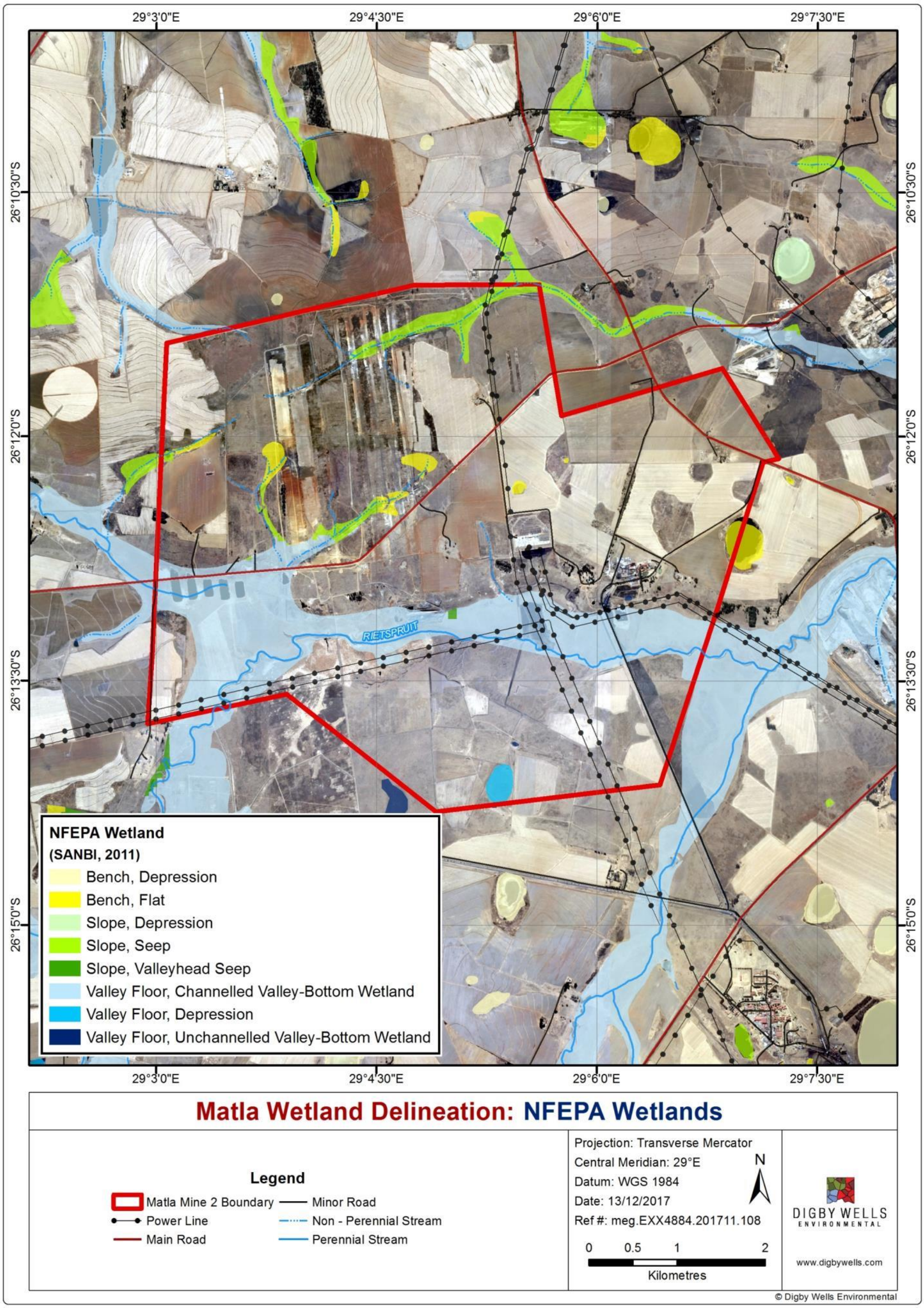

Figure 8-2: NFEPA Wetlands

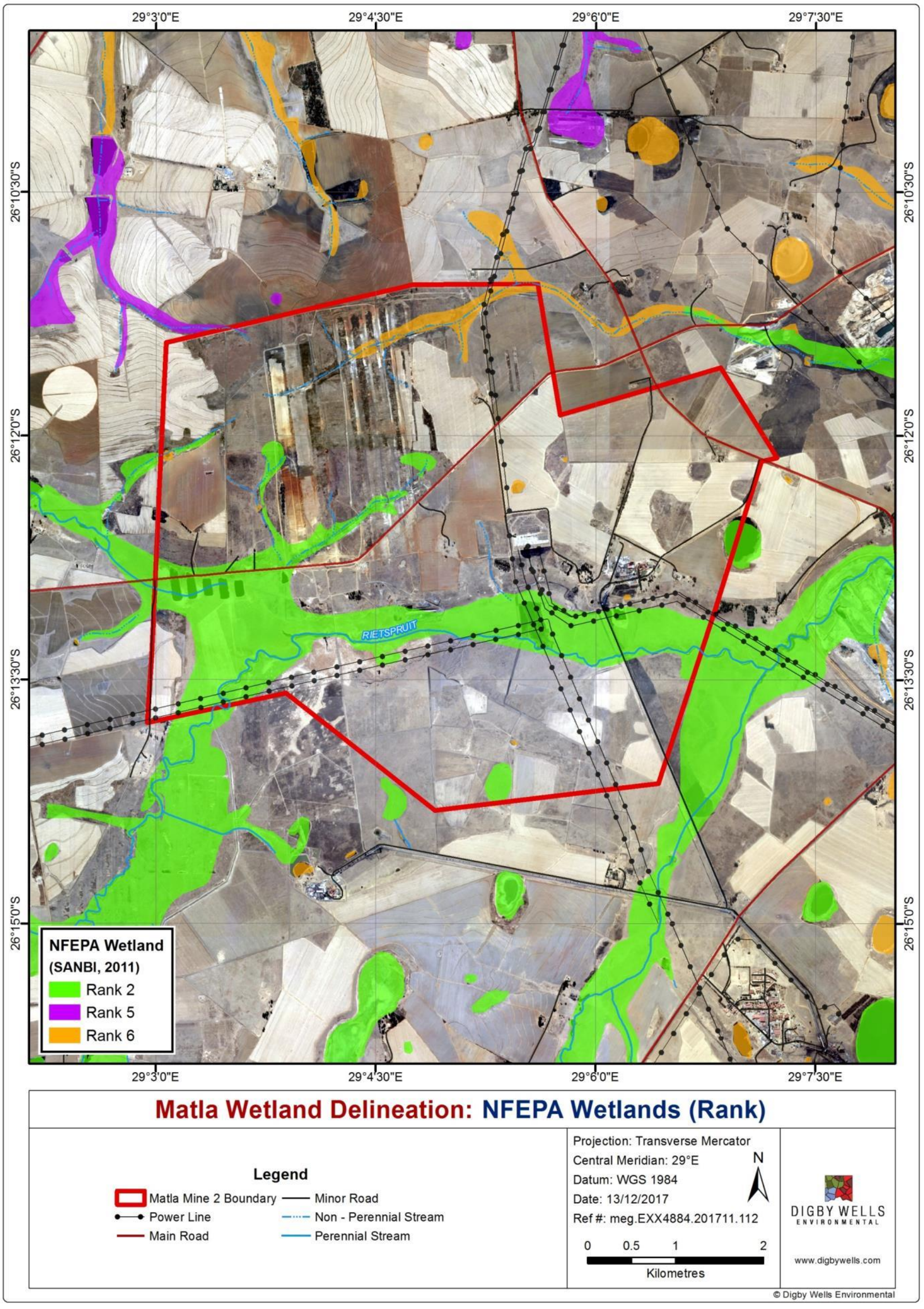

Figure 8-3: NFEPA Wetlands (ranks)

8.3 Mining and Biodiversity Guidelines

The Mining and Biodiversity Guideline (2013) can be seen as a cumulative finding of all available biodiversity and ecological related information with a final mapped area. The assessment looks at NFEPA and regional biodiversity plans such as the MBSP. This is shown in Figure 8-4 below.

The majority of the underground area is designated as ‘Highest Risk for Mining’, ‘with portions in the north characterised as ‘Moderate Risk for Mining’.

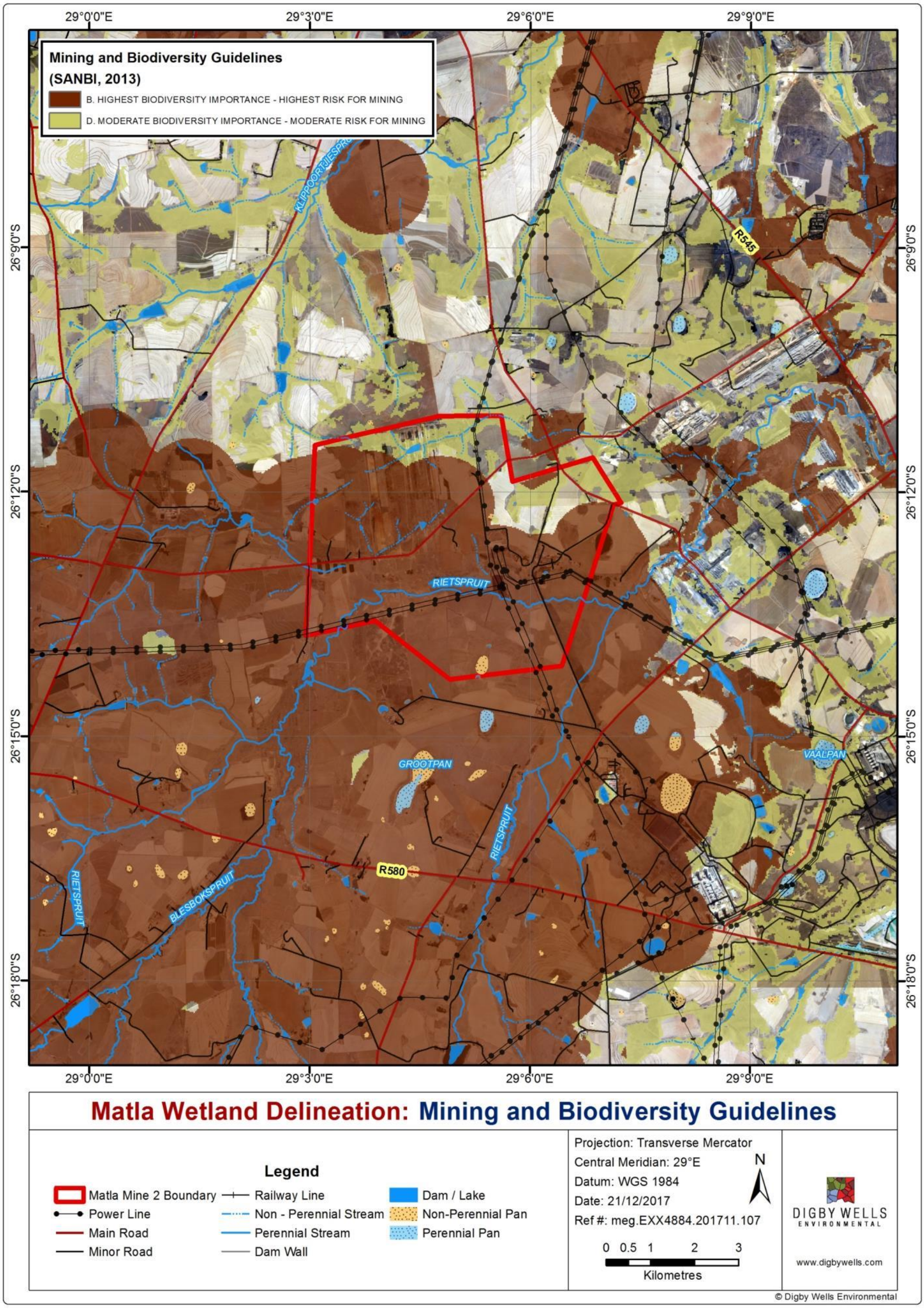

Figure 8-4: Mining and Biodiversity Guideline

8.3.1 Mpumalanga Biodiversity Sector Plan

The MBSP (2013) is a spatial tool that forms part of the national biodiversity planning. The terrestrial MBSP has delineated a portion in the south of Matla Mine 2 as 'CBA Irreplaceable'. 'CBA Optimal' are also found within the Project area (yellow), with small pockets of ESA Local Corridors (orange). According to the guidelines from the MSBP, CBAs must be kept in a natural state with no further loss of habitat; where only low-impact, biodiversity-sensitive land-uses are appropriate. With respects to ESAs, the land use goal should be to maintain the ecosystem in a functional, near-natural state; however, some habitat loss is acceptable. This means that a greater range of land-uses over a wider extent is appropriate for these areas. This notwithstanding, they are subject to an authorisation process that ensures the underlying biodiversity objectives are not compromised. The remainder of the Project area is classified as either natural or modified areas. It is important to note that this is a large scale project and some local scale discrepancies may exist. Although natural areas were not pristine as they are subject to grazing and / or grass bailing, these areas are mapped and regarded as natural habitat for naturally occurring fauna and flora species.

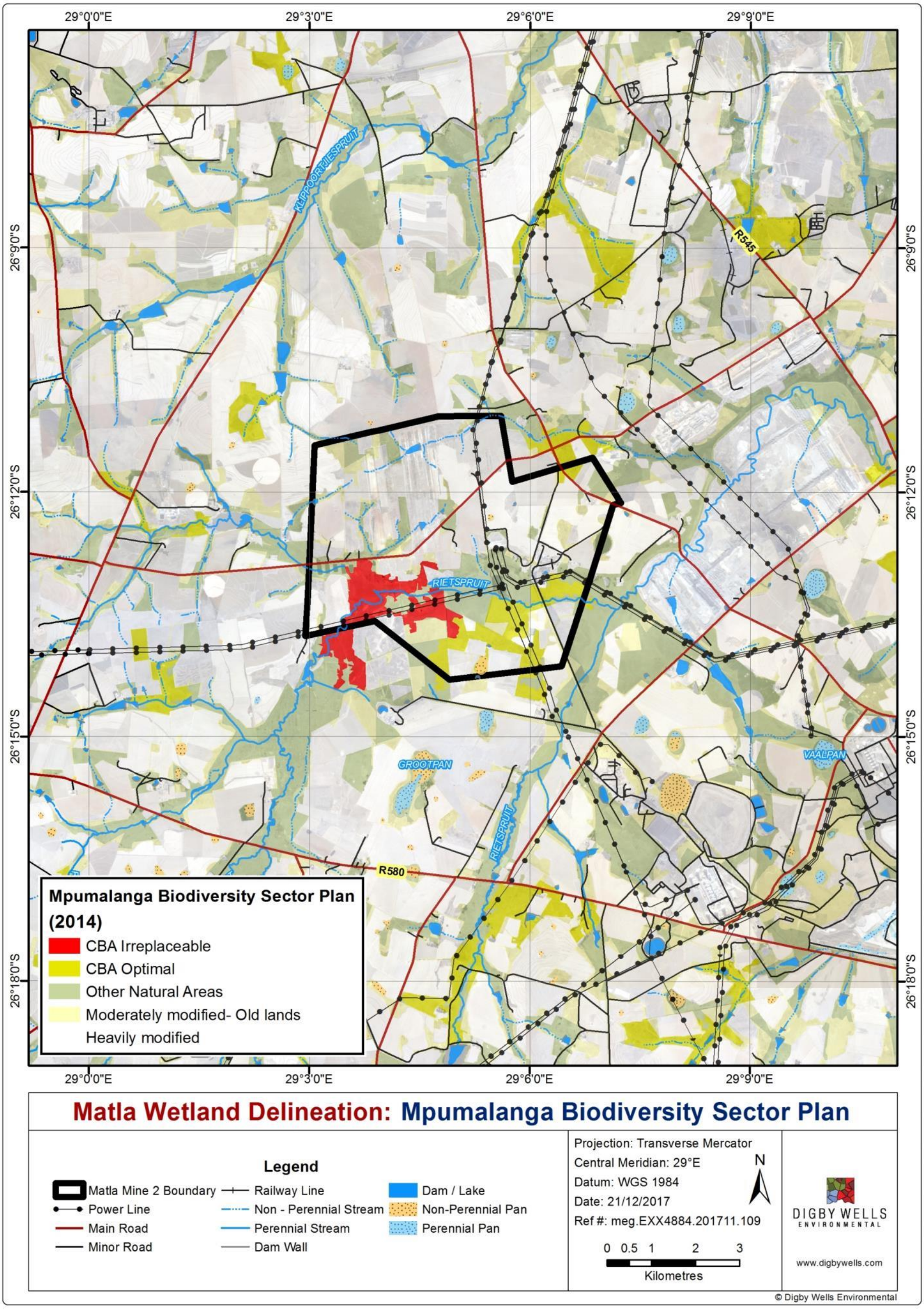

Figure 8-5: Mpumalanga Biodiversity Sector Plan

8.4 Regional Vegetation

The Matla Mine 2 area falls within the Grassland Biome (Mucina and Rutherford, 2012), one of the nine South African plant Biomes and the second most bio-diverse biome in South Africa. The Grassland Biome is situated primarily on the central plateau of South Africa, and the inland areas of Kwa-Zulu-Natal and the Eastern Cape provinces. This biome is rich in flora and fauna diversity but is under threat due to rapid urbanisation and expansion of mining and industrial activities.

The Project area occurs in the Eastern Highveld Grassland and Eastern Temperate Freshwater Wetlands regional vegetation types (Mucina and Rutherford, 2012) (Figure 8-6) Table 8-1 list the species characteristic of the Eastern Highveld Grassland whilst Table 8-2 lists species characteristic of Eastern Temperate Freshwater Wetlands.

Table 8-1: Plant Species Characteristic of the Eastern Highveld Grasslands

Plant Form	Species
Graminoids	*Aristida aequiglumis, A. congesta, A. junciformis subsp. galpinii, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus, Eragrostis chloromelas, E. capensis, E. curvula, E. gummiflua, E. patentissima, E. plana, E. racemosa, E. sclerantha, Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Setaria sphacelata, Sporobolus africanus, S. pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix, T. rehmannii, Alloteropsis semialata subsp. eckloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides*
Herbs	*Berkheya setifera, Haplocarpha scaposa, Justicia anagalloides, Pelargonium luridum, Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Euryops gilfillanii, E. transvaalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides subsp. latifolia, Selago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata.*
Geophytic herbs	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia*
Succulent Herbs	*Aloe ecklonis*

Table 8-2: Plant species characteristic of the Eastern Temperate Freshwater Wetlands

Type	Plant form	Species

Type	Plant form	Species
Marshes	Megagraminoid	*Cyperus congestus* (d)
	Graminoids	*Agrostis lachnantha* (d), *Carex acutiformis* (d), *Eleocharis palustris* (d), *Eragrostis plana* (d), *E. planiculmis* (d), *Fuirena pubescens* (d), *Helictotrichon turgidulum* (d), *Hemarthria altissima* (d), *Imperata cylindrica* (d), *Leersia hexandra* (d), *Paspalum dilatatum* (d), *P. urvillei* (d), *Pennisetum thunbergii* (d), *Schoenoplectus decipiens* (d), *Scleria dieterlenii* (d), *Setaria sphacelata* (d), *Andropogon appendiculatus*, *A. eucomus*, *Aristida aequiglumis*, *Ascolepis capensis, Carex austro-africana*, *C. schlechteri*, *Cyperus cyperoides*, *C. distans*, *C. longus*, *C. marginatus*, *Echinochloa holubii*, *Eragrostis micrantha*, *Ficinia acuminata*, *Fimbristylis complanata*, *F. ferruginea*, *Hyparrhenia dregeana*, *H. quarrei, Ischaemum fasciculatum*, *Kyllinga erecta*, *Panicum schinzii*, *Pennisetum sphacelatum*, *Pycreus macranthus*, *P. nitidus*, *Setaria pallide-fusca*, *Xyris gerrardii*.
	Herbs	*Centella asiatica* (d), *Ranunculus multifidus* (d), *Berkheya radula*, *B. speciosa*, *Berula erecta* subsp. *thunbergii*, *Centella coriacea*, *Chironia palustris*, *Equisetum ramosissimum*, *Falckia oblonga, Haplocarpha lyrata, Helichrysum difficile*, *H. dregeanum*, *H. mundtii*, *Hydrocotyle sibthorpioides, H. verticillata*, *Lindernia conferta*, *Lobelia angolensis, L. flaccida*, *Mentha aquatica*, *Monopsis decipiens*, *Pulicaria scabra*, *Pycnostachys reticulata*, *Rorippa fluviatilis* var. *fluviatilis*, *Rumex lanceolatus*, *Senecio inornatus*, *S. microglossus*, *Sium repandum*, *Thelypteris confluens*, *Wahlenbergia banksiana*.
	Geophytic Herbs	*Cordylogyne globosa*, *Crinum bulbispermum*, *Gladiolus papilio*, *Kniphofia ensifolia*, *K. fluviatilis*, *K. linearifolia*, *Neobolusia tysonii, Satyrium hallackii* subsp. *hallackii*.
Reed & sedge beds	Megagraminoids	*Phragmites australis* (d), *Schoenoplectus corymbosus* (d), *Typha capensis* (d), *Cyperus immensus*.
	Graminoid	*Carex cernua*.
Water bodies	Aquatic Herbs	*Aponogeton junceus*, *Ceratophyllum demersum*, *Lagarosiphon major*, *L. muscoides*, *Marsilea capensis*, *Myriophyllum spicatum, Nymphaea lotus*, *N. nouchali* var. *caerulea*, *Nymphoides thunbergiana*, *Potamogeton thunbergii*.
	Carnivorous Herb	*Utricularia inflexa*.

Type	Plant form	Species
	Herb	*Marsilea farinosa subsp. farinosa.*

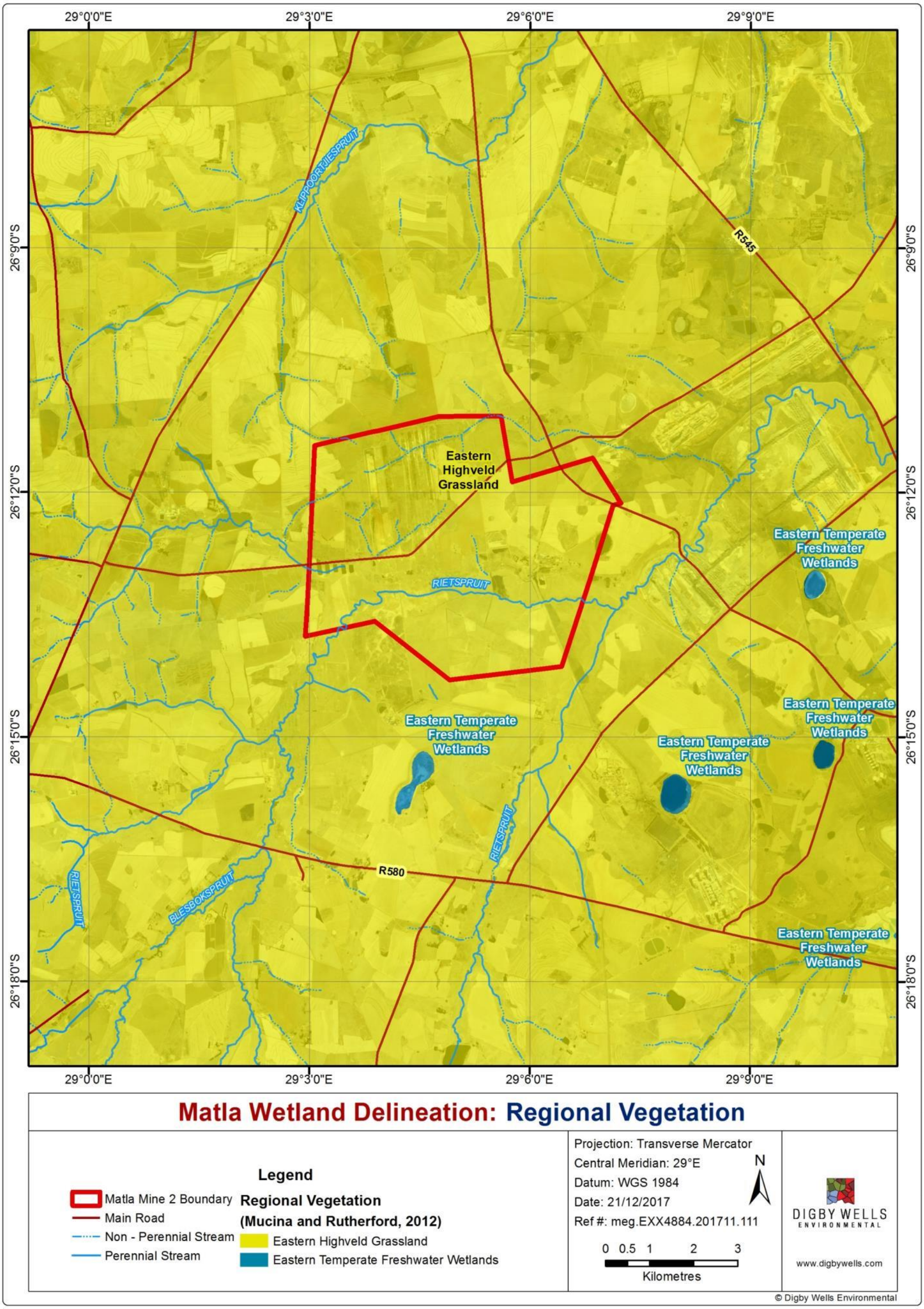

Figure 8-6: Regional Vegetation

9 Wetland Assessment Findings

9.1 Wetland delineation and classification

The Matla Mine 2 Project Area is characterised by multiple wetland systems totalling 1494.8 ha. Fourteen HGM Units were identified on site, with the largest system being a Channelled Valley Bottom wetland which drains to the east of the project area and is fed by various hillslope seeps and valley bottom wetlands. The breakdown of the wetland types per area is detailed in Table 9-1 and illustrated in Figure 9-3 and Figure 9-1.

Table 9-1: Wetland HGM Units

HGM Unit	HGM Unit Type	Area (ha)
1	Seep	63.9
2	Channelled Valley Bottom (and associated hillslope seeps)	1096.0
3	Seep	42.9
4	Seep	37.2
5	Depression	1.7
6	Depression	8.1
7	Depression	29.1
8	Depression (water)	27.2
9	Depression	9.9
10	Depression	6.3
11	Depression	0.8
12	Un-channelled Valley Bottom	43.3
13	Channelled Valley Bottom	148.5
14	Un-channelled Valley Bottom	43.8

The buffer zones relating to the wetlands are illustrated in Figure 9-2. Zones of Regulation of 100m around each wetland have been assigned according to Government Notice 704 (GN 704), section 4(b), which states that no underground mining or opencast mining, prospecting or any other operation or activity may take place within 100 m from any watercourse.

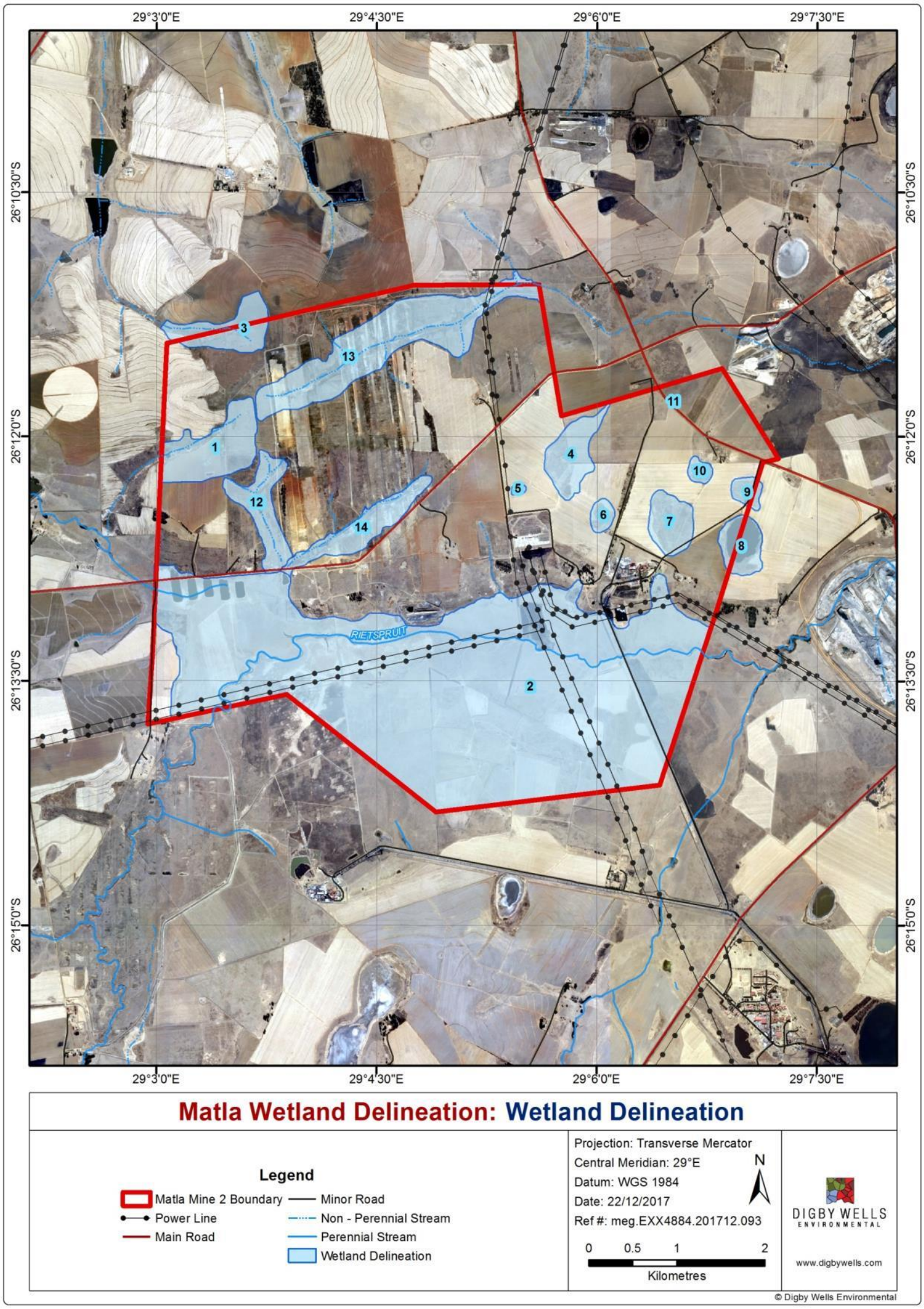

Figure 9-1: Wetland Delineation

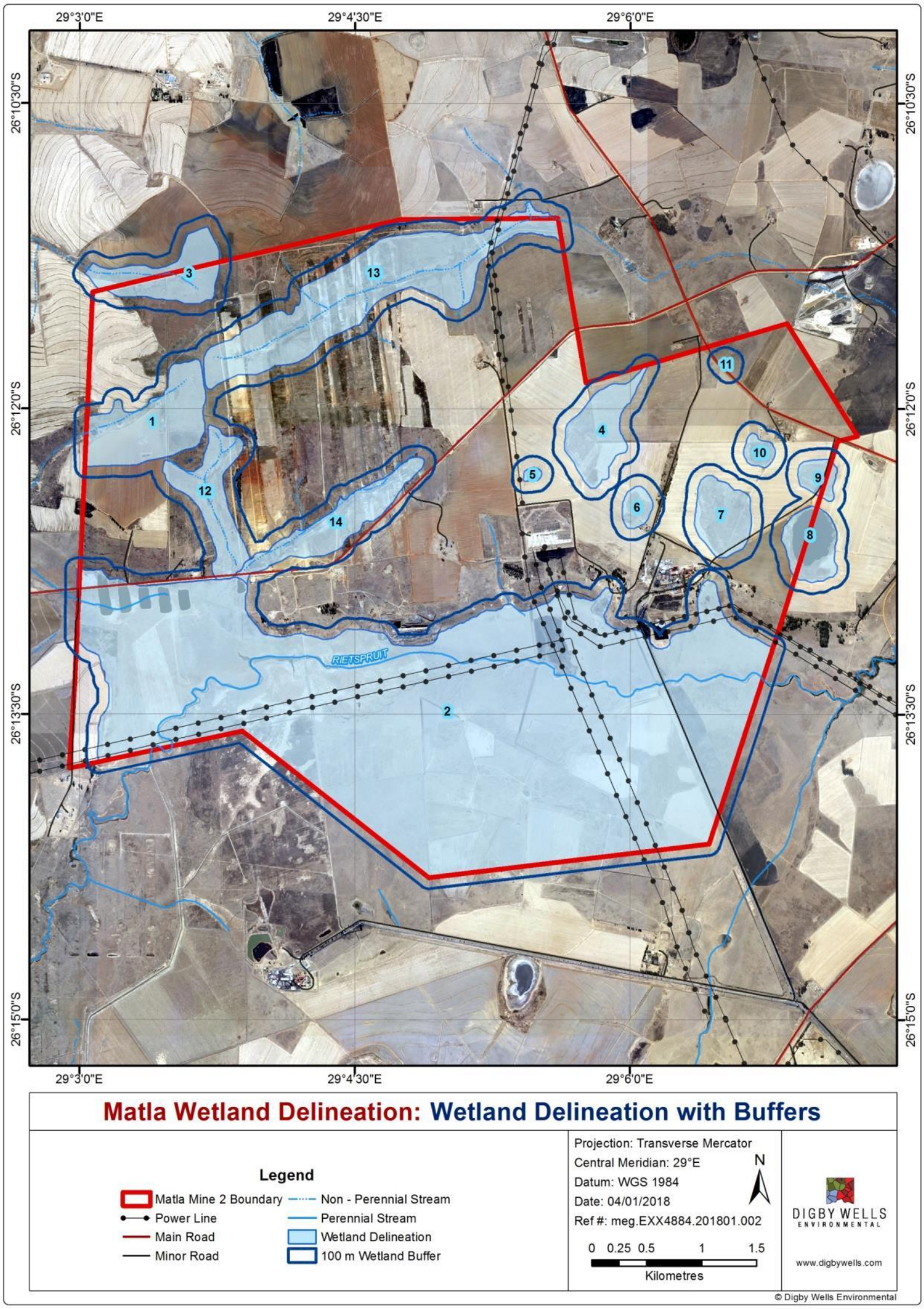

Figure 9-2: Wetland Regulation Zones

9.2 Wetland Ecological Assessment

9.2.1 Indicators

Soils in the wetlands were predominantly black clay and vertic soils. Hutton soils occurred outside of the wetlands, where cultivation activities were extensively observed (Figure 9-3).

Figure 9-3: Overview of the Soils on Site

Vegetation was largely uniform across the HGM units, with the wetlands being dominated by *Typha capensis* (Bulrush) *Agrostis Lacnantha* (Bent Grass), and *Juncus effusus* (Common Rush), *Setaria sphacelata* (Bristle Grass) *and Hyparrhenia tamba* (Blue Thatching Grass). *Erythrina zeyheri* (Plough-breaker) and *Crinum bulbispermum* (Orange River lily, a protected species) were found within the temporary zones of many of the wetlands. Although these are not Obligate Wet (OW) species, they are known to grow in wetland areas (Figure 9-4)

Figure 9-4: Overview of the wetland species on Site (A: *Juncus effusus*; B: *Crinum bulbispermum* (protected); C: *Imperata cylindrica*; D: *Erythrina zeyheri*)

The dominant land use of the area is mining (underground) followed by agro-pastoral including large areas of cropland and natural grassland for grazing. Many of the wetlands

have been altered significantly through subsidence from mining activities. Examples of these impacts recorded on site are shown in Figure 9-5 and Figure 9-6 below.

- Subsidence has resulted in a completely transformed landscape. This impacts largely on the hydrological and geomorphological functioning of the wetlands and is the greatest impact on the wetlands in this area;
- Croplands have replaced some of the naturally occurring vegetation and this has impacted the ability of wetlands to maintain biodiversity;
- Cattle farming which has resulted in overgrazing in many areas, trampling and erosion. In addition, this impact has resulted in impaired water quality of the wetlands associated with the site. These activities cause increased sedimentation of the systems due to exposed substrate. Sedimentation alters the natural hydrological and geomorphological functioning of the wetlands and may have an impact on aquatic life. The impaired water quality may also result from additional loading of phosphates and nitrates;
- The powerlines and associated servitude within HGM Unit 2 will result in disturbance to the system (removal of vegetation, compaction of soils and erosion) and also pose a threat to avifauna.
- Disturbance has also led to the establishment of alien and invasive plant species, particularly *Populus x canescens* (Grey Poplar), *Verbena bonariensis* (Tall Verbena) and *Bidens pilosa* (Black Jack), further limiting the ability of the hydromorphic grasslands to function.
- Many wetlands are impacted on by roads, which have resulted in some fragmentation of the natural systems, compaction of soils in some places, loss of vegetation and the formation of preferential flow paths.

Figure 9-5: Impacts on the wetlands in the Project Area. A: Invasive species, Grey Poplar; B: Powerlines that traverse the Project area; C: Cattle graze extensive areas; D: Erosion; E: Sheep grazing; F: Erosion created by a road.

Figure 9-6: Impacts of the subsidence created by underground mining (A: Rehabilitation of subsided areas; B: Water collecting in the subsided areas; C: Subsided areas creating dams; D: Channels dug through the crests of the subsidence areas

The ecological functioning of these ecosystems is directly linked to their position in the landscape as well as their ecological condition. Wetlands of the Mpumalanga Province and Highveld region within the Grassland biome represent important ecosystems providing many services and goods to people (MPTA, 2014); however, this does lead often to over exploitation of these systems which compromises their ecological integrity.

Although the application of the WET-Ecoservices tool was beyond the scope of this Wetland Assessment, a few of the wetland ecosystem services noted on site are described below:

- Water supply for human use is an important service provided by these wetlands. A few dams are present in channelled valley bottoms, whilst pans collect water for livestock and provide water for abstraction purposes;
- Channelled valley bottoms aid in streamflow regulation, nutrient assimilation, and sediment trapping. Un-channelled valley bottoms also provide the aforementioned

services, with the addition of slowing down of flood waters. These functions are strongly linked to the absence of a channel as water is spread throughout the wetland unit. Seeps sustain streamflow during the dry season as they are slowly fed with sub-surface flow that moves laterally into the valley floor and river systems. Due to the diffuse nature of water movement through seep systems, sediment trapping and nutrient assimilation is an important water quality enhancement benefit. Within their immediate catchment, pans play important roles such as sediment trapping, nutrient assimilation and carbon storage;

- Channelled valley bottoms provide habitat for aquatic species as well as birds (a secretary bird, *Sagittarius serpentarius*, was observed in HGM Unit 2) and mammals that feed off aquatic species. Similarly, pans provide unique habitat in the landscape for species.

9.2.2 Present Ecological State

Table 9-2 indicates the PES scores for the various HGM Units.

The wetlands within the Project Area exhibit a variety of PES values, ranging from *Seriously Modified* (Category E), to *Largely Natural* (Category B) (Table 9-2).

HGM Unit 8 and HGM 10 are classified as *Largely Natural* (Category B) wetlands. These pans have not been impacted on to a great extent. The geomorphological and hydrological regimes have not been altered significantly and very little disturbance was observed with regards to vegetation.

Eight *Moderately Modified* (Category C) wetlands were identified (HGM units 2, 3, 4, 5, 6, 7, 9 and 11). These wetlands were mainly impacted on by cultivation and/or grazing with few geomorphological impacts.

Two *Largely Modified (*Category D*)* wetlands are present in the Project Area - HGM Unit 1 and HGM Unit 12. The *Largely Modified* category is mainly attributed to the subsidence in the area.

Two *Seriously Modified* (Category E) wetlands were present. HGM Unit 13 and HGM Unit 14 have been seriously impacted on through subsidence, which has altered the hydrology of the wetland significantly as the subsidence has occurred perpendicular to the flow of the original wetlands, unlike that of HGM Unit 12, where subsidence occurred parallel to the wetland, therefore not completely altering the natural hydrology. Some canals have been constructed through the crests of the subsidence areas of HGM 13 and 14 to allow water to flow in the same direction of the original wetlands (see Figure 9-6: D), however, the flow has been significantly impacted on.

Table 9-2: Present Ecological Health Scores

HGM Unit	Hydrological Health Score	Geomorphological Health Score	Vegetation Health Score	Final Ecological Health Score	PES Score
1	7.5	4	5.5	5.9	D
2	1	3	6.7	3.2	C
3	0	0.3	8.1	2.4	C
4	3.5	0.1	7	3.5	C
5	1	0.2	5.4	2.0	C
6	2	0.4	4.1	2.2	C
7	2	0.4	5.7	2.6	C

HGM Unit	Hydrological Health Score	Geomorphological Health Score	Vegetation Health Score	Final Ecological Health Score	PES Score
8	2	0.2	3.2	1.8	B
9	3.5	0.5	4.6	2.9	C
10	1	0.2	4.2	1.7	B
11	3	0.4	6	3.1	C
12	7	0.2	8.1	5.3	D
13	8.5	3.3	8.3	7	E
14	8.5	2.4	7.6	6.5	E

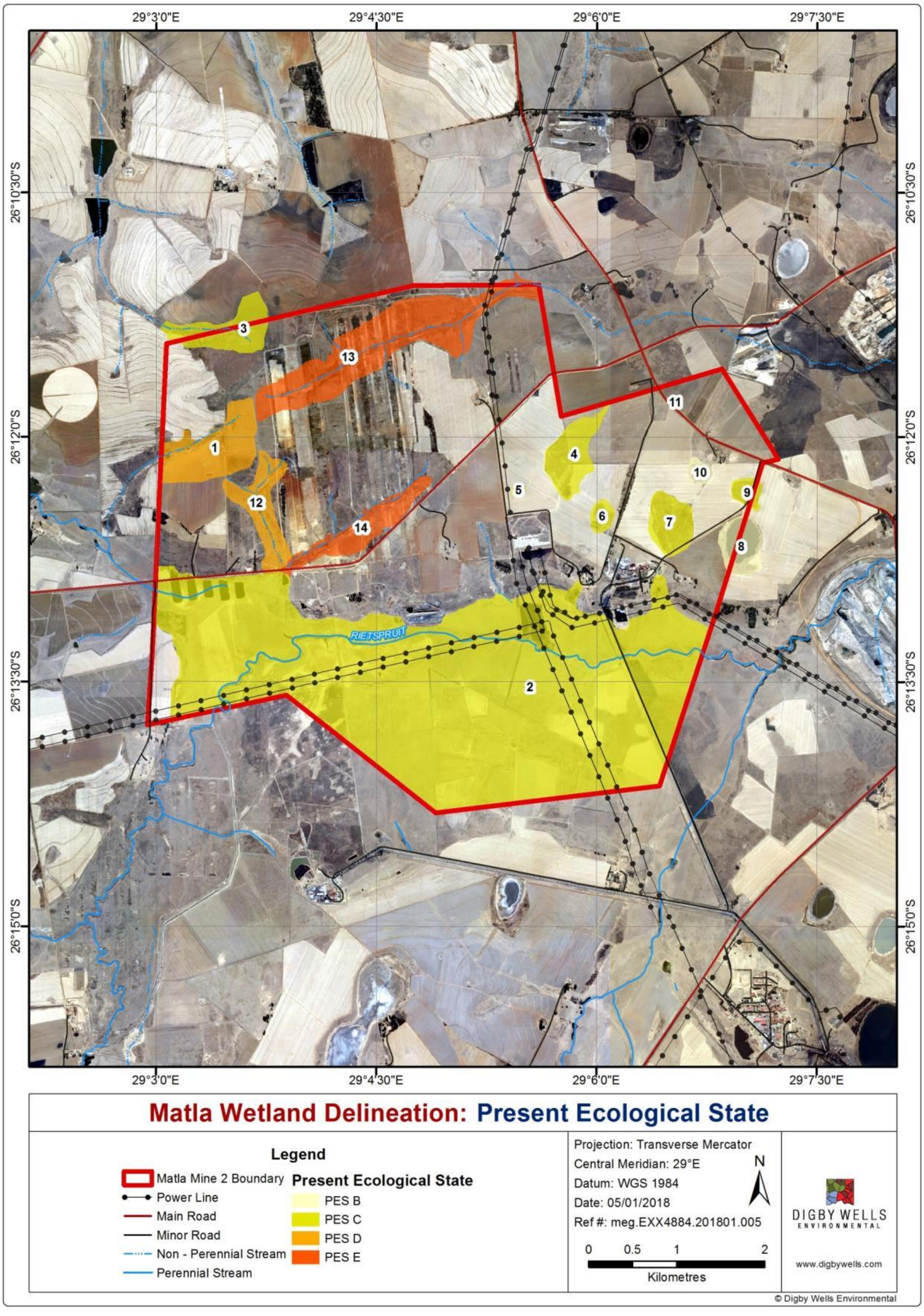

Figure 9-7: Present Ecological State

9.2.3 Ecological Importance and Sensitivity

Table 9-3 indicates the EIS scores for the various HGM Units with the final EIS score for the wetlands ranging from *Low* (0.7) to *Very High* (3.1).

Although the wetlands are modified, they do still provide predominantly *Moderate* to *Low* hydrological importance services (mostly ranging between 0.5 and 1.7), such as flood attenuation and assimilation of toxicants and nitrates. HGM Unit 2 is an exception, with a *High* score.

The Ecological Importance and Sensitivity category is ranging from *Low* (0.7) to *Very High* (3.1). Some HGM units have been completely transformed and therefore provide little habitat for fauna and flora, whilst others HGM units such as HGM Unit 2, still have intact vegetation where red data species were observed.

In general, the values are *Low* for 'Direct Human Benefits' (most ranging between 0.1 and 1) as these wetland mainly fall within the mine fences and mining rights area and therefore are not utilised as they would be in a unrestricted area. HGM unit is the only exception (2.5) as it is contains standing water utilised for fish purposes.

Table 9-3: EIS Scores

HGM Unit	Ecological Importance & Sensitivity	Hydrological/Functional Importance	Direct Human Benefits	Final EIS Score	Final EIS Category
1	1.4	1.4	0.2	1.4	C
2	3.1	2.1	0.6	3.1	A
3	1.8	1.6	0.4	1.8	C
4	1.8	1.5	0.5	1.8	C
5	1.9	1.7	0.8	1.9	C
6	1.8	1.7	1	1.8	C
7	2.1	1.7	0.8	2	C
8	1.8	1.7	2.5	2.5	B
9	1.8	1.7	1	1.8	C
10	1.9	1.7	1	1.9	C
11	1.4	1	0.4	1.4	C
12	0.9	0.6		0.9	D
13	0.7	0.5	0.1	0.7	D
14	0.8	0.5	0.1	0.8	D

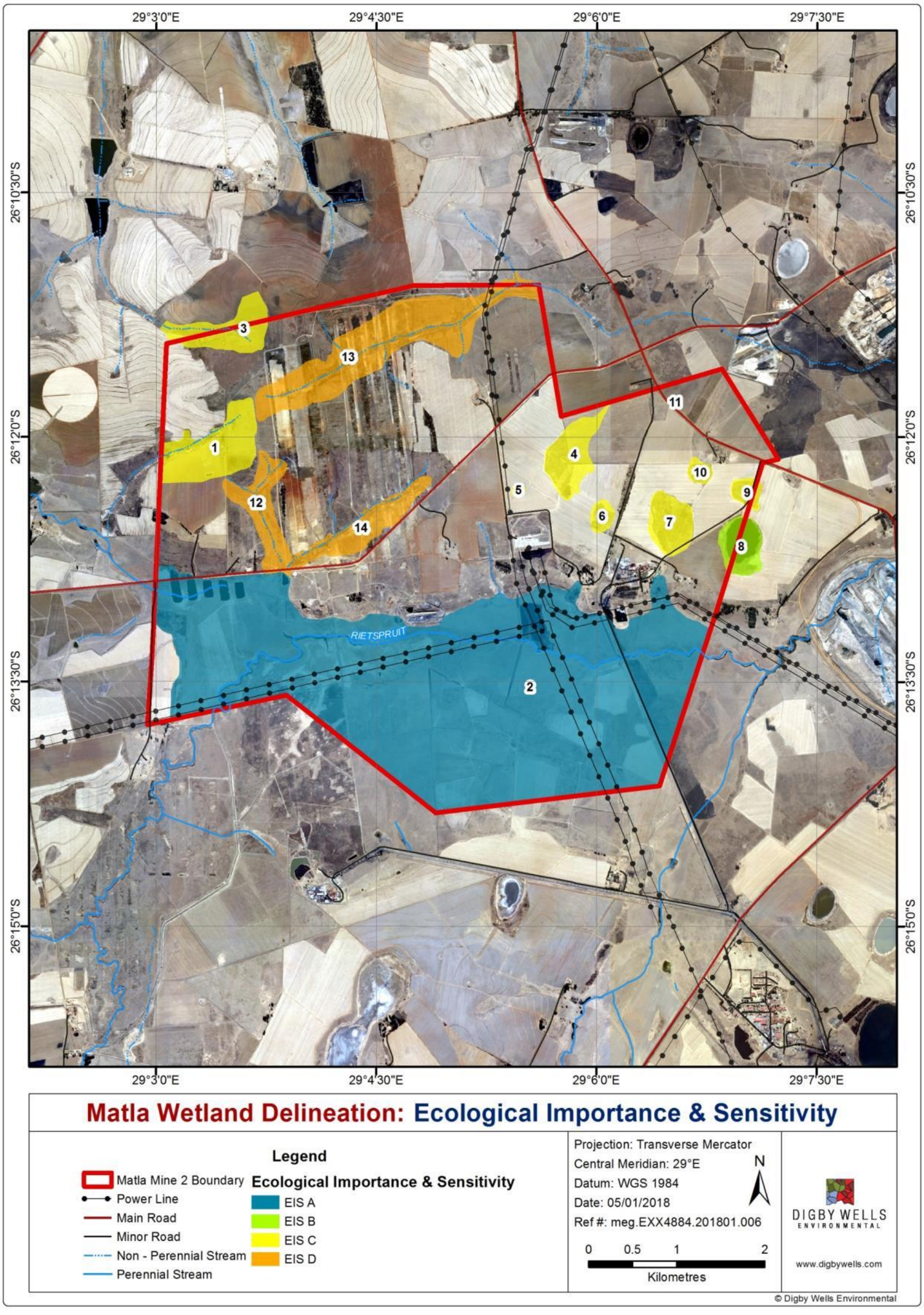

Figure 9-8: Ecological Importance and Sensitivity

Table 9-4: Wetland Summary

HGM unit	HGM unit Type	Size	PES	EIS
1	Seep	63.9	D	C
2	Channelled Valley Bottom (and associated hillslope seeps)	1096.0	C	A
3	Seep	42.9	C	C
4	Seep	37.2	C	C
5	Depression	1.7	C	C
6	Depression	8.1	C	C
7	Depression	29.1	C	C
8	Depression (water)	27.2	B	B
9	Depression	9.9	C	C
10	Depression	6.3	B	C
11	Depression	0.8	C	C
12	Un-channelled Valley Bottom	43.3	D	D
13	Channelled Valley Bottom	148.5	E	D
14	Un-channelled Valley Bottom	43.8	E	D

10 Impact Assessment for Wetlands

10.1 Discussion of Potential Impacts

The activities assessed for the wetlands impact assessment are listed in Table 10-1. This section includes an impact assessment for activities associated with the proposed underground mining activities in the Matla Mine 2 Project area. The Project area affects fourteen wetland HGM units of varying degrees of ecological integrity. Figure 9-1 provides an indication of the locality of the various wetland features in relation to the project area.

It is the opinion of the ecologist that due to the already largely transformed nature of HGM Units, with special mention of wetlands affected by cross-sectional subsidence, the impacts related to the proposed project can be greatly reduced should the relevant mitigation and management measures outlined in this report be adhered to. However, in areas such as HGM Unit 2 situated on the southern portion of the Matla Mine 2 Project area, impacts as a result of the proposed mining activities are likely to be high.

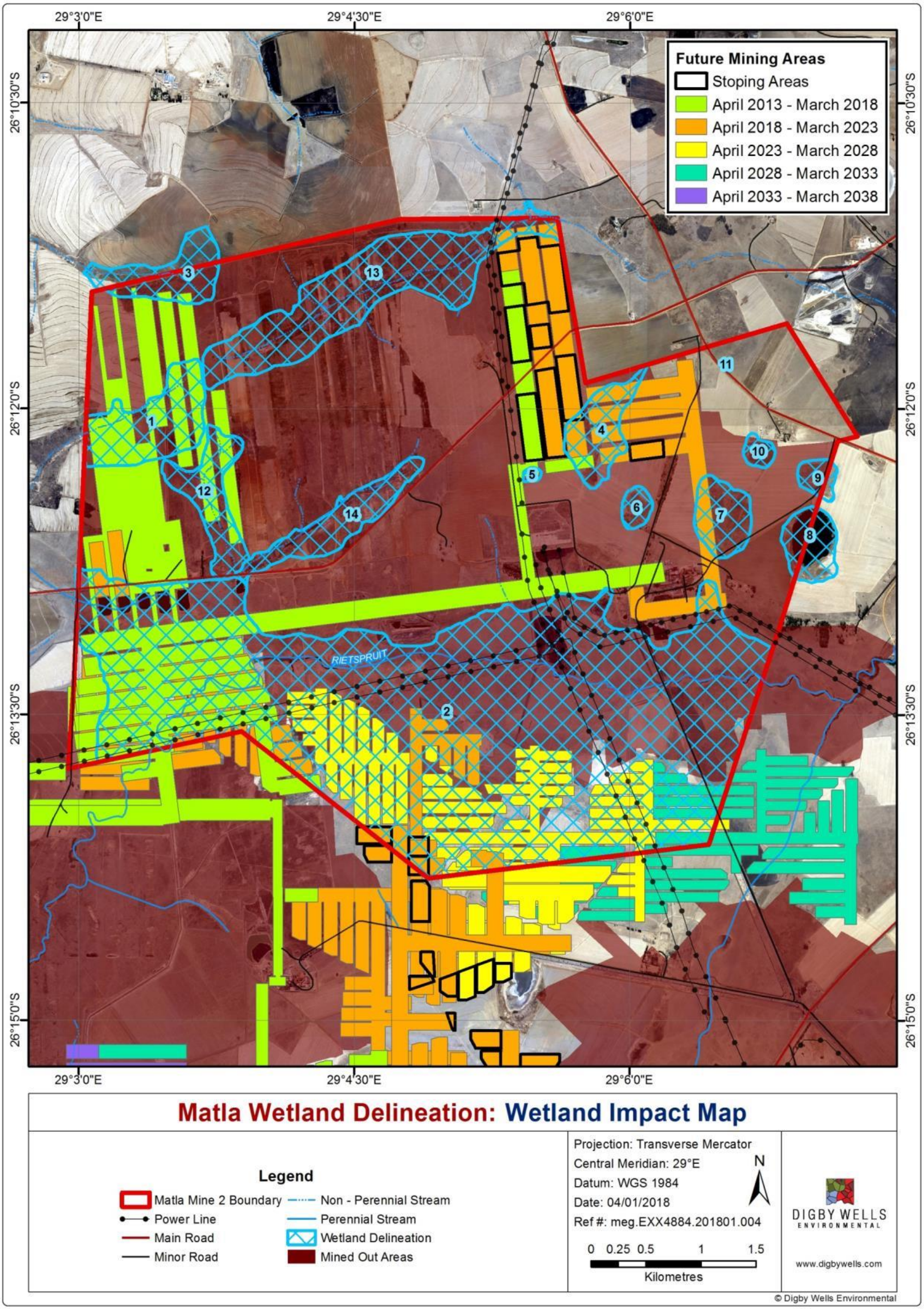

Figure 10-1: Future Mined Areas within the Matla Mine 2 Project area

Table 10-1: Project Activities

Activity	Phase of Project
Infrastructure layout planning	Planning and pre-construction phase
Construction of infrastructure associated with the Matla Mine 2 underground mining project	Construction phase
Operational activities within the Matla Mine 2 Project area	Operational phase
Decommissioning of infrastructure	Decommissioning
Rehabilitation of decommissioned infrastructure	Rehabilitation/Closure
Rehabilitation of surface areas affected by subsidence	Rehabilitation/Closure
Monitoring and maintenance of decommissioned and rehabilitated areas	Post-closure

10.1.1 Planning and Pre-Construction Phase

10.1.1.1 Project Activities Assessed

Project activities and associated impacts for the proposed planning and pre-construction phase are listed in Table 10-2 and Table 10-3.

Table 10-2: Interactions for the planning and pre-construction phase

Interaction		Impact
1	Proposed infrastructure layout and localities of the underground mining areas.	Potential loss of catchment yields and surface water recharge, potential loss of biodiversity, impaired water quality, potential loss of instream integrity, potential impacts to freshwater resources further downstream of this point.

10.1.1.2 Impact Description

The location of various infrastructure and underground mining areas occur either within the delineated freshwater feature areas or within the 32m or 100m zones of regulation according to NEMA and Regulation GN704 of the NWA.

10.1.1.3 Management Objectives

The objectives for management measures for the planning and pre-construction phase are to preserve wetland functionality and integrity prior to any disturbances or impacts associated with the proposed project through optimal site selection of the proposed infrastructure.

The following management and mitigation measures are prescribed for the planning and pre-construction phase:

- Ensure that as far as possible all infrastructures are placed outside of delineated freshwater features;
- Ensure that sound environmental management is in place during the planning phase;
- Design of infrastructure should be environmentally and structurally sound and all possible precautions taken to prevent spillage, seepage or decant to the surface and groundwater resources present as a result of altered hydrology and affected water tables;
- It must be ensured that the design and construction of all infrastructures prevents failure.

10.1.1.4 Management Actions and Targets

The Impact Ratings are indicated in the table below.

Table 10-3: Potential Impacts of the Planning and Pre-Construction Phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Proposed infrastructure layout			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the operational life span of the project.	Minor (negative) – 52
Extent	Greater municipal area (4)	Loss of catchment yield, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered probable.	
Nature	Negative		
Post-Mitigation			

Dimension	Rating	Motivation	Significance
Duration	Medium term 1 – 5 years (3)	The impact will cease after the life of the project has ceased.	Minor (negative) - 36
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the project.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should the proposed decommissioning and rehabilitation project proceed, improvements to the ecological integrity of the systems present are considered likely.	
Nature	Negative		
Activity and Interactions: Proposed underground mining areas			
Prior to Mitigation/Management			
Duration	Permanent (7)	The impact is irreversible, even with management.	Moderate (negative) – 96
Extent	Greater municipal area (4)	Loss of catchment yield, as well as degraded habitat due to altered hydrology will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious loss and/or damage to physical or biological resources or highly sensitive environments (5)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts, limiting ecosystem function.	

Dimension	Rating	Motivation	Significance
Probability	Almost certain (6)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered almost certain.	
Nature	Negative		
Post-Mitigation			
Duration	Permanent (7)	The impact is irreversible, even with management.	Moderate (negative) - 84
Extent	Local (3)	Loss of catchment yield, as well as degraded habitat due to altered hydrology will affect entire watercourse and river reaches.	
Intensity x type of impact	Moderate loss and/or damage to physical or biological resources or highly sensitive environments (3)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts, limiting ecosystem function	
Probability	Almost certain (6)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered almost certain	
Nature	Negative		

10.1.2 Construction Phase

10.1.2.1 Project Activities Assessed

Project activities and associated impacts for the proposed construction phase are listed in Table 10-4 and Table 10-5.

Table 10-4: Interactions for the Construction Phase

Interaction		Impact
1	Site access roads and transport roads crossing wetlands	Increased vehicular movement along river crossings and within wetland/riparian zones, resulting in: ▪ Potential contamination of soils as a result of the ingress of hydrocarbons; ▪ Compaction of soils; ▪ Loss of natural vegetation; ▪ Increased sedimentation; and ▪ Increased potential for onset of erosion.
2	Waste rock dump, stockpiles, etc	Vegetation clearing and sedimentation of wetland areas downstream of the stockpiles.

10.1.2.2 Impact Description

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

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

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

10.1.2.3 Management Actions and Targets

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

- Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation;
- Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction;
- Implement and maintain alien vegetation management programme;
- Limit the footprint area of the construction activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);
- If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated;

- Ensure that no incision and canalisation of the wetland features present takes place;
- All erosion noted within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
- All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled;
- A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;
- Permit only essential personnel within the 32 or 100m zones of regulation for all freshwater features identified;
- All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel;
- No crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;
- No material may be dumped or stockpiled within any rivers, tributaries or drainage lines in the vicinity of the proposed decommissioning footprint;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the construction footprint;
- All vehicles must be regularly inspected for leaks;
- Re-fueling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;
- All spills should be immediately cleaned up and treated accordingly; and
- Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility.

10.1.2.4 Impact Ratings

Impact ratings for the construction phase are provided in the tables below.

Table 10-5: Potential Impacts of the Construction Phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Site access roads			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the life of the project has been completed	Minor (negative) – 52

Dimension	Rating	Motivation	Significance
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed.	Minor (negative) - 36
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present	
Probability	Unlikely (3)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered unlikely.	
Nature	Negative		
Dimension	**Rating**	**Motivation**	**Significance**
Activity and Interactions: Waste rock dump, stockpiles, etc.			
Prior to Mitigation/Management			

Dimension	Rating	Motivation	Significance
Duration	Project life (5)	The impact will cease after the life of the project has been completed	Minor (negative) – 52
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed.	Minor (negative) - 36
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present	
Probability	Probable (4)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered probable.	
Nature	Negative		

10.1.3 Operational Phase

10.1.3.1 Project Activities Assessed

Project activities and associated impacts for the operational phase are listed in Table 10-6 and Table 10-7.

Table 10-6: Interactions for the Operational Phase

Interaction		Impact
1	Site access roads crossing wetlands	Increased vehicular movement along river crossings and within wetland/riparian zones, resulting in: ▪ Potential contamination of soils as a result of the ingress of hydrocarbons; ▪ Compaction of soils; ▪ Loss of natural vegetation; ▪ Increased sedimentation; and ▪ Increased potential for onset of erosion.
2	Transport of waste rock or product to stockpile locations	Sedimentation and loss of flow connectivity.
3	Impacts to water quality	Potential ingress of hydrocarbons and other pollutants to the freshwater systems present.
4	Subsidence	Altered hydrology, loss of biodiversity, fragmentation of wetland systems.

10.1.3.2 Impact Description

Among the impacts associated with the proposed project are potential impacts to soil and water quality as a result of the ingress of hydrocarbons and mechanical spills associated with moving machinery required for stockpiling,

Larger impacts include compaction of soils, potential loss of natural vegetation and the increased potential for erosion and sedimentation in the operational footprint.

Any potential stockpiling within wetland areas has the potential to result in loss of stream connectivity, loss of refuge areas, alterations to the terrain profiles of the areas and the creation of preferential flow paths, which may result in sedimentation, alterations to the vegetation structure of the area, encourage alien vegetation encroachment and result in increased erosion and sedimentation potentials.

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

By far, the most significant impact likely to affect the wetland systems present is the impact of subsidence, which is likely to result in altered hydrology, loss of biodiversity as a result of moisture stress. In addition, subsidence is likely to result in fragmentation of the wetland systems present, in turn, resulting in a loss of surface water recharge to the systems further downstream as well as a loss in catchment yield.

10.1.3.3 Management Actions and Targets

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

- Clean and dirty water separation systems to be implemented prior to the commencement of activities and to be maintained throughout the life of the proposed project;
- Ensure that as far as possible all operational infrastructures are placed outside of wetland/riparian areas and their associated 32 or 100m zones of regulation respectively;
- Limit the footprint area of the operational activities to what is absolutely essential in order to minimise impacts as a result of subsidence and any potential vegetation clearing and compaction of soils (all areas but critically so in wetland areas);
- If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated;
- Ensure that no incision and canalisation of the wetland features present takes place as a result of the proposed operational activities;
- All erosion noted within the operational footprint as a result of either subsidence or any potential surface activities should be remedied immediately and included as part of the ongoing rehabilitation plan;
- During the operational phase, erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
  - Where the track has slope of less than 2%, berms every 50m should be installed;
  - Where the track slopes between 2% and 10%, berms every 25m should be installed;
  - Where the track slopes between 10%-15%, berms every 20m should be installed; and
  - Where the track has slope greater than 15%, berms every 10m should be installed.

- All soils compacted as a result of operational activities should be ripped/scarified (<300mm) and profiled;
- A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;
- Permit only essential personnel within the 32 or 100m zones of regulation for all wetland features identified;
- All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel;
- No crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;
- No material may be dumped or stockpiled within any rivers, tributaries or drainage lines in the vicinity of the proposed operational footprint;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the decommissioning area footprint;
- All vehicles must be regularly inspected for leaks;
- Re-fueling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;
- All spills should be immediately cleaned up and treated accordingly;
- Appropriate sanitary facilities must be provided for the duration of the operational activities and all waste must be removed to an appropriate waste facility;
- Monitor all systems for erosion and incision;
- All areas impacted as a result of subsidence should be suitably rehabilitated; and
- Areas across wetlands where cross-sectional subsidence is observed should be rehabilitated in such a way as to maintain stream connectivity in a downstream direction.

10.1.3.4 Impact Ratings

Table 10-7 represents the impact ratings for the operational phase.

Table 10-7: Potential Impacts of the Operational Phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Site access and roads			
Prior to Mitigation/Management			

Dimension	Rating	Motivation	Significance
Duration	Project life (5)	The impact will cease after the life of the project has been completed	Minor (negative) – 52
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed.	Minor (negative) - 36
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present	
Probability	Unlikely (3)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered unlikely.	
Nature	Negative		
Dimension	**Rating**	**Motivation**	**Significance**
Activity and Interactions: Transport of Waste Rock and Product			

Dimension	Rating	Motivation	Significance
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the life of the project has been completed	Minor (negative) – 52
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed.	Negligible (negative) - 27
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present.	
Probability	Unlikely (3)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered probable.	
Nature	Negative		
Dimension	Rating	Motivation	

Dimension	Rating	Motivation	Significance
Activity and Interactions: Impacts to Water Quality			
Prior to Mitigation/Management			
Duration	Permanent (6)	The impact is likely to continue after the life of the project has been completed.	Minor (negative) – 70
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Likely (5)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered likely.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed.	Negligible (negative) - 27
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present	
Probability	Unlikely (3)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered unlikely.	
Nature	Negative		

Dimension	Rating	Motivation	Significance
Activity and Interactions: Subsidence			
Prior to Mitigation/Management			
Duration	Permanent (7)	The impact is irreversible, even with management.	Major (negative) –127
Extent	Greater municipal area (4)	Loss of catchment yield, as well as degraded habitat due to altered hydrology will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious loss and/or damage to physical or biological resources or highly sensitive environments (7)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts, limiting ecosystem function	
Probability	Definite (7)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered definite.	
Nature	Negative		
Post-Mitigation			
Duration	Permanent (7)	The impact is irreversible, even with management.	Moderate (negative)

Dimension	Rating	Motivation	Significance
Extent	Local (3)	Loss of catchment yield, as well as degraded habitat due altered hydrology will affect entire watercourse and river reaches, however, with the implementation of applicable management measures, some system fragmentation may be mitigated.	- 90
Intensity x type of impact	Serious loss and/or damage to physical or biological resources or highly sensitive environments (5)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts, limiting ecosystem function	
Probability	Almost certain (6)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered almost certain	
Nature	Negative		

10.1.4 Decommissioning Phase

10.1.4.1 Project Activities Assessed

Project activities and associated impacts for the proposed decommissioning phase are listed in Table 10-8.

Table 10-8: Interactions for the Decommissioning Phase

Interaction	Impact

Interaction		Impact
1	Site access roads crossing wetlands	Increased vehicular movement along river crossings and within wetland/riparian zones, resulting in: ▪ Potential contamination of soils as a result of the ingress of hydrocarbons; ▪ Compaction of soils; ▪ Loss of natural vegetation; ▪ Increased sedimentation; and ▪ Increased potential for onset of erosion
2	Removal in infrastructure (including stockpiles)	Potential dumping of decommissioned infrastructure in wetland/riparian areas; Potential incomplete removal of infrastructure; Disturbance of natural vegetation structures

10.1.4.2 Impact Description

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

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

Any temporary storage or dumping of decommissioned infrastructure within wetland areas, has the potential to result in loss of stream connectivity, loss of refuge areas, alterations to the terrain profiles of the areas and the creation of preferential flow paths, which may result in sedimentation, alterations to the vegetation structure of the area, encourage alien vegetation encroachment and result in increased erosion and sedimentation; potentials.

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

10.1.4.3 Management Objectives

The objectives for management measures for the decommissioning phase are to preserve wetland functionality and integrity for the duration and into the rehabilitation and closure phases of the proposed project. Activities must not expand in the general footprint area and cause severe degradation of wetlands that are already impacted upon.

10.1.4.4 Management Actions and Targets

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

- Ensure that sound environmental management is in place during the proposed decommissioning phase;
- Ensure that as far as possible all decommissioned infrastructures are placed outside of wetland/riparian areas and their associated 32 or 100m zones of regulation respectively;
- Limit the footprint area of the decommissioning activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);
- If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated;
- Ensure that no incision and canalisation of the freshwater resources present takes place as a result of the proposed decommissioning activities;
- All erosion noted within the decommissioning area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan;
- All soils compacted as a result of decommissioning activities should be ripped/scarified (<300mm) and profiled;
- A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;
- Permit only essential personnel within the zones of regulation for all freshwater features identified;
- All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel;
- No crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;
- Wherever possible, restrict decommissioning activities to the drier winter months to avoid sedimentation of the freshwater resources further downstream;
- No material may be dumped or stockpiled within any wetland areas (or the buffers) in the vicinity of the proposed decommissioning footprint;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any freshwater areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the decommissioning area footprint;
- All vehicles must be regularly inspected for leaks;

- Re-fueling must take place on a sealed surface area away from freshwater systems to prevent ingress of hydrocarbons into topsoil;
- All spills should be immediately cleaned up and treated accordingly;
- Appropriate sanitary facilities must be provided for the duration of the decommissioning activities and all waste must be removed to an appropriate waste facility; and
- Monitor all systems for erosion and incision.

10.1.4.5 Impact Ratings

The majority of wetlands that are at risk of negative impacts during the decommissioning phase have been identified as largely modified to seriously modified and further impacts related to sedimentation and habitat degradation may result in a further drop in ecological state of the freshwater systems present. Table 10-9 represents the impact ratings for the decommissioning phase.

Table 10-9: Potential Impacts of the Decommissioning Phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Decommissioning of all infrastructure			
Prior to Mitigation/Management			
Duration	Project life (4)	The impact will cease after the decommissioning, rehabilitation and closure phases of the project have been completed.	Minor (negative) – 46
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered probable.	
Nature	Negative		

Dimension	Rating	Motivation	Significance
Post-Mitigation			
Duration	Project life (4)	The impact will cease after the decommissioning, rehabilitation and closure phases of the project have been completed.	Negligible (negative) - 32
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present	
Probability	Probable (4)	Should the proposed project proceed, improvements to the ecological integrity of the systems present are considered likely.	
Nature	Negative		

10.1.5 Rehabilitation, Closure and Post-Closure Phases

10.1.5.1 Project Activities Assessed

Project activities and associated impacts for the Rehabilitation, Closure and Post-closure Phases are listed in Table 10-10.

Table 10-10: Interactions for the Rehabilitation, Closure and Post-Closure Phases

Interaction		Impact
4	Site access roads crossing wetlands	Increased vehicular movement along river crossings and within wetland/riparian zones, resulting in: ▪ Potential contamination of soils as a result of the ingress of hydrocarbons; ▪ Compaction of soils; ▪ Loss of natural vegetation; ▪ Increased sedimentation; and ▪ Increased potential for onset of erosion.
5	Rehabilitation, closure and post-closure activities within and around any wetland/riparian habitat, such as demolition and removal of all infrastructure, and subsequent rehabilitation and closure of the wetland areas present in the vicinity of the decommissioning footprint including: ▪ Rehabilitation of historical impacts to the wetlands in the vicinity of the proposed decommissioning footprint; ▪ Removal of AIPs and implementation of an alien vegetation management plan; ▪ Clean-up of any waste or hazardous materials in the vicinity of the proposed decommissioning footprint, both in and in the vicinity of wetland areas; ▪ Ripping and re-profiling of slopes and natural terrain profiles in the vicinity of the decommissioned area, subsidence areas and associated historically eroded areas; and ▪ Re-seeding of disturbed or cleared areas. Re-seeding of re-profiled areas.	Similarly to the decommissioning phase, the activities occurring within an ecologically sensitive catchment pose significant potential negative impacts to functioning wetlands and the catchment. Furthermore, the rehabilitated area could cause major negative impacts due to spread of AIPs, increased soil compaction, wetland fragmentation and loss of biodiversity in areas of subsidence, erosion and subsequent sedimentation into the wetland ecosystems.

10.1.5.2 Impact Description

The rehabilitation, closure and post-closure activities pose some potential negative impacts to functioning wetlands and the catchment, including spread of alien invasive vegetation, increased soil compaction, erosion and subsequent sedimentation into the wetland ecosystems should the appropriate activities and management and mitigation measures not be adequately implemented.

10.1.5.3 Management Objectives

The objective of the mitigation and management measures for the rehabilitation, closure and post-closure phases of the proposed project is to ensure that long-term impacts to wetlands post-closure are reduced as far as possible.

10.1.5.4 Management Actions and Targets

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

- Wetland monitoring must be carried out during both the decommissioning and rehabilitation phases to ensure impact to wetlands are minimised as far as possible;
- Wetlands and their associated zones of regulation are to be clearly demarcated and avoided wherever possible;
- An alien vegetation management plan to be implemented and managed for the life of the proposed decommissioning, rehabilitation, closure and post-closure phases;
- As much vegetation growth as possible should be promoted within the proposed development area during all phases. In order to protect soils, vegetation clearance should be kept to a minimum;
- Monitor all systems for erosion and incision;
- All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses;
- Preventative measures such as hessian sheeting should be used in steep re-seeded areas where high erosion potentials exist;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the project area footprint;
- Compacted soils should be ripped, re-profiled and re-seeded;
- All vehicles must be regularly inspected for leaks;
- Re-fueling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;

- All existing litter, debris should be removed from the wetland areas and littering should be prohibited on an ongoing basis;
- All spills should be immediately cleaned up and treated accordingly;
- Appropriate sanitary facilities must be provided for the duration of the rehabilitation activities and all waste must be removed to an appropriate waste facility; and
- Ongoing wetland rehabilitation is necessary both within and in the vicinity of the proposed decommissioning footprint and appropriate wetland monitoring techniques must take place on an annual basis during the summer/wet season in order to identify any emerging issues, trends or improvements in the receiving environment, with special mention of areas likely to be affected by subsidence and in turn, altered hydrology and terrain.

10.1.5.5 Impact Ratings

During the rehabilitation, closure and post-closure phases, minor impacts are expected. Table 10-11 represents the impact rating for the rehabilitation, closure and post-closure phases.

Table 10-11: Potential Impacts of the Rehabilitation, Closure and Post-Closure Phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Rehabilitation of habitat and wetlands within and in the vicinity of the Matla Mine 2 Project area.			
Prior to Mitigation/Management			
Duration	Permanent (7)	The impact is irreversible, even with management.	Moderate (negative) – 96
Extent	Greater municipal area (4)	Loss of catchment yield, as well as degraded habitat due to altered hydrology will affect entire watercourse and river reaches.	

Dimension	Rating	Motivation	Significance
Intensity x type of impact	Serious loss and/or damage to physical or biological resources or highly sensitive environments (5)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts, limiting ecosystem function	
Probability	Almost certain (6)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered almost certain	
Nature	Negative		
Post-Mitigation			
Duration	Permanent (7)	The impact is irreversible, even with management.	
Extent	Local (3)	Loss of catchment yield, as well as degraded habitat due altered hydrology will affect entire watercourse and river reaches, however, with the implementation of applicable management measures, some system fragmentation may be mitigated.	Moderate (negative) - 90

Dimension	Rating	Motivation	Significance
Intensity x type of impact	Serious loss and/or damage to physical or biological resources or highly sensitive environments (5)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts, limiting ecosystem function	
Probability	Almost certain (6)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered almost certain	
Nature	Negative		

10.1.6 Cumulative Impacts

The freshwater resources in this area are currently heavily impacted as a result of various cumulative impacts as a result of extensive mining activities in the area. In addition, other impacts to the freshwater resources present in the vicinity of the proposed project include agricultural cultivation and grazing activities. Existing underground mining activities have resulted in subsidence of large areas within the Project area as well as within the greater mining rights area. This has resulted in large impacts to the wetland systems present including fragmentation of the systems, altered hydrology and terrain profiles, loss of biodiversity and altered vegetation structures.

It is the opinion of the ecologist that should this mining project proceed, further impacts to the ecology of the wetlands are deemed likely, with special mention of areas where underground mining may result in fragmentation of the systems present.

10.2 Monitoring Plan

Due to the proposed location of the underground mining areas likely to affect selected wetland areas as a result of subsidence, with special mention of HGM1, 2 and 4, the Wet-health and Wet-Ecoservices tools are to be used to re-evaluate PES and eco-services on an annual basis by a suitably qualified wetland specialist for the life of the proposed project and for a period of at least 5 years after the decommissioning and closure of the proposed project during the summer/wet monitoring season.

Thereafter, monitoring is recommended every two years until the system is deemed appropriately rehabilitated. If monitoring results necessitate corrective action in terms of re-profiling of areas affected by subsidence, alien vegetation removal and erosion control, these corrective measures should be implemented immediately.

The Environmental Management Officer (EMO) must be present on site during decommissioning and rehabilitation phases and must ensure that the wetland areas and their associated zones of regulation are clearly demarcated and that no unnecessary clearing of vegetation takes place.

10.3 Rehabilitation Monitoring and Recommendations

Extensive rehabilitation activities and measures were observed in the vicinity of Panels 6, 7 and 8 in line with recommendations supplied by Golder (2009). Rehabilitation measures implemented which affect the wetland ecology of the HGM units observed in this area include the following:

- Re-profiling, re-shaping and re-sloping of the areas affected by subsidence;
- Aggressive revegetation of the area as for side slopes;
- The development of a series of small ponds along the wetland areas to serve as sediment traps, to reduce speed of run-off flow, and to allow the establishment of wetland vegetation, which will have a filtering and cleaning effect on water quality; and
- Evidence of redirection of the flow paths through barriers to reduce the speed of run-off flow through the wetland areas;

The maintenance of valley bottom and hillslope seepage wetlands are typically characterised by subsurface seepage of water and are maintained by the emergence of interflow and/or shallow groundwater from deeper terrestrial soils in the wetlands catchment area. Thus, maintenance of the supporting hydrology and recharge areas for interflow and shallow groundwater are critical to the maintenance of these wetlands.

As mentioned in Section 9.2.2 above, the wetlands in the vicinity of Panels 6, 7 and 8, may be regarded as largely and seriously modified. HGM Units 13 and 14 have been largely impacted upon in terms of geomorphology, hydrology and vegetation integrity. While impacts to the geomorphology have resulted in some loss of continuous flow and fragmentation in these systems, they do serve to reduce flow speed, thus reducing the potential for erosion and allowing for the re-establishment of wetland vegetation in ponded areas and while impacts to the hydrology of the area are extensive, evidence of both surface and groundwater recharge were observed.

It is recommended that an annual assessment of the wetland integrity of these systems take place so as to monitor any degradation or improvement in the systems over time. In addition, the following actions are deemed appropriate:

- A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;
- Permit only essential personnel within the zones of regulation for all wetland areas present;
- All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel;
- No crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity and hydrology must be maintained;
- No material may be dumped or stockpiled within any wetland areas (or the buffers);
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any demarcated wetland areas and their associated zones of regulation;
- Continued efforts to improve the establishment of wetland species should take place and wetland areas where vegetation is absent should be re-seeded with an indigenous wetland species grass mix;
- It is recommended that a detailed wetland rehabilitation plan be compiled both for already impacted areas, and future impacted areas as a result of mining activities;
- Monitor all systems for erosion and incision.

11 Conclusion

Digby Wells) was appointed by Exxaro to conduct a wetland assessment including wetland sensitivity mapping and an impact assessment, as part of the existing and proposed underground mining areas associated with Matla Mine 2.

11.1 Wetland Delineations and Sensitivity Mapping

Fourteen hydro-geomorphic (HGM) wetland units were identified in the vicinity of the proposed Project area comprising of two Channelled Valley Bottom Wetlands, two Un-channelled Valley Bottom wetlands, three Hillslope Seeps and seven Depressions.

11.2 Present Ecological State (PES)

The wetlands within the Project Area exhibit a variety of PES values, ranging from *Seriously Modified* (Category E), to *Largely Natural* (Category B) HGM Unit 8 and 10 are classified as *Largely Natural* (Category B) wetlands. These pans have not been impacted on to a great extent. The geomorphological and hydrological regimes have not been altered significantly and very little disturbance was observed with regards to vegetation. Eight *Moderately Modified* (Category C) wetlands were identified (HGM units 2, 3, 4, 5, 6, 7, 9 and 11). These wetlands were mainly impacted on by cultivation and/or grazing with few geomorphological impacts. Two *Largely Modified (*Category D*)* wetlands are present in the Project Area - HGM

Unit 1 and HGM Unit 12. The *Largely Modified* category is mainly attributed to the subsidence in the area. Two *Seriously Modified* (Category E) wetlands were present. HGM Unit 13 and HGM Unit 14 have been seriously impacted on through subsidence, which has altered the hydrology of the wetland significantly as the subsidence has occurred perpendicular to the flow of the original wetlands, unlike that of HGM Unit 12, where subsidence occurred parallel to the wetland, therefore not completely altering the hydrology. Some canals have been constructed through the crests of the subsidence areas of HGM 13 and 14 to allow water to flow in the same direction of the original wetlands nevertheless the flow has been significantly impacted on.

11.3 Ecological Importance and Sensitivity

EIS score for the wetlands ranged from *Low* (0.7) to *Very High* (3.1).Although the wetlands are modified, they do still provide predominantly *Moderate* to *Low* hydrological importance services (mostly ranging between 0.5 and 1.7), such as flood attenuation and assimilation of toxicants and nitrates. HGM Unit 2 is an exception, with a *High* score. The Ecological Importance and Sensitivity category is ranging from *Low* (0.7) to *Very High* (3.1). Some HGM units have been completely transformed and therefore provide little habitat for fauna and flora, whilst others HGM units such as HGM Unit 2, still have intact vegetation where red data species were observed. In general, the values are *Low* for 'Direct Human Benefits' (most ranging between 0.1 and 1) as these wetland mainly fall within the mine fences and mining rights area and therefore are not utilised as they would be in a unrestricted area. HGM unit is the only exception (2.5) as it is contains standing water utilised for fish purposes.

11.4 Impact Assessment

Among the impacts associated with the proposed project are potential impacts to soil and water quality as a result of the ingress of hydrocarbons and mechanical spills associated with moving machinery required for stockpiling. Larger impacts include compaction of soils, potential loss of natural vegetation and the increased potential for erosion and sedimentation in the operational footprint.

Any potential stockpiling within wetland areas has the potential to result in loss of stream connectivity, loss of refuge areas, alterations to the terrain profiles of the areas and the creation of preferential flow paths, which may result in sedimentation, alterations to the vegetation structure of the area, encourage alien vegetation encroachment and result in increased erosion and sedimentation potentials.

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

By far, the most significant impact likely to affect the wetland systems present is the impact of subsidence, which is likely to result in altered hydrology and loss of biodiversity as a result

of altered terrain profiles and vegetation structures. In addition, subsidence is likely to result in fragmentation of the wetland systems present, in turn, resulting in a loss of surface water recharge to the systems further downstream as well as a loss in catchment yield.

11.5 Summary and Ecological Opinion

Due to the proposed location of the underground mining areas, there is the potential to affect selected wetland areas as a result of subsidence, with special mention of HGM Units 1, 2 and 4. Impacts were found to range in extent, including both high and low impacts. Surface impacts related to transport of waste and product, vehicle movement and any surface infrastructure were regarded as low and may be further reduced with adequate mitigation and management. In contrast, impacts related to the underground mining are considered high.

It is the opinion of the ecologist that should this mining project proceed, further impacts to the ecology of the wetlands are deemed possible.

12 References

Duthie A, MacKay H, De Lange M (editors). 1999. Present Ecological Status (PES) Method. Department of Water Affairs and Forestry, South Africa

DWAF, 1999. Determining the Ecological Importance and Sensitivity (EIS) and Ecological Management Class (EMC). Version 1.0. 24 September 1999.

DWAF. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Pretoria: Department of Water Affairs and Forestry.

Kleynhans, CJ.1999. A procedure for the determination of the ecological reserve for the purposes of the national water balance model for South African River. Institute of Water Quality Studies, Department of Water Affairs & Forestry, Pretoria.

Kotze, D.C. and Breen, C.M., 1994. Agricultural land-use impacts on wetland functional values. Water Research Commission.

Kotze, D.C. and Marneweck, G.C. 1999. Guidelines for delineating the boundaries of a wetland and the zones within a wetland in terms of South African Water Act. As part of the development of a protocol for determining the ecological reserve for wetlands in terms of the Water Act resource protection and assessment policy implementation process. Department of Water Affairs and Forestry, South Africa.

Kotze, D.C., Marneweck, G.C., Batchelor, A.L., Lindley, D.C., and Collins, N.B. 2007. A Technique for rapidly assessing ecosystem services supplied by wetlands. Mondi Wetland Project.

Macfarlane, D., Kotze, D., Ellery, W., Walters, D., Koopman, V., Goodman, P., et al. 2009. A technique for rapidly assessing wetland health: Wet-Health. Water Research Commission.

McCarthy T. S. 2011. The impact of acid mine drainage in South Africa. South African Journal of Science 107: 7pp.

Nel J.L., Murray K.M., Maherry A.M., Petersen C.P., Roux D.J., Driver A., Hill L., van Deventer H., Funke N., Swartz E.R., Smith-Adao L.B., Mbona N., Downsborough L., Nienaber S. 2011. Technical report for the National Freshwater Ecosystem Priority Areas project. Water Research Commission. WRC report No. 1801/2/11, ISBN 978-1-4312-0149-5. Set no. 978-1-4312-0148-7.

Oberholzer P.J., Myburgh J.G., Ashton P.J., Coetzee J.J., Botha A.M. 2011. Bioaccumulation of aluminium and iron in the food chain of Lake Loskop, South Africa. Ecotoxicology and Environmental Safety 75:134-141 p.

Rountree, M.W., H. Malan and B. Weston (editors). 2012. Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). Joint Department of Water Affairs/Water Research Commission Study.

Rutherford MC, Mucina L. Introduction. In: Mucina L, Rutherford MC,editors. The vegetation of South Africa, Lesotho and Swaziland. Pretoria: South African National Biodiversity Institute, 2006; p. 384–385

Swanepoel, C.M., Barnard, R.O., 2007. Discussion Paper: Wetland in agriculture. Water