SURFACE WATER ASSESSMENT

PROPOSED KOPPIE MINING PROJECT, LOCATED

NEAR BETHAL IN THE MPUMALANGA PROVINCE

AUGUST 2021

Oasis Environmental Specialists (Pty) Ltd

Tel: 016 987 5033

Cell: 076 589 2250

Email: joppie@oasisenvironmental.co.za

Website: http://oasisenvironmental.co.za

37 Oorbietjies Street, Lindequesdrift

Potchefstroom, 1911

DOCUMENT CONTROL		
Project Name:		**SURFACE ASSESSMENT FOR THE PROPOSED KOPPIE MINING PROJECT, LOCATED NEAR BETHAL IN THE MPUMALANGA PROVINCE.**
Client:	**Person:**	**Riana Panaino**
	Company:	**ECO Elementum (Pty) Ltd.**
	Position:	**Environmental Consultant**
	Email:	riana@ecoe.co.za
	Cell:	**082 828 3268**
Compiled by:	**Person:**	**Joppie Schrijvershof** ***Pri Sci Nat: 115553*** ***MSc (NWU- Aquatic Science)***
	Company:	**Oasis Environmental Specialists (Pty) Ltd.**
	Position:	**Aquatic, Wetland and Ecological Scientist**
	Email:	joppie@oasisenvironmental.co.za
	Cell:	**076 589 2250**
Date:		**2021-08-25**
Reference Number:		**SW-20-001**

I, **Jacob Schrijvershof,** declare that -

- I act as the independent specialist in this matter;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist assessment relevant to this application, including knowledge of the National Environmental Management Act (Act 107 of 1998) (NEMA) and the National Water Act (Act 36 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; all the particulars furnished by me in this report are true and correct;
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B (1) of the National Environmental Management Act, 1998 (Act 107 of 1998); and
- I understand that any false information published in this document is an offence in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Joppie Schrijvershof

Executive summary

The purpose of this report is to summarise the surface water findings for Proposed Koppie Mining Project. This survey was conducted on the 27th of November 2020 in order to assess the current surface water conditions and to expand baseline data for future reference. The farm portions are located near Bethal in the Mpumalanga Province.

- The Preferred Option is to be placed on Portions 3, 6, 10 and 21 of the Farm Uitgedacht 229 IS; and
- The Alternative Option is to be placed on Portions 6, 21, 27, 30 and 32 of the Farm Uitgedacht 229 IS; and

The aim of this study is to ensure compliance with the general legislative requirements as part of the for the Water Use Authorisation process prescribed by the National Water Act (NWA) (Act No 36 of 1998) and National Environmental Management Act (NEMA) (Act No 107 of 1998).

The scope of the surface water baseline and impact assessment study was to:

- Establish the water quality baseline by assessing water quality in the Viskuile and Joubertsvlei systems within the proposed project area and comparing it to national water quality standards.
- Field visit to survey the affected watercourses;
- Use the information in the available reports to describe the prevailing surface water environment and climate in the study area;
- Developing a sensitivity map based on field visits and supported by appropriate regional information to inform the risk assessment;
- Undertake an impact/risk assessment of the proposed project on the surface water environment for the construction and operation phases of the project; and
- Recommendation of site-specific mitigation measures.

The overall results of the aquatic and wetland assessment based on the various methodologies concluded that:

- The study sites had stagnant water in certain sections of the stream at the time at the assessment. Litter and sewage from a small community were observed within the water systems. The upstream site for the Joubertsvleispruit was dry at the time of the assessment, where the downstream site and the Viskuile River had pockets of water at the time of the assessment.
- *In situ* water quality variables was within acceptable limits compared to the Target Water Quality Ranges (TWQRs) for aquatic ecosystems of South Africa. The pH remained relatively constant throughout the sites and within the neutral range. Temperatures were relatively stable, where electrical conductivity levels were above recommended

guideline levels for the Joubertsvleispruit. Dissolved oxygen (DO) levels were below guideline levels at both upstream and downstream sites, this may be attributed to a lack of suitable flow conditions. Agriculture and mining activities were observed at the time of the assessment near these systems. It must be noted that *in situ* water quality testing cannot identify specific chemicals for the basis for the health determination of a river system.

- The physical and chemical water quality results were evaluated in respect of the RQO's for the Oliphant's Catchments guidelines for Aquatic Ecosystems for the B11A catchment as provided by Department Water and Sanitation to assess the conditions of the watercourses.
- Water samples were obtained during the field survey for the analysis of the physical and chemical properties of the Viskuile and Joubertsvlei systems and to compare them to these reference conditions. All chemical variables measured were found to be within guideline levels indicating that these systems are within a good condition based on water quality.
- The study site can be characterised as having rolling hills with relatively steep sloping topography. The site ranges in altitude from 1593 m to 1717 m above sea level. A Digital Elevation Model (DEM) of the aerial photography of the site revealed two depressions in landscape cutting in the middle of the mining boundary
- Several 'A' Section and 'B' Section channels were delineated. The main drainage channels were identified as 'B' Section channels and any other drainage features were found to be 'A' Section channels feeding the 'B' section channels during rainfall. These channels are associated with the floodplain wetland areas.
- From the wetland study, two floodplain wetland systems were identified with the Proposed Koppie Mining Project boundary. The floodplain wetland received poor scores, indicating that these wetland is heavily transformed system.

The DWS based risk assessment (GN 509) found that the impact on the wetland areas from the Proposed Koppie Mining Project were rated as an overall **moderate impact during construction** and as an overall **high impact during operation for** the Alternative Option. The Preferred Option's an overall risk is considered **moderate impact during construction** and as an overall **moderately-high impact during operation**. This is considering and taking into account that the mitigations measures as provide being implemented appropriately, otherwise the impacts will be significantly higher for both options. Identified impacts pertaining to erosion, sedimentation, water quality and quantity alterations and the continued spread of alien invasive species and the main concern is the placement of the proposed Adit within the wetland areas.

Provided mitigation measures are to be implemented within an environmental management programme (EMPr) and the significance of any negative impacts reduced. Potential impacts associated with the operational phase include:

- Increased sedimentation;
- Water quality contamination due to runoff or seepage;
- Alteration of natural flow regime;
- Increased utilisation of aquatic resources; and
- Possible habitat loss.

Mitigation measures, aimed at minimising the afore-mentioned impacts, include (but are not limited to):

- Design and implementation of a suitable stormwater system;
- Rehabilitation of the disturbed areas;
- Limiting instream sedimentation;
- Minimising pollutants entering the watercourse;
- Implement a programme for the clearing/eradication of alien species including long term control of such species;
- A 110 m buffer was implemented for the wetland systems;
- Ongoing water quality monitoring must take place every month during operational phases; and
- Biomonitoring where/if flow conditions allow for effective sampling analysis must take place bi-annually to determine any trends in ecology and hydrology.

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LIST OF ABBREVIATIONS AND ACCRONYMS

BGIS: Biodiversity Geographic Information System

DEM: Digital Elevation Model

DWAF: Department of Water Affairs and Forestry

DWS: Department of Water Affairs and Sanitation

EA: Environmental Authorisation

EC: Ecological Category

EIS: Ecological Importance and Sensitivity

GIS: Geographic Information System

NFEPA: National Freshwater Priority Area

NWA: National Water Act (Act no 36 of 1998)

PES: Present Ecological Status

QDS: Quarter Degree Square

TWQRs Target Water Quality Ranges

WMA: Water Management Areas

WUL: Water Use Licence

1 INTRODUCTION

1.1 Background

Oasis Environmental Specialists (Pty) Ltd was appointed by Eco Elementum (Pty) Ltd to conduct surface water assessment report for the proposed project, which will involve the development of a new Greenfields underground coal mining operation near the towns of Bethal and Hendrina within the jurisdiction of the Msukaligwa Local Municipality and Gert Sibande District Municipality in the Mpumalanga province. The mine will be located on portions from the Farm Koppie 228 IS and the Farm Uitgedacht 229 IS. (**Figure 1**). The field assessment was conducted on the 27st of November 2020 in order to assess the surface water features and to expand baseline data for future reference.

The mining right area is 1955.450 ha in extend and the footprint of the activity 80 ha (proposed surface infrastructure) and falls within the quarter degree squares 2629AD and 2629BC. The proposed mining layout is illustrated with two options to the mining establishment:

- The Preferred Option (**Figure 2**) to be placed on Portions 3, 6, 10 and 21 of the Farm Uitgedacht 229 IS; and
- The Alternative Option (**Figure 3**) mining layout to be placed on Portions 6, 21, 27, 30 and 32 of the Farm Uitgedacht 229 IS; and

1.2 Legal framework

1.2.1 National Environmental Management Act (Act No. 107 of 1998)

The EIA Regulations, promulgated under NEMA, focus primarily on creating a framework for co-operative environmental governance. NEMA provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by State Departments and to provide for matters connected therewith.

1.2.2 National Waste Act, 2008 (Act No. 59 of 2008)

The NEMWA aims at promoting sustainable waste management practices through the implementation of “Integrated Waste Management Planning”, where “Integrated Waste Management Planning is viewed as a holistic approach of managing waste, aimed at optimising waste management practises to ensure that the implementation thereof yields practical solutions that are environmentally, economically and socially sustainable and acceptable to the public and all relevant spheres of government”.

1.2.3 National Water Act, 1998 (Act No. 36 of 1998)

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) aims to provide management of the national water resources to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected as well as integrated management of water resources with the delegation of powers to institutions at the regional or catchment level. The purpose of the Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in responsible ways. Of specific importance to this application is Section 19 of the NWA, which states that an owner of land, a person in control of land or a person who occupies or uses the land which thereby causes, has caused or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring and must therefore comply with any prescribed waste standard or management practices.

1.3 Scope of work

The scope of the surface water baseline and impact assessment study was to:

- Establish the water quality baseline by assessing water quality in the Viskuile and Joubertsvlei streams around the project area and comparing it to national water quality standards.
- Field visit to survey the affected watercourses;
- Use the information in the available reports to describe the prevailing surface water environment and climate in the study area;
- Developing a sensitivity map based on field visits and supported by appropriate regional information to inform the impact assessment;
- Undertake an impact assessment of the proposed project on the surface water environment for the construction and operation phases of the project; and
- Recommendation of site-specific mitigation measures.

1.4 Assumptions and Limitations

It is difficult to apply pure scientific methods within a natural environment without limitations, and consequential assumptions need to be made. The following constraints may have affected this assessment:

- A hand-held Garmin eTrex 30 were used to delineate the watercourses had an accuracy of 3 m to 6 m
- The findings, results, observations, conclusions and recommendations provided in this report are based on the author's best scientific and professional knowledge as well as available information regarding the perceived impacts on the watercourses; and
- Flood volumes, floodline delineation and storm water management is not discussed in this report as a Storm Water Management Plan will be drawn up for the project by a professional engineer, which includes the aforementioned matters..

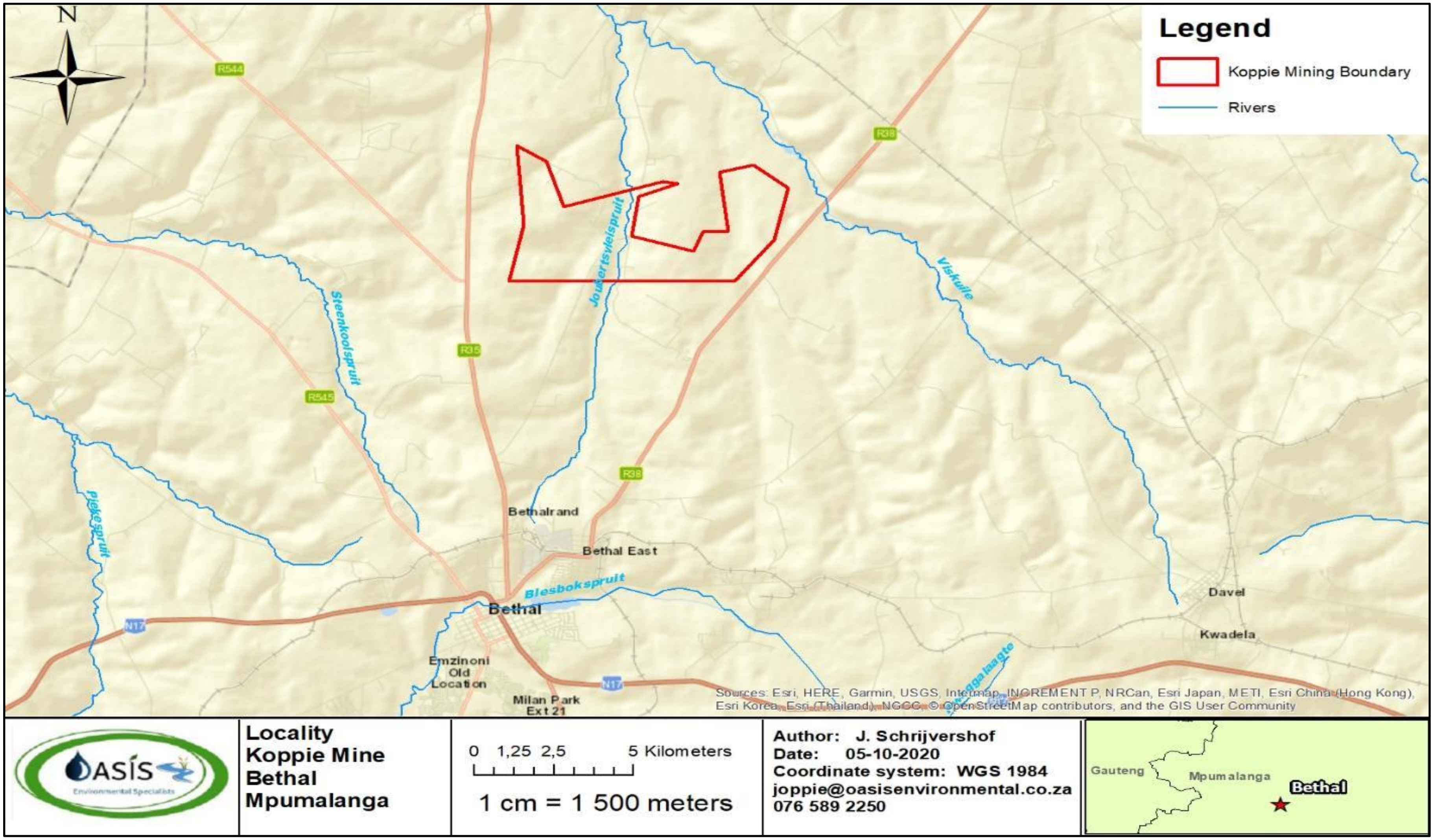

Figure 1: Locality of Proposed Koppie Mining Project near Bethal, Mpumalanga Province.

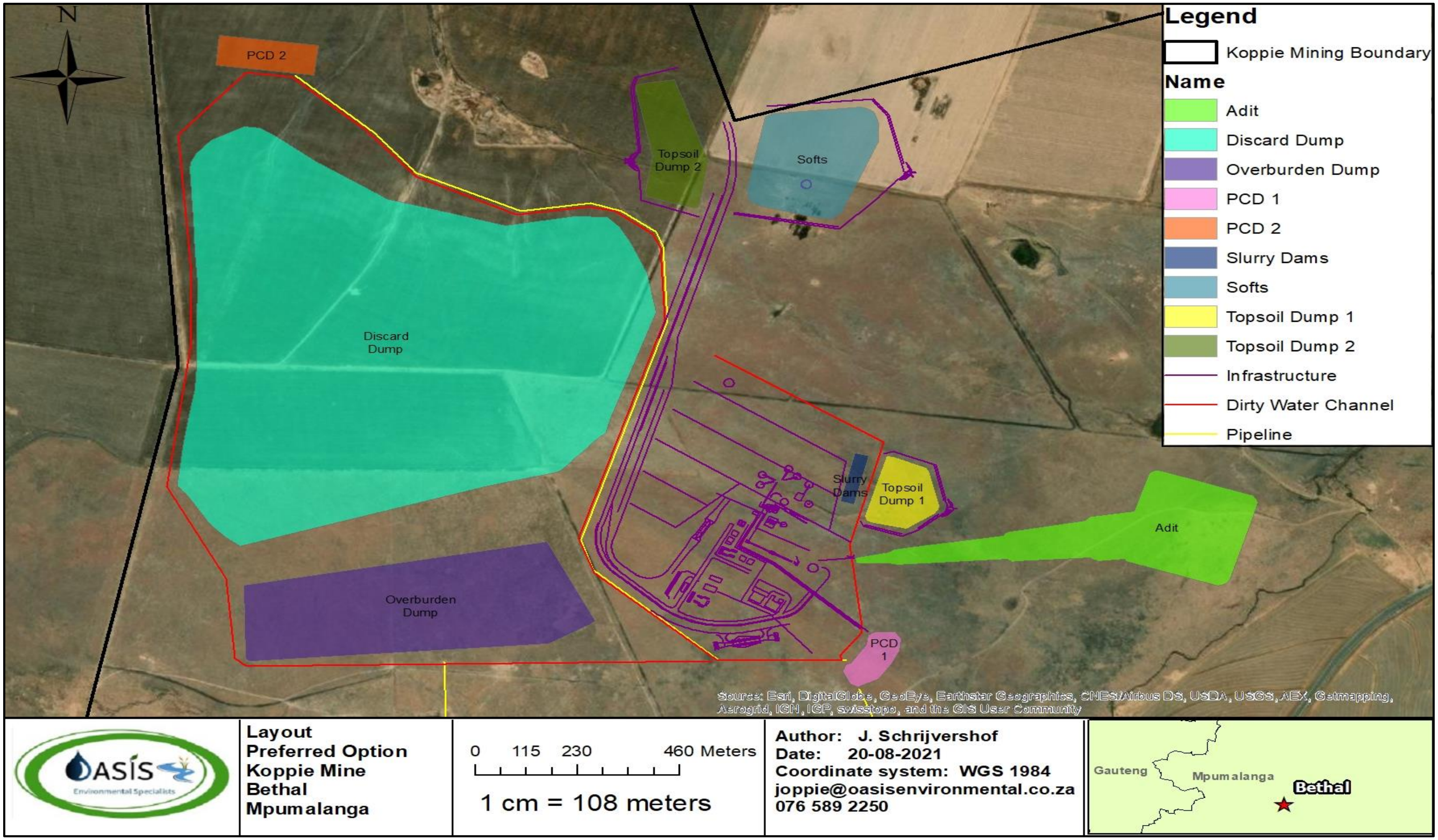

Figure 2: Layout of the Proposed Koppie Mining Project‘s Preferred Option.

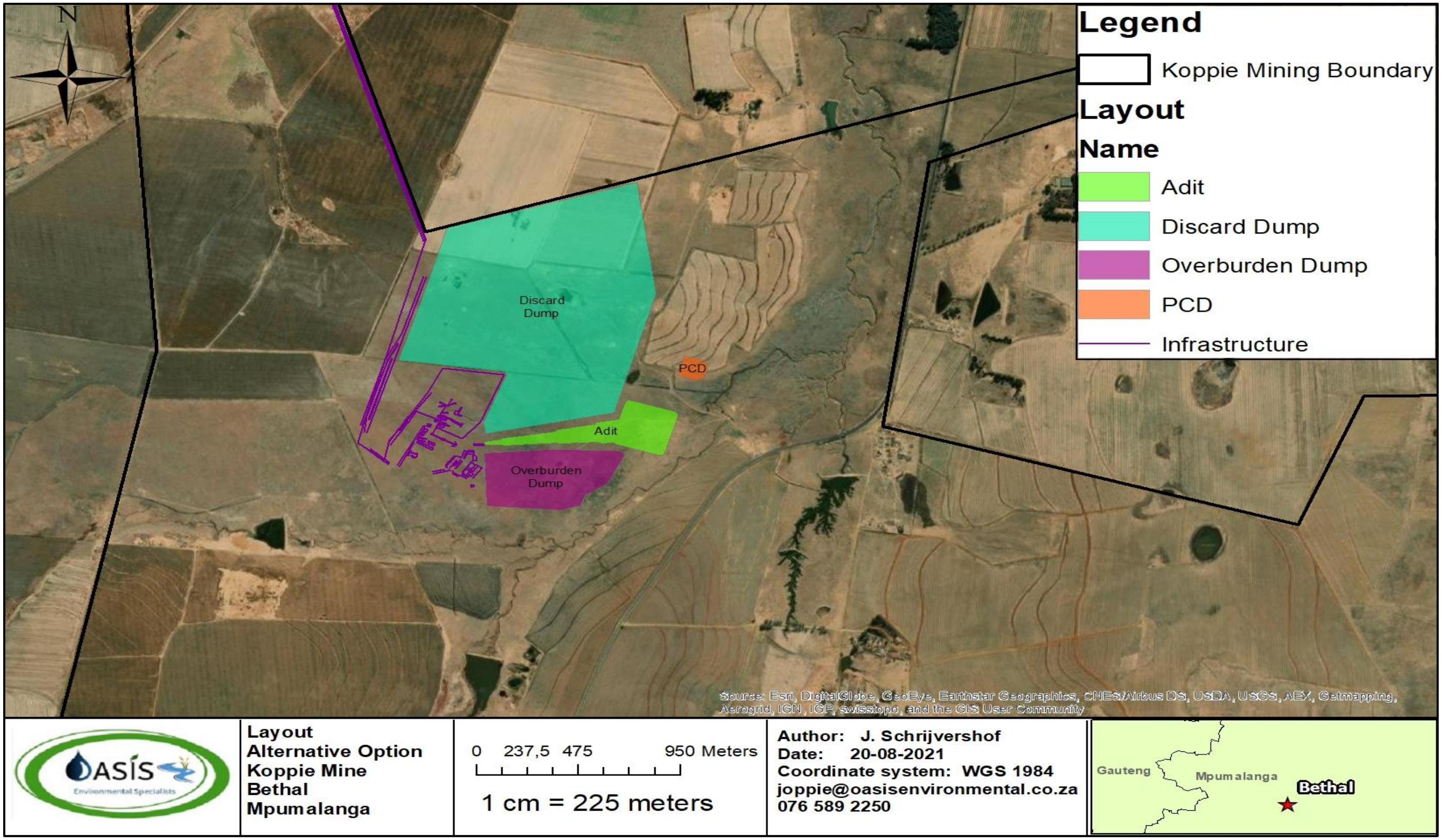

Figure 3: Layout of the Proposed Koppie Mining Project's Alternative Option.

2 METHODOLOGY

2.1 Water quality

This section details the different techniques and methods utilised to obtain the data for this report in order to finally assess the surface water conditions of the site based on the various inputs explained below.

The physical and chemical properties of water that determine its suitability for a variety of uses and for the protection of the health and integrity of aquatic ecosystems refers to the quality of water (DWAF, 1996). The various water quality parameters were all taken *in situ*. These parameters include pH, temperature (°C), electrical conductivity (µS/cm), and dissolved oxygen (DO % and mg/L) using calibrated water quality meters. These values were measured using an Aquameter (model no AM-200) and Aquaprobe (model no AM-800). These parameters were compared to guidelines of the Target Water Quality Ranges (TWQRs) for aquatic ecosystems of South Africa.

The study included a desktop study which provided the majority of the surface water and climate baseline information, water quality data comparison, a site survey to assess the condition of the watercourses on site and the application of rating criteria to assess the impacts of the proposed project on the surface water systems namely the Viskuile and Joubertsvlei systems.

A field survey was conducted on the 27th of November 2020. The field survey was conducted supplementary to the desktop analysis and served as a fatal flaw analysis to determine whether there are any major ecological concerns with regard to the proposed development.

Water samples were obtained during the field survey for analysis of water quality. The results were evaluated in respect of the RQO for the applicable catchments and the DWS guidelines for Aquatic Ecosystems for the B11A catchment (**Table 1**).

Table 1: Summary of the water quality component reserve component DWS (2013).

River: Olifants		EWR: Olifants_EWR1
Water quality metrics		
Major ions	Mg	The 95th percentile of the data must be ≤ 70 mg/l
	SO_4	The 95th percentile of the data must be ≤ 250 mg/l
	Na	The 95th percentile of the data must be ≤ 115 mg/l
	Cl	The 95th percentile of the data must be ≤ 175 mg/l
	Ca	The 95th percentile of the data must be ≤ 80 mg/l
Physical / *In situ*	EC	The 95th percentile of the data must be ≤ 85 mg/l
	pH	The 5th and 95th percentile of the data must range from 5.6 – 9.2
	Temperature	Variation of 2°C or 10% from background average temp
	Dissolved Oxygen	The 5th percentile of the data must be ≥ 6.0 mg/l
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.
Nutrients	Nitrite & Nitrate	The 50th percentile of the data must be ≤ 3.0 mg/l
	PO_4-P	The 50th percentile of the data must be ≤ 0.091 mg/l
Response variables	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/l
	Fluoride	The 95th percentile of the data must be ≤ 3.52 mg/l

2.1.1 Channel Delineation

Riparian areas were delineated based on topographic setting, vegetative indicators as well as the presence or absence of alluvial soils as described in 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (DWAF, 2005) requirements. This manual separates the classification of watercourses into three (3) separate types of channels or sections defined by their position relative to the zone of saturation in the riparian area (**Figure 4**). The classification system separates channels into: those that do not have baseflow ('A' Sections); those that sometimes have baseflow ('B' Sections) or non-perennia. Those that always have baseflow ('C' Sections) or perennial. 'A' Section channels convey surface runoff immediately after a storm event and are not associated with a riparian zone. 'B' Section channels are categorised as channels that sometimes have baseflow, dependant on rainfall events and are therefore non-perennial. They are in contact with the zone of saturation often enough to have vegetation associated with saturated conditions as well as gleyed soil within the channel confines. 'B' Section channels are considered hydrologically sensitive as they are associated with riparian habitats.

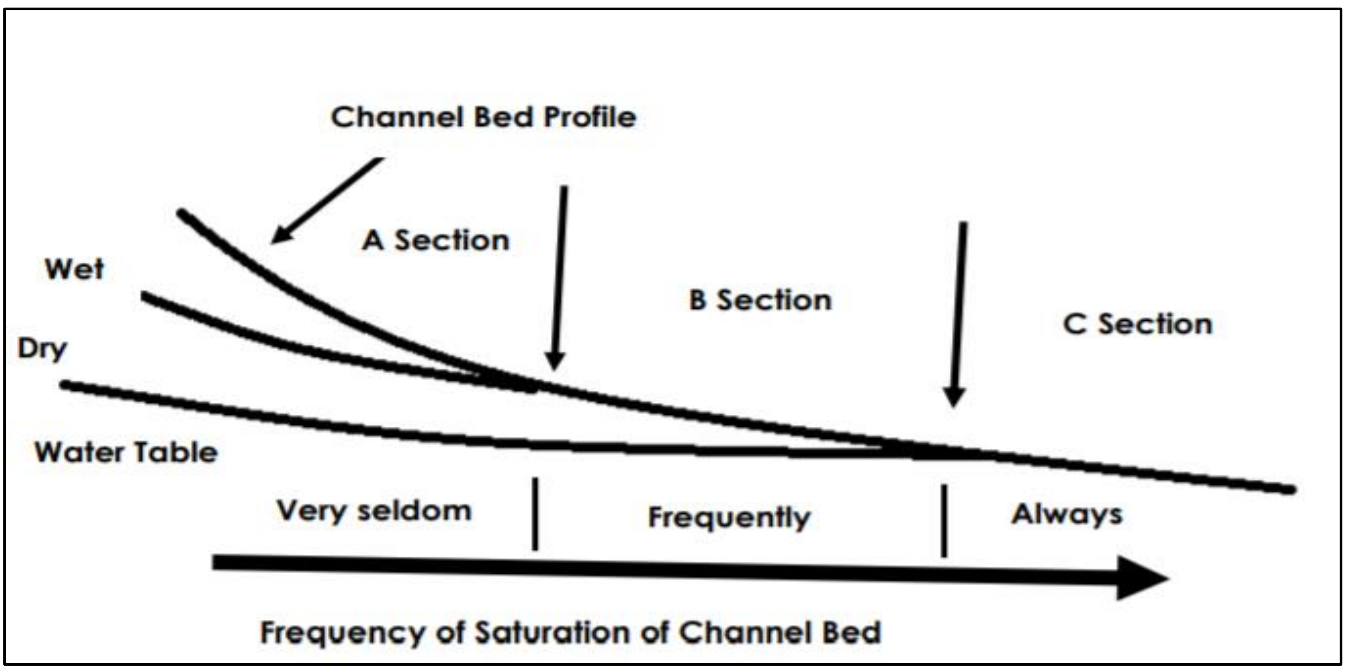

Figure 4: Different zones of wetness found in channels (DWAF, 2005).

Riparian areas perform numerous vital functions including the protection and enhancement of water resources through the following resources:

- Aiding in the storage of water and flood prevention;
- Stabilising stream banks;
- Improving water quality by trapping sediment and nutrients;
- Maintaining natural water temperatures for aquatic species;
- Providing foraging and roosting habitats for birds and other animals;
- Providing corridors for dispersal and migration of different species; and
- Acting as a buffer between aquatic ecosystems and adjacent land uses.

3 BACKGROUND INFORMATION

3.1 Climate

The climate is typical Highveld with a mean annual rainfall of between 600 and 800 mm. Average maximum temperature ranges between 17°C and 27°C and the mean minimal temperature between 0,6°C and 13°C (**Table 2**).

The study area is situated within the eastern portion of the Mpumalanga Highveld. Climatic features of this area can be summarised as follows:

- Cool to warm, temperate climate; cold winters with frost for an average of 120 days per annum;
- Temperatures ranging from 17 to 27° C on average in summer and from 0 to 13° C on average in winter;
- Winds tend to be light, north easterly and south westerly;
- The mean annual precipitation for the area is between 600mm and 700mm;
- The site has an annual potential evaporation of 1964mm.

Table 2: Minimum, maximum and average temperatures (C°) for the Bethal area

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
Avg. Temperature (°C)	19.9	19.5	18.5	15.3	12.1	8.9	9.2	11.9	15.5	17.5	18.2	19.4
Min. Temperature (°C)	13.9	13.4	12	8.4	4.1	0.6	0.7	3.2	7.2	10.3	11.9	13.3
Max. Temperature (°C)	26	25.6	25	22.3	20.2	17.2	17.7	20.7	23.8	24.7	24.6	25.6

Most of the rainfall occurs during the summer months. The region receives the lowest rainfall during July and the highest during January (**Table 3**). The majority of rain events are between October and April. The rainfall pattern decreases significantly during the winter months resulting in rare rainfall events. The mean annual run off for the Olifants WMA is 2 042 million m^3/a. Nearly 9% of the province's ecosystems are endangered, some critically so. 9% of land in the province is degraded; 35.8% of land has been transformed, primarily within the grassland biome; and 33% of the provincial river types are critically endangered. Hence, responsible and sustainable development, as well as proper environmental management and conservation is paramount.

Table 3: Average monthly precipitation for the study area

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
Precipitation / Rainfall (mm)	122	84	70	50	15	7	6	9	27	84	116	120

3.2 Quaternary catchment and Land Use

The proposed mine is situated in the Klein Olifants River sub-catchment (Quaternary drainage region B11A) which falls within the Olifants catchment and the Olifants Water Management Area (**Figure 5**). The land use features within the study site are mainly agriculture in the form of subsistence farming, crops and opencast mining (**Figure 6**). The two streams in close proximity to the mining area are the Joubertsvleispruit and the Viskuile River. Both of these streams are tributaries of the Klein Olifants River.

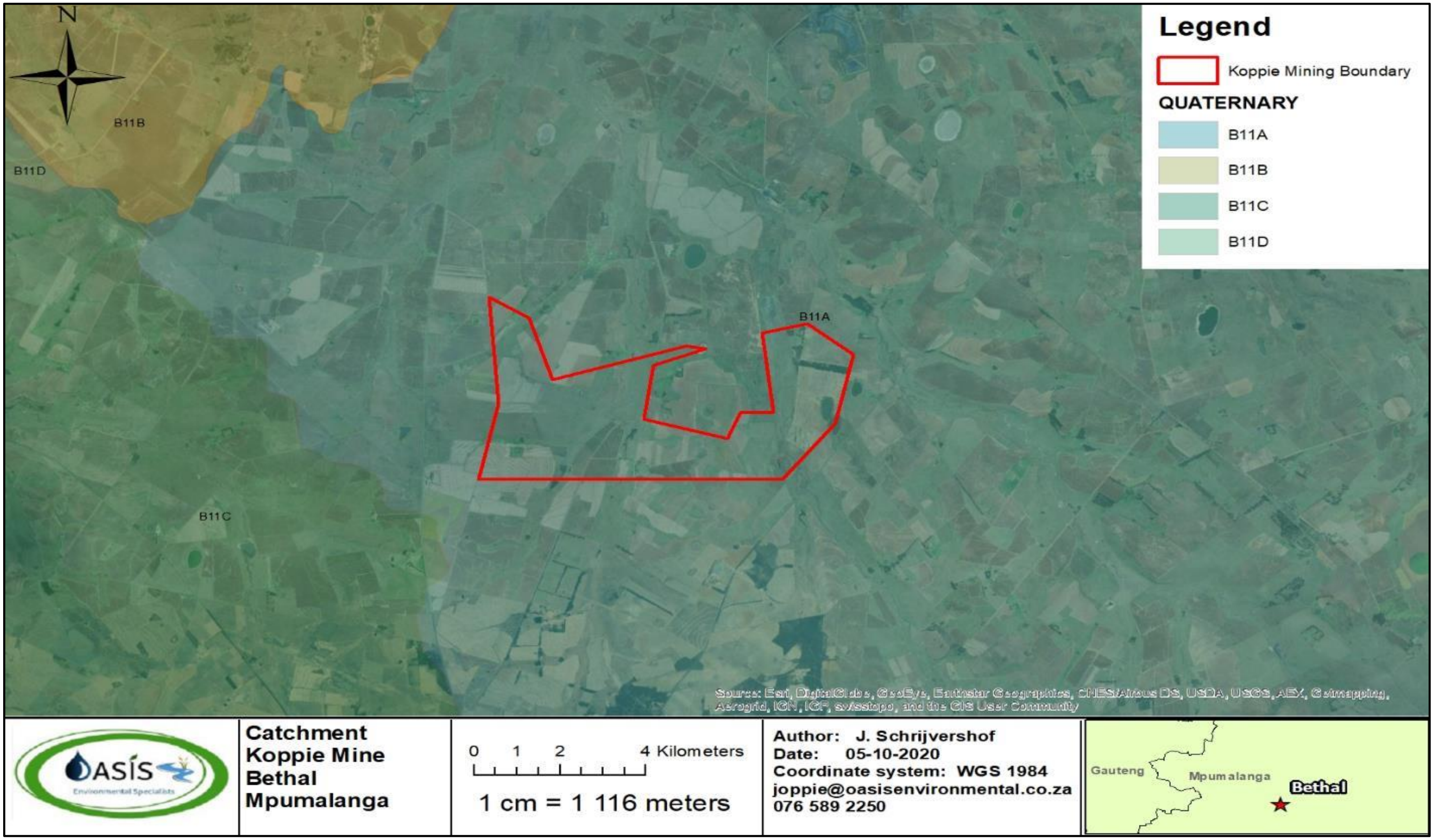

Figure 5: Proposed Koppie Mining Project - Catchment map.

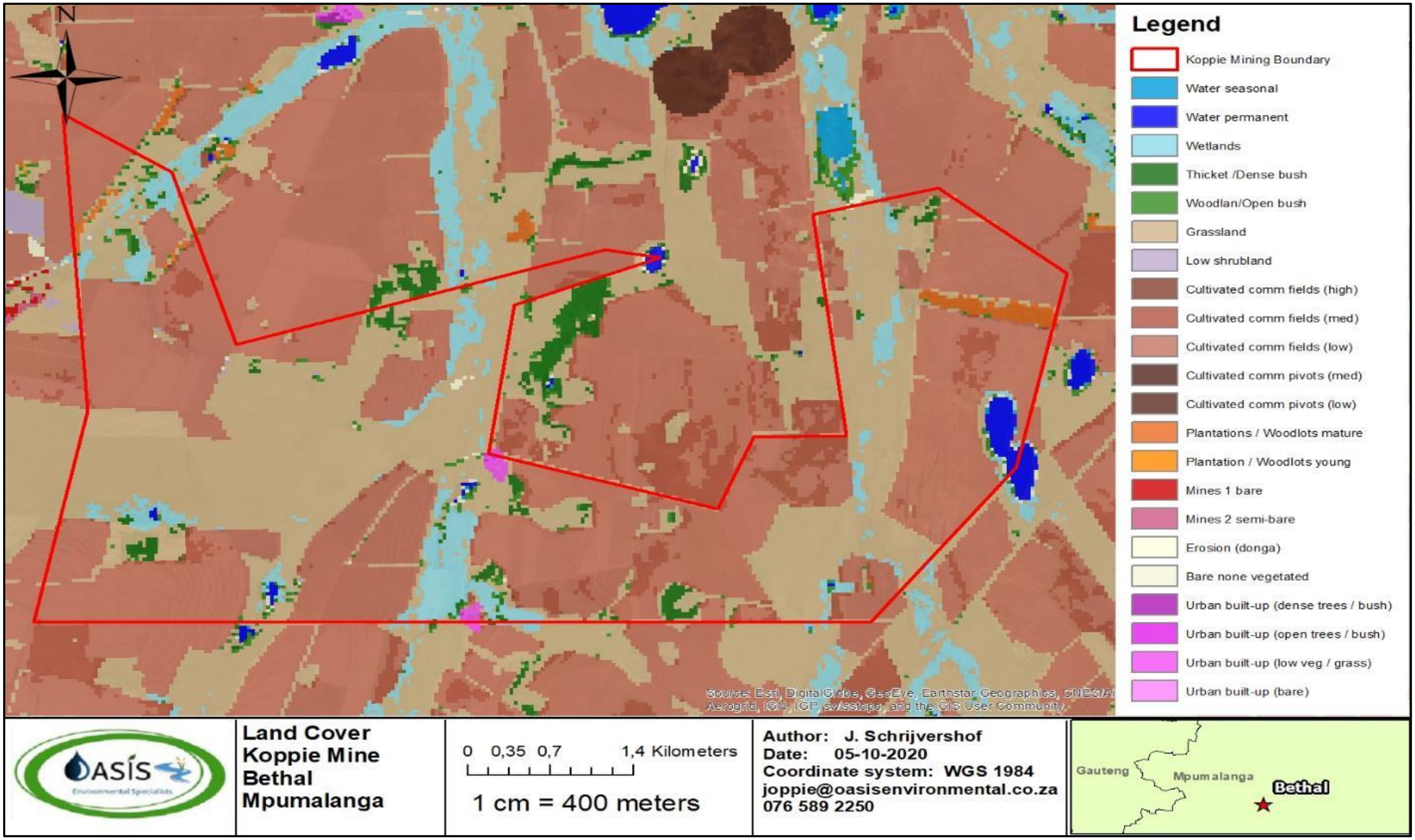

Figure 6: Proposed Koppie Mining Project - Land cover map.

4 RESULTS

A site assessment was conducted on the 27th of November 2020. The sampled sites are illustrated in the **Figure 7 and Figure 8** and the coordinates is provided in **Table 4**. During the site visit it was evident that alien invasive plant infestation and extensive crop cultivation affected the functionality of the watercourses within the area. It must be noted that the study sites had stagnant water in certain sections of the stream at the time at the assessment. Litter and sewage from a small community were observed within the systems. The upstream site for the Joubertsvleispruit was dry at the time of the assessment, where the downstream site and the Viskuile River has pockets of water at the time of the assessment.

The Viskuile River was assessed which served as a reference site for the study area and is the receiving environmental from the Joubertsvleispruit flowing adjacent to the proposed mining areas.

Table 4: Coordinates for the aquatic study site at Proposed Koppie Mining Project.

Site	Coordinates	
Joubert US	26°20'22.75"S	29°30'6.81"E
Joubert DS	26°18'11.30"S	29°30'5.91"E
Viskuil US	26°19'42.53"S	29°33'30.51"E
Viskuil DS	26°16'50.94"S	29°30'34.70"E

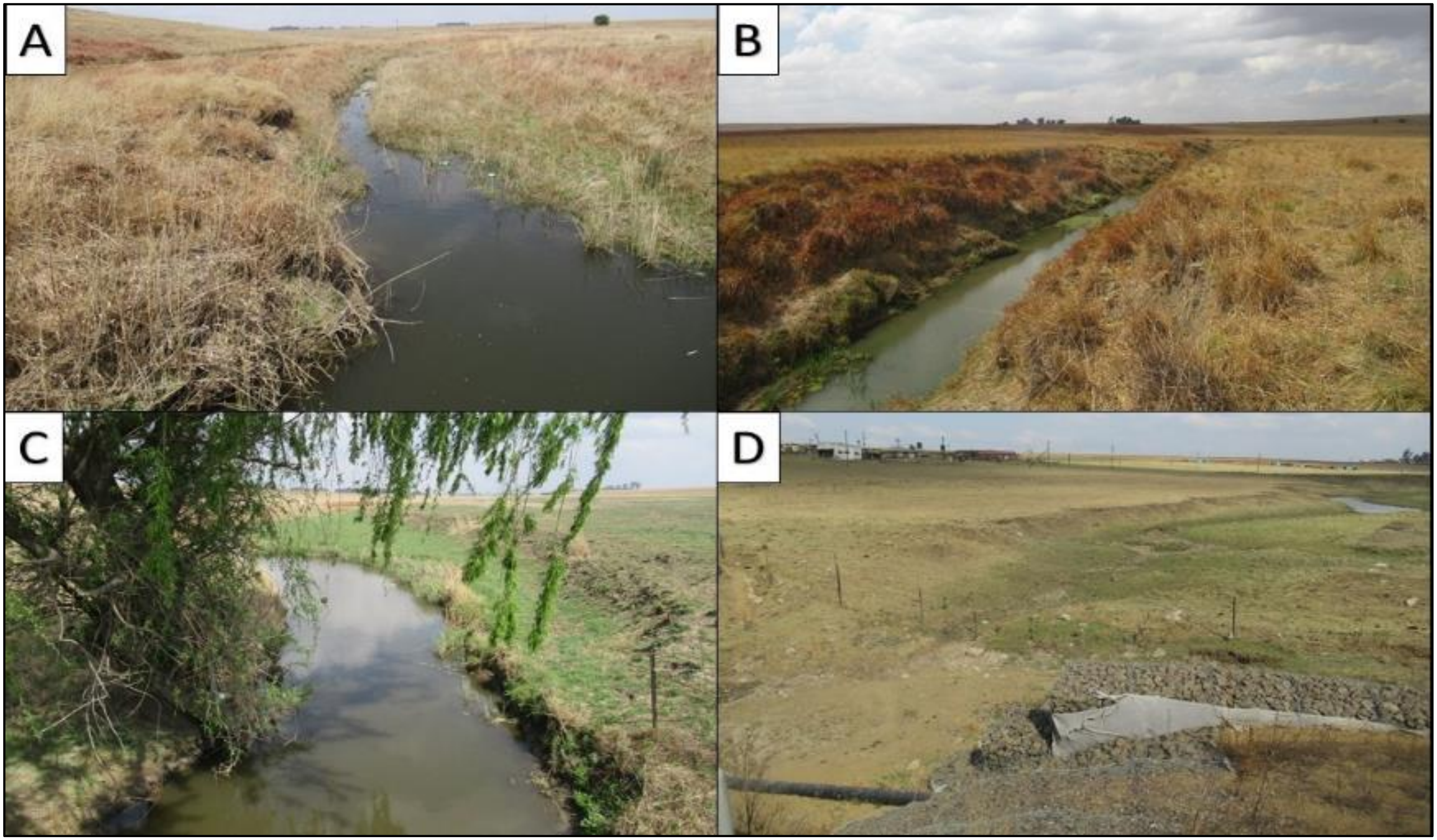

Figure 7: The sampled sites assessed associated with the PROPOSED KOPPIE MINING PROJECT where (A) represents the upstream site of the Viskuile River (Viskuil US); (B) the downstream site of the Viskuile River (Viskuile DS); (C) the downstream site of the Joubertsvleispruit (Joubert DS); and (D) the upstream site of the Joubertsvleispruit (Joubert US) which was dry at the time of the assessment.

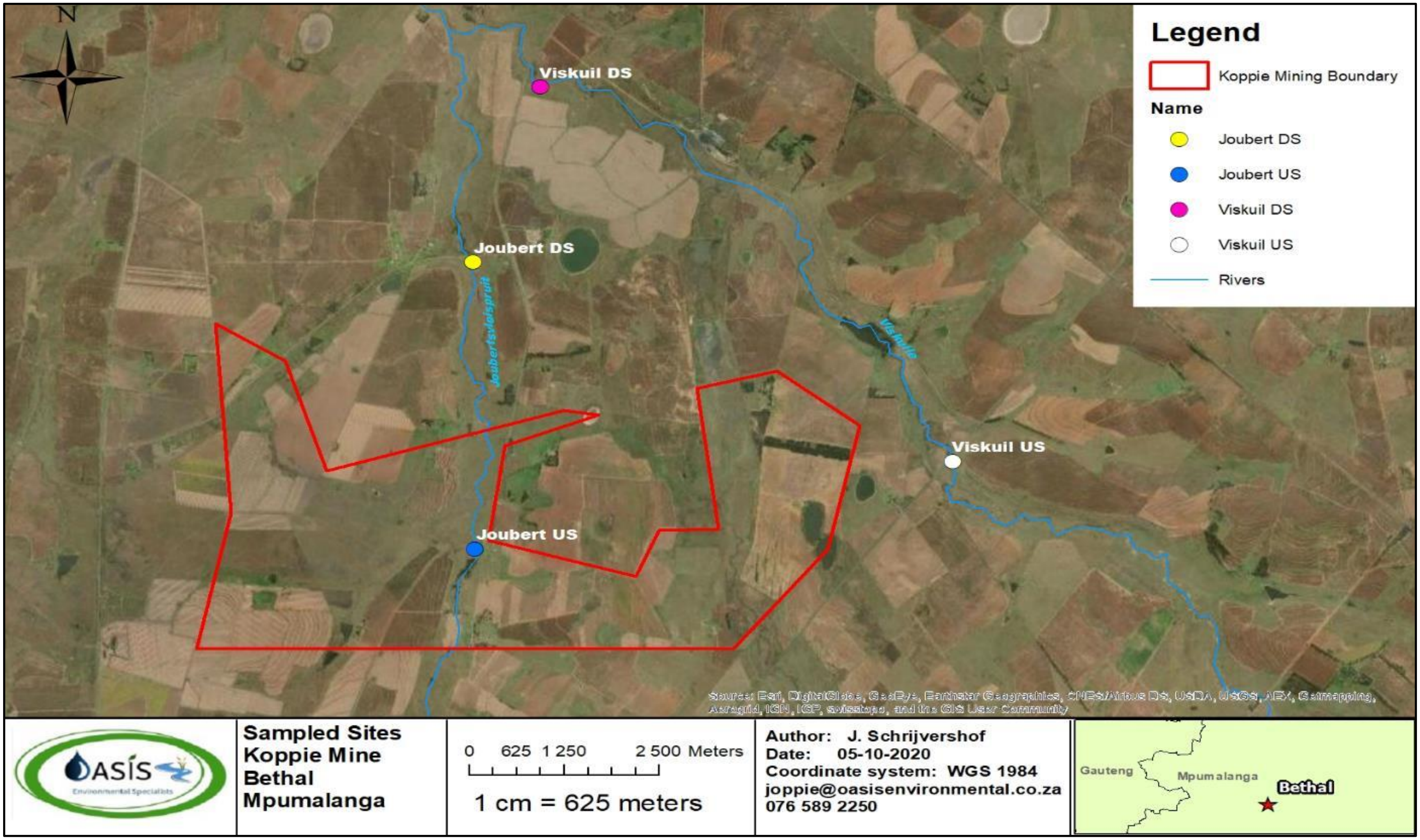

Figure 8: Proposed Koppie Mining Project - Sample localities of the surface water on the Viskuile River and the Joubertsvleispruit.

4.1 Water Quality

In situ water quality variables was within **acceptable** limits compared to the Target Water Quality Ranges (TWQRs) for aquatic ecosystems of South Africa. The pH remained relatively constant throughout the sites and within the neutral range. Temperatures were relatively stable, where electrical conductivity levels were above recommended guideline levels for the Joubertsvleispruit (**Table 5**). Dissolved oxygen (DO) levels were below guideline levels at both upstream and downstream sites, this may be attributed to a lack of suitable flow conditions. Agriculture and mining activities were observed at the time of the assessment near these systems.

It must be noted that *in situ* water quality testing cannot identify specific chemicals for the basis for the health determination of a river system.

Table 5: *In situ* water quality results for the Joubertsvei and Viskuile systems at the Proposed Koppie Mining Project sites compared to guidelines of the Target Water Quality Ranges (TWQRs) for aquatic ecosystems of South Africa.

Constituents	Guideline values (TWQRs)	Joubert US	Joubert DS	Viskuil US	Viskuil DS
pH	6.5-9,5	08.74	08.48	07.40	08.40
Temp (°C)	5-30	24.30	25.40	22.55	25.73
Conductivity (µS/cm)	<700	633	622	510	543
Dissolved Oxygen (%)	>80%	63.8	40.3	56.2	70.8
Dissolved Oxygen (mg/L)	>6	4.35	3.15	4.30	5.25

Table 6: Physico-chemical water quality results for the Joubertsvei and Viskuile systems at the Proposed Koppie Mining Project sites compared to the Olifants River catchment guidelines.

Analysis	Unit	Guideline Levels	JOU US	JOU DS	VIS US	VIS DS
Turbidity	*NTU*		43.8	38.8	12.8	21.3
Sulphate	*mg/l SO4-2*	≤ 250 mg/l	18	<13	<13	<13
ortho-Phosphate as P	*mg/l P*	≤ 1 mg/l	<1	<1	<1	<1
Nitrite as N	*mg/l N*	≤ 3.0 mg/l	0.35	0.11	0.05	0.02
Nitrate as N	*mg/l N*	≤ 3.0 mg/l	0.76	0.42	0.10	0.14
Fluoride	*mg/l F^-*	≤ 3.52 mg/l	0.95	0.32	0.21	0.11
Ammonia as N	*mg/l N*	≤ 0.4 mg/l	0.248	0.261	0.229	0.227
Chloride	*mg/l Cl^-*	≤ 175 mg/l	66	29	<10	14
Sodium	*mg/l Na*	≤ 115 mg/l	92	51	54	41
Magnesium	*mg/l Mg*	≤ 70 mg/l	21	36	21	40
Calcium	*mg/l Ca*	≤ 80 mg/l	31	52	33	27

The physical and chemical water quality results were evaluated in respect of the RQO's for the Oliphant's Catchments guidelines for Aquatic Ecosystems for the B11A catchment and to assess the conditions of the watercourses.

Water samples were obtained during the field survey for the analysis of the physical and chemical properties of the Viskuile and Joubertsvlei systems and to compare them to these reference conditions. All variables measured were found to be within guideline levels indicating that these systems are within a good condition based on water quality (**Table 6**).

4.2 Wetland Delineation and Assessment

This section provides the findings of the various methodologies utilised during the wetland assessment.

4.2.1 Desktop Assessment

Examination of the National Freshwater Ecosystem Priority Areas (NFEPA) database were undertaken for the Proposed Koppie Mining Project. The NFEPA project aims to produce maps which provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. They were identified based on a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands and estuaries (MacFarlane *et al*., 2009). Identification of FEPA Wetlands are based on a combination of special features and modelled wetland conditions that include expert knowledge on features of conservation importance as well as available spatial data on the occurrence of threatened frogs and wetland-dependent birds.

Several valley bottom and depression NFEPA wetlands were identified within the mining boundary during the desktop assessment (**Figure 9**).

However, ground-truthing the existence and condition of FEPA wetlands is important to understand local conditions which have an impact on the wetland system, their functional integrity and health.

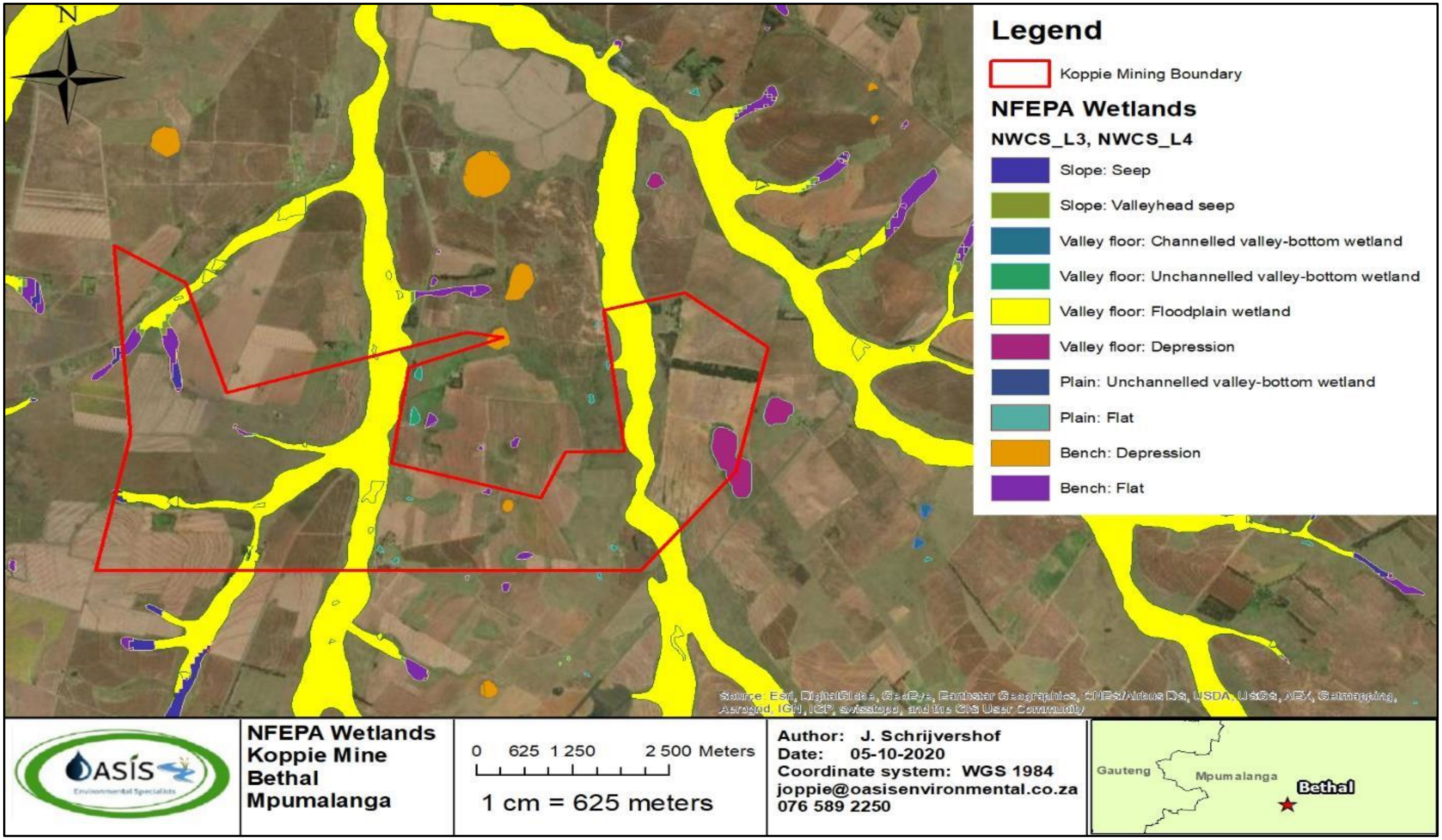

Figure 9: Proposed Koppie Mining Project - NFEPA Wetland map.

4.2.2 Terrain indicator

The topography of an area is generally a good practical indicator for identifying those parts in the landscape where wetlands are likely to occur. Generally, wetlands occur as a valley bottom unit however wetlands can also occur on steep to mid slopes where groundwater discharge is taking place through seeps (DWAF, 2005). In order to classify a wetland system, the localised landscape setting must be taken into consideration through ground-truthing of the study site after initial desktop investigations (Ollis *et al*., 2014).

The study site can be characterised as having rolling hills with relatively steep sloping topography. The site ranges in altitude from 1593 m to 1717 m above sea level. A Digital Elevation Model (DEM) of the aerial photography of the site revealed 2 depressions in landscape cutting in the middle of the mining boundary (**Figure 10**). These areas identified during the desktop assessment where then assessed in more detail during the field investigation and confirmed to be floodplain wetlands.

The gently undulating highland topography is typical of the central Mpumalanga province, with fairly broad to narrowly incised valleys of headwater drainages. There are a number of marshy areas or vleis in the upper parts of the valleys and numerous pans, which vary from insignificant vegetated depressions to large deeply etched features with bare clayey floors. An ecologically important concentration of pans and freshwater lakes is located in the Chrissiesmeer area.

The municipality is roughly dissected by the (continental) divide between the Upper Vaal and Usuthu / Pongola Water Management Areas. In the north of the Municpality, certain sub-catchments drain into the Olifants and Inkomati WMA's. The headwaters of the Vaal River are found in the western half of the municipality and drain in a southwesterly direction along with the Tweefontein River.

The Usuthu River rises in the northeast of the municipality. The headwaters of the Inkomati River flow northwards from the municipality into the Inkomati WMA, and the headwaters of the Olifants and Klein-Olifants River drain the far northwest of the municipality (Msukaligwa Local Municipality 2010).

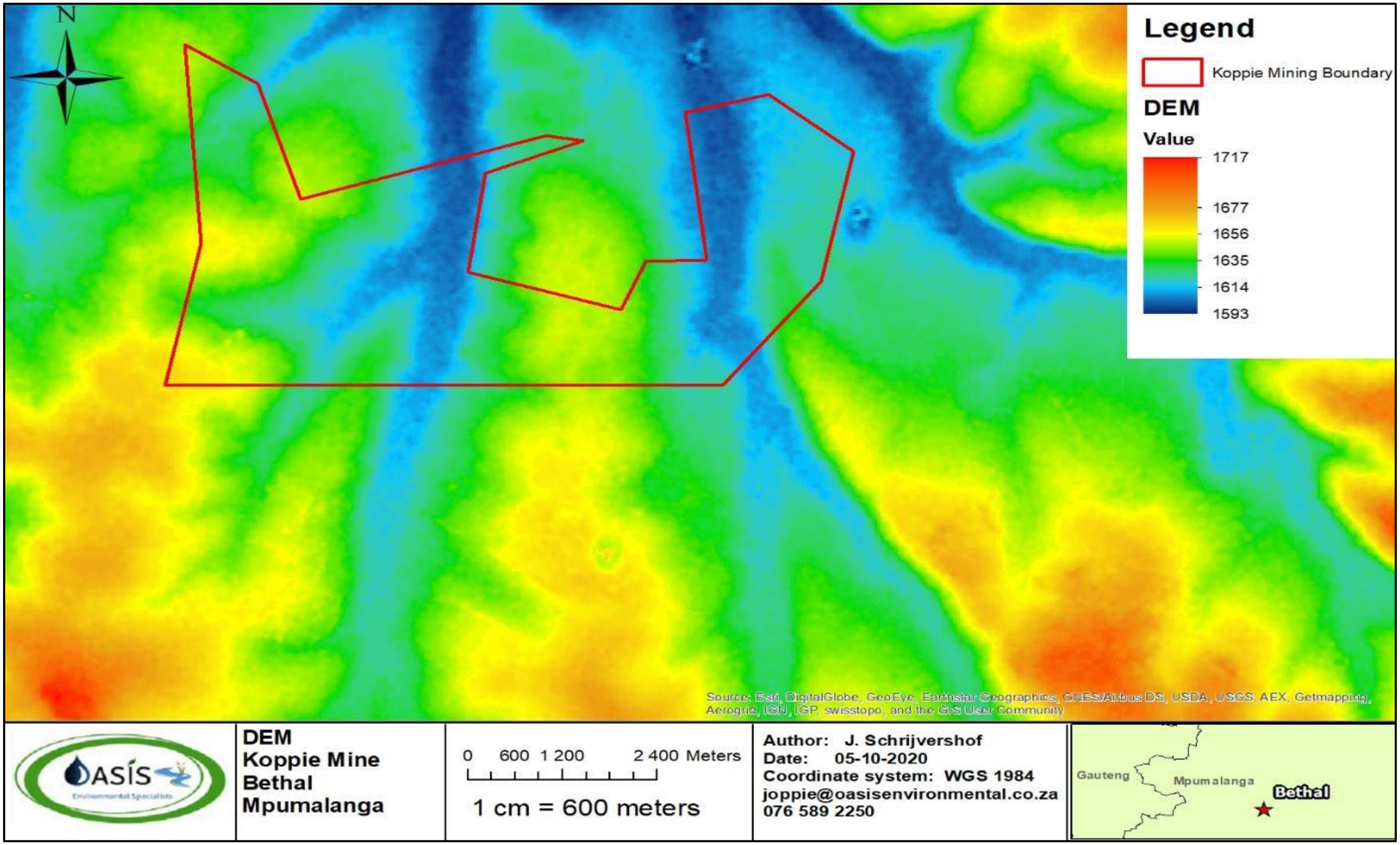

Figure 10: Proposed Koppie Mining Project - Digital Elevation Model map.

4.2.3 Surface Water Features

Several 'A' Section and 'B' Section channels were delineated. The main drainage channels were identified as 'B' Section channels without any riparian plant species identified and any other drainage features were found to be 'A' section channels feeding the 'B' section channels during rainfall (**Figure 11 and Figure 12**). These channels are associated with the floodplain wetland areas.

From the wetland study, two floodplain wetland systems were identified within the Proposed Koppie Mining Project. The floodplain wetland received poor scores, indicating that these wetland is heavily transformed system. The majority of the indigenous vegetation within the development footprint and the surrounding area is transformed with alien invasive vegetation, mining, grazing, cultivation and pollution from informal settlements (**Figure 13).**

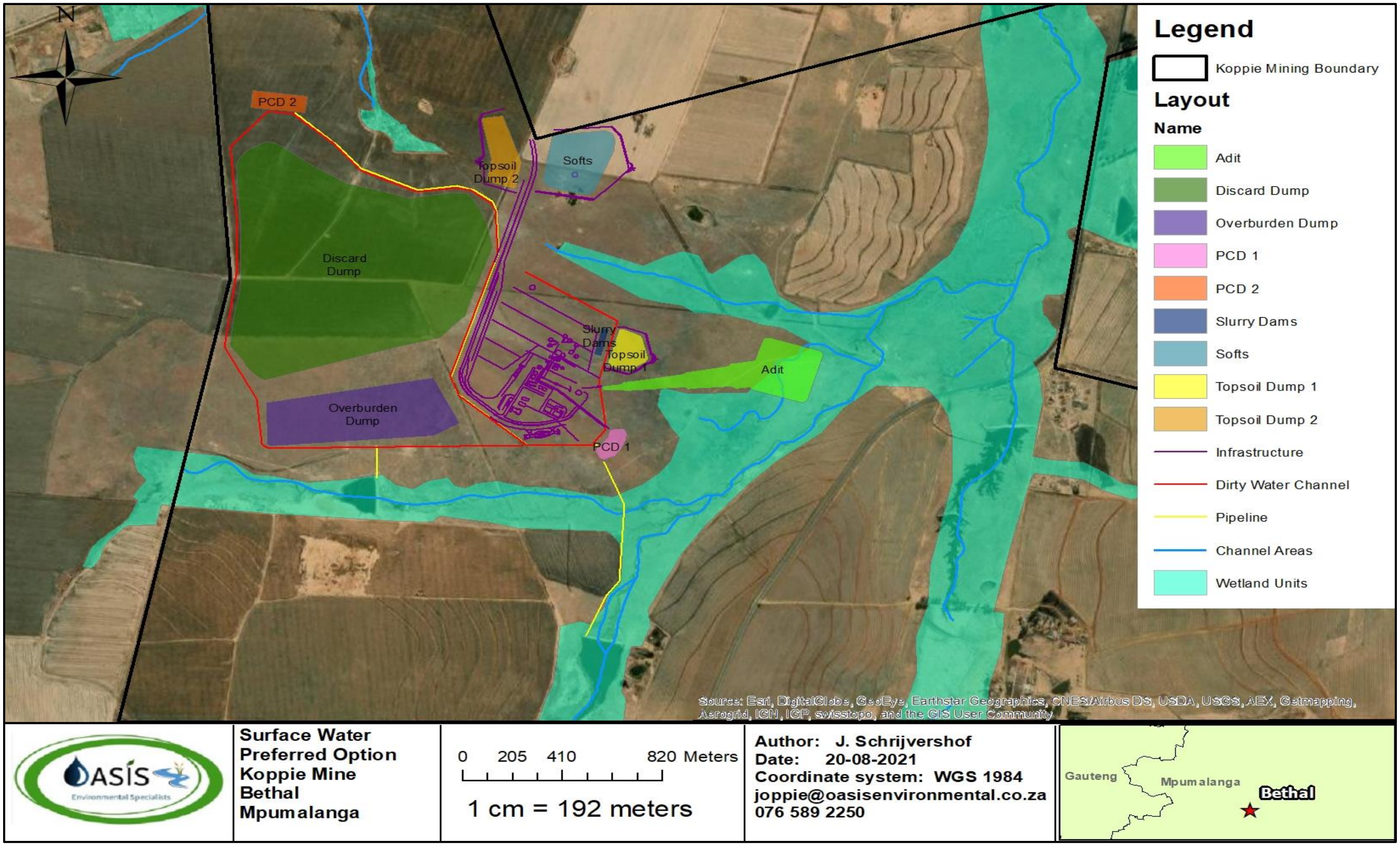

Figure 11: Proposed Koppie Mining Project – Surface water features for the Preferred Option.

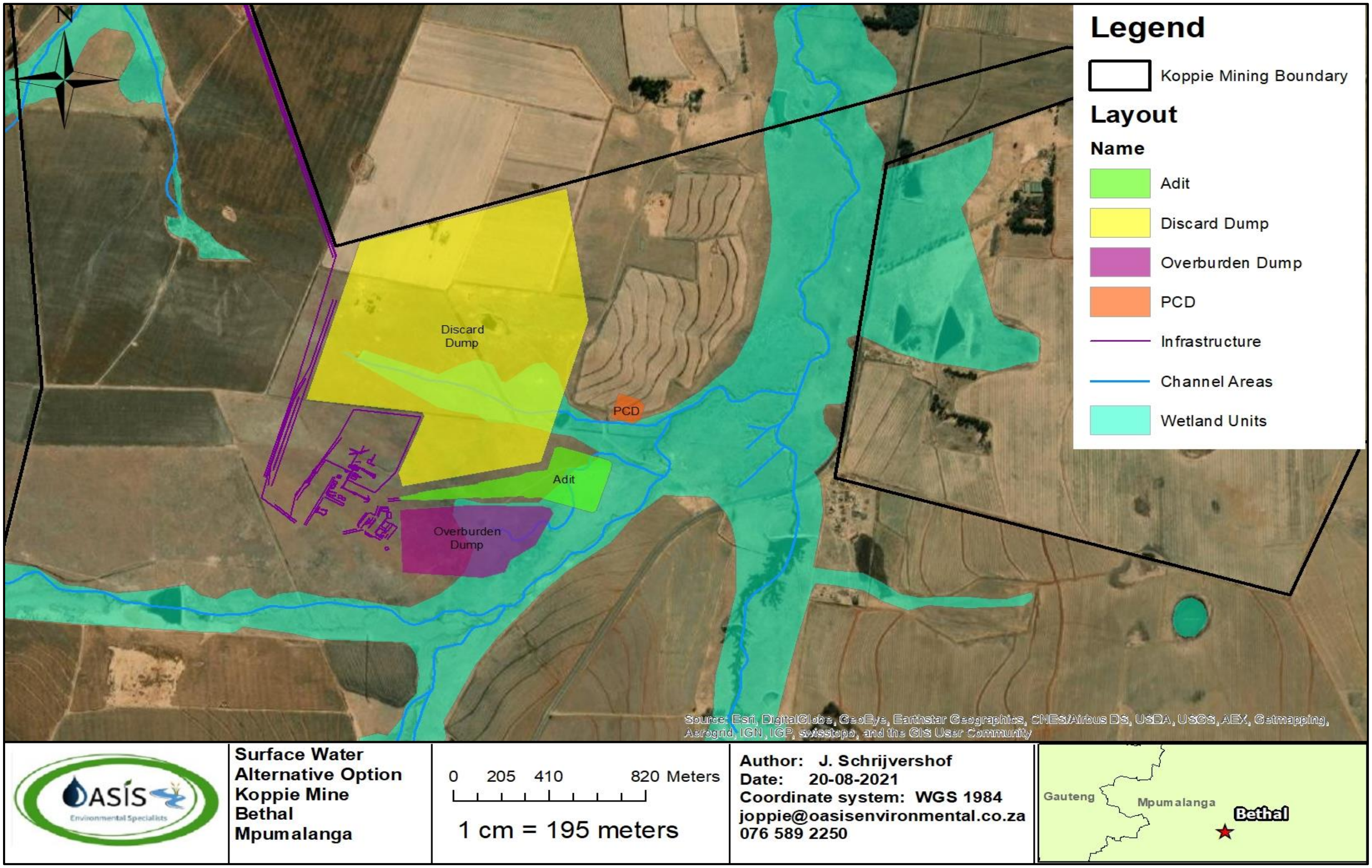

Figure 12: Proposed Koppie Mining Project – Surface water features for the Alternative Option.

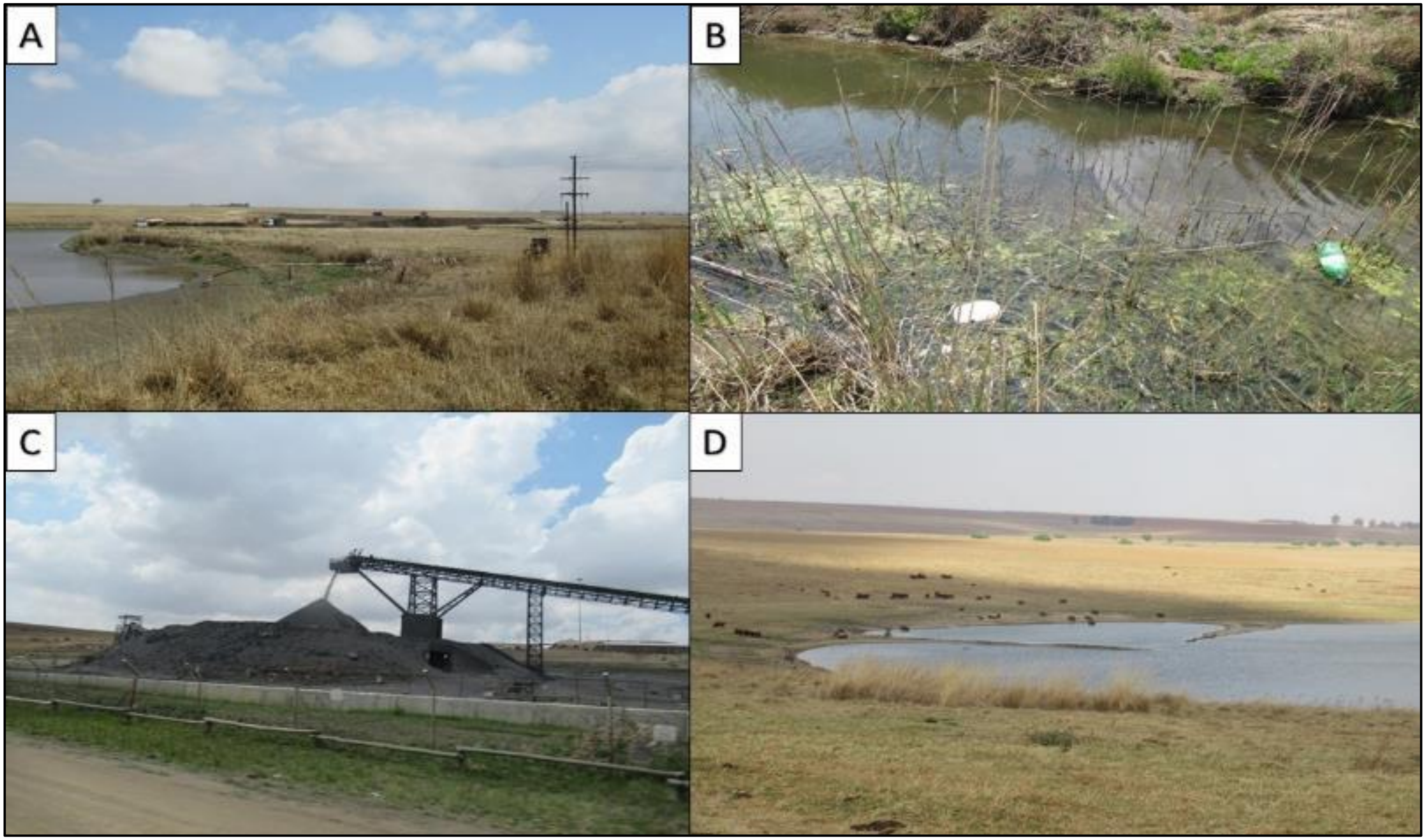

Figure 13: Current impacts identified within the proximity of the Proposed Koppie Mining Project that negatively impact the surrounding wetlands and environment included: (A) Damming of the wetland and river systems (B) Littering within rivers and wetland areas (C) Mining activities in the area (D) Cattle grazing leading to bank trampling of watercourses.

5 RISK ASSESSMENT OF DELINEATED WETLANDS

The risk assessment focussed on the impacts associated with the Proposed Koppie Mining Project as mentioned above.

Vegetation clearing will occur and this will lead to increased turbidity and sedimentation in the stream as well as altered flow patterns. The machinery used has a risk of hydrocarbon spills into watercourses.

There are impacts on the flow patterns to the stream as well as possibly increased nutrient levels from the waste materials entering the water course.

limiting the confidence for the risk assessment for the Preferred Option and the Alternative Option **without mitigation in Table 7 and Table 8 and with mitigation in Table 9 and Table 10 respectively.**

The proposed mining infrastructure of coal will include the following for the Preferred Option:

- Access / haul roads;
- Washing plant;
- Workshops;
- Offices;
- Weighbridge;
- Two slurry dams;
- Two Pollution Control Dams;
- Stormwater management facilities;
- Boreholes;
- Powerlines;
- Substation;
- Sewage management systems;
- Conveyor belt systems;
- Two Topsoil Dumps;
- Dirty water channels
- Adit;
- Ventilation Shafts;
- Discard Dump;
- Overburden Dump; and

- Two pipelines leading to the existing dams.

The proposed mining infrastructure of coal will include the following for the Alternative Option:

- Access / haul roads;
- Washing plant;
- Workshops;
- Offices;
- Weighbridge;
- One Pollution Control Dam;
- Stormwater management facilities;
- Boreholes;
- Powerlines;
- Substation;
- Sewage management systems;
- Conveyor belt systems;
- Adit;
- Ventilation Shafts;
- Discard Dump; and
- Overburden Dump.

Operational Phase

Increased sedimentation may occur as a result from the runoff from the dumps and stockpiles. This has the potential to change habitat structure within the receiving environment and this will in turn result in changes in ecosystem function. Changes in habitat structure due to sedimentation would result in changes in the species composition.

Water quality impairment has the potential to change ecosystem function, change community structure as species sensitive to water quality impairment are eliminated and tolerant species increase in number, this results in a loss of biodiversity of sensitive species in other words the sensitive species disappear first when water quality alterations take place.

Invasive alien plants have far reaching detrimental effects on native biota and has been widely accepted as being a leading cause of biodiversity loss. They typically have rapid reproductive turnover and are able to outcompete native species for environmental resources, alter soil stability, and promote erosion, change litter accumulation and soil properties. In addition, certain alien plants exacerbate soil erosion whilst others contribute to a reduction in stream flow thereby potentially increasing sediment inputs and altering natural hydrology of receiving watercourses. These impacts negatively affect areas that are largely natural (with low existing weed levels) greater than for areas already characterised by dense infestations of alien plants with low indigenous plant diversity (Macfarlane *et al*., 2014).

5.1.1 Sedimentation and soil erosion

Soil erosion will result in the deposition of sediment into the wetland system; posing a risk to the downstream catchment geomorphological/functional integrity. Subsequent impacts that are likely to result are: a loss of instream flow including aquatic refugia and flow dependent taxa; sedimentation of the watercourse that will be destructive to many faunal species affecting their habitat; breeding and feeding cycles.

Some of the key biological effects related to the deposition of sediment and suspension of fine sediment within the watercourses includes:

- Habitat alteration downstream of crossing points due to increased sediment deposition (degradation of coarse riverbed habitats by the infilling of interstitial spaces and the reduction of inter-granular flow for example);
- Reductions in photosynthetic activity and primary production caused by sediments impeding light penetration;
- Reduced density and diversity in benthic invertebrate communities as a result of habitat degradation, blanketing of fish spawning sites and the establishment of more tolerant taxa or exotic species; and
- Changes to the behaviour and feeding ability of fish at low levels of suspended sediments, while physiological damage and mortality can occur at very high concentrations of suspended sediment resulting in clogging of fish gills, interference in embryogenesis and larval development of amphibians and mortality of filter-feeding macro-invertebrates.

During the operational phase of the mine rainfall is likely to filter through into the stockpiles and dumps. This water is likely to accumulate particles and pollutants that will pose a risk to the surrounding water courses. Sediment that washes off the dump and stockpile areas during periods of rainfall will also contribute to increased sedimentation in the aquatic environment.

Erosion and sedimentation impacts are linked to alterations in hydrological regimes as a result of increased storm water floodpeaks associated with increased impermeable surfaces and the concentration of flows. Increases in peak discharge may significantly increase stream power, increasing the risk of erosion (localised scouring and incision) and resultant sedimentation of watercourses. Local site factors such as soil erodibility, vegetation cover, gradient of local slopes and regional rainfall/runoff intensity will affect the probability and intensity of erosion impacts (Macfarlane *et al*., 2014). Typical results of erosion & sedimentation on water resources may include:

- Locally increased channel slopes;
- Loss of in-stream biotope diversity due to scouring or blanketing of sites with sediment;
- Localised scouring at stormwater discharge points into watercourses;
- Headcut migration upstream and subsequent deepening of channels (where base level lowering has occurred);
- Lowering of the local water table and subsequent desiccation of adjacent to the river and riparian areas;
- Relatively higher channel banks that may exceed critical height resulting in bank failure/collapse;
- Addition of sediment to the water column (increased turbidity) affecting suitability for aquatic organisms; and
- Deposition of large masses of sediment downstream causing localised channel braiding, instability of the river banks and alterations in water distribution.

5.1.2 Pollution of water resources and soil

Changes to the water quality will result in changes to the ecosystem structure and function as well as a potential loss of biodiversity. Water quality pollution leads to modification of the species composition where sensitive species are lost and organisms tolerant to environmental changes dominate the community structure. Any substances entering and polluting watercourses will directly impact downstream ecology through surface runoff during rainfall events, or subsurface water movement, particularly during the wetter summer months.

Contaminants such as hydrocarbons, solids, pathogens and hazardous materials may enter watercourses (examples include petrol/diesel, oil/grease, paint, cement/concrete and other hazardous substances). These contaminants negatively affect aquatic ecosystems including sensitive or intolerant species of flora and fauna. Where significant changes in water quality occur, this will ultimately result in a shift in aquatic species composition, favouring more tolerant species, and potentially resulting in the localised exclusion of sensitive species. Water quality monitoring must be implemented to ensure sustainable management of water sources within that area. Sudden drastic changes in water quality can also have chronic effects on aquatic biota leading to localised extinctions. Deterioration in water quality will also affect its suitability for human domestic/agricultural use and have far reaching impacts for local communities who may rely on rivers as water supply (Macfarlane *et al*., 2014).

5.1.3 Alien Invasive Species

There are several alien invasive plant species currently present within the area. Any ground disturbance provides an opportunity for alien invasive plant species to spread and for new species to establish themselves in the areas. Alien invader plant species pose an ecological threat as they alter habitat structure, lower biodiversity (both number and "quality" of species), change nutrient cycling and productivity, and modify food webs (Zedler & Kercher, 2004). Such changes on the ecology of the riparian habitat have/will have a detrimental impact on its ability to maintain both floral and faunal biodiversity. Invasive alien plant species, particularly woody species, have much increased water usage compared with indigenous vegetation. Many alien invasive plant species are particularly found in riparian ecosystems and their invasion results in the destruction of indigenous species; increased inflammable biomass (high fire intensity); erosion; clogging of waterways such as small streams and drainage channels causing decreased river flows and incision of river beds and banks. This results in an overall impact on the hydrological functioning of the system.

Physical alteration of cross-sectional and longitudinal profiles of rivers may also result from bulk earthworks associated with the plants for example, altering natural water flow and sediment dynamics within rivers, having a knock-on effect on habitat and ecosystem dynamics. These impacts can stimulate erosion, as well as potential sedimentation of downstream habitats and a change to water regimes of adjoining riverine and riparian habitat. Areas that are mainly natural/intact would be most affected by these impacts (Macfarlane *et al*., 2014).

5.1.4 Mitigation

The Proposed Koppie Mining Project will have negative effects on the environment. Provided mitigation measures are to be implemented as to reduce the significance of any negative impacts. The following mitigation measures may reduce the severity of impacts:

- Design and implementation of a suitable stormwater system;
- Rehabilitation of the disturbed areas;
- Limiting instream sedimentation;
- Minimising pollutants entering the watercourse;
- Implement a programme for the clearing/eradication of alien species including long term control of such species;
- A 110 m buffer implemented for the wetland system;
- Water quality monitoring must take place every month during operational phases; and
- Biomonitoring must take place bi-annually during hi flow and low flow season.

Sedimentation and soil erosion

Mitigation options

- Alien vegetation must be cleared prior to clearing/stripping new areas, to ensure alien vegetation is not spread to other areas.
- A topsoil stripping and stockpiling guideline must be completed to ensure rehabilitation success.
- Attenuation of stormwater from any establishment and its associated infrastructure is important to control the velocity of runoff towards the wetland systems. Attenuation structures must be placed between the development and associated infrastructure and the river.
- Attenuation measures must include, but are not limited to - the use of sand bags, erosion control blankets, and silt fences.
- Long term attenuation measures, such as attenuation/infiltration trenches, swales must be established to control stormwater from hardened surfaces so as to Sustainable Urban Drainage Systems (SUDS): All storm water runoff from the site must be supplemented by an appropriate road drainage system that must include open, grass-lined channels/swales rather than simply relying on underground piped systems or concrete V-drains. SUDS will encourage infiltration across the site, provide for the filtration and removal of pollutants and provide for some degree of flow attenuation by reducing the energy and velocity of storm water flows through increased roughness when compared with pipes and concrete V-drains.
- Do not allow surface water or stormwater to be concentrated, or to flow down cut or fill slopes without erosion protection measures being in place.
- Vegetation clearing must be undertaken as and when necessary in phases.
- Materials such as metals, chemicals cement and sand for the plant and plant infrastructure, other than sourced from the approved quarries/pits, must be sourced from a licensed commercial source.
- Any topsoil removed from the project footprint must be stockpiled separately from subsoil material and be stored suitably for use in rehabilitation activities.
- Install sediment barriers (silt catchers and Reno mattresses) along any drainage areas to prevent the migration of silt.
- All demarcated sensitive zones outside of the mine area are strictly off limits during any mining activity.
- Exposed soils must be rehabilitated as soon as practically possible to limit the risk of erosion. Erosion control measures must be employed where required.

- Stabilise, re-shape and rehabilitate disturbed areas as soon as practically possible (within 3 weeks of disturbance) with indigenous wetland and riparian vegetation. Such rehabilitation should be informed by a suitable replanting and re-vegetation programme, sand bags, silt fencing, etc. A mix of rapidly germinating indigenous vegetation must be used.
- Riparian vegetation bordering on drainage lines, wetlands and rivers will be considered environmentally sensitive and impacts on these habitats should be avoided.
- If erosion has taken place, rehabilitation will commence as soon as possible.
- All roads need to be maintained and any erosion ditches forming along the road filled and compacted.
- Berms/ earthen walls should be vegetated in order to avoid erosion and sedimentation.
- Runoff water from the waste dumps, stockpiles and contaminated stormwater will be channelled into newly pollution control dams to avoid effects on the wetland system. The water in these pollution control dams will be reused during the mining operations.
- Demarcated and bunded stockpiles and waste dumps will also be placed in areas where groundwater and surface water pollution can be avoided.
- The runoff will be routinely monitored for acidity and salinity as an early warning for potential increases in salinity or acidic drainage water.

Pollution of water resources and soil

Mitigation options

- Demarcate wetland areas to avoid unauthorised access.
- No washing of any equipment in close proximity to a watercourse is permitted.
- No releases of any substances that could be toxic to fauna or faunal habitats within the channels or any watercourses is permitted.
- Spillages of fuels, oils and other potentially harmful chemicals must be cleaned up immediately and contaminants properly drained and disposed of using proper solid/hazardous waste facilities (not to be disposed of within the natural environment). Any contaminated soil must be removed and the affected area rehabilitated immediately.
- Portable toilets must be placed on impervious level surfaces that are lipped to prevent spillage. The general consensus is that they should be within 30 m to 50 m of a work face
- Cut-off trenches must be constructed to prevent any harmful substances from entering the wetland area.
- Education of workers is key to establishing good pollution prevention practices. Training programs must provide information on material handling and spill prevention and response, to better prepare employees in case of an emergency.

- Signs should also be placed at appropriate locations to remind workers of good housekeeping practices including litter and pollution control.
- The proper storage and handling of hazardous substances (hydrocarbons and chemicals) needs to been ensured. All employees handling fuels and other hazardous materials are to be properly trained. Storage containers must be regularly inspected so as to prevent leaks.
- Ensure that any rubbish/litter is cleared once a month as to minimise litter near the wetland areas. These will need to be cleaned out in accordance with a regular maintenance programme.
- Industry Best Practise Guidelines and Standards needs to be implemented in terms of tailings storage design. Built-in engineering designs such as drainage systems and decanting pools are recognised as mitigation measures.
- Water quality will be monthly monitored with the site activities. This includes sites upstream and downstream.
- Ensure pollution sources are isolated through clean and dirty water separation and monitor this throughout the lifespan of the Koppie Coal Mine.
- All contractors and employees should undergo induction which is to include a component of environmental awareness

Alien Invasive Species

<u>Mitigation Options</u>

- An alien invasive management programme must be incorporated into an Environmental Management Programme.
- Ongoing alien plant control must be undertaken, particularly in the disturbed areas as these areas will quickly be colonised by invasive alien species, especially in the riparian zone, which is particularly sensitive to AIP infestation.
- Herbicides must be carefully applied, in order to prevent any chemicals from entering the river. Spraying of herbicides within or near to the wetland areas is strictly forbidden.
- Re-instate indigenous vegetation (grasses and indigenous trees) in disturbed areas.

Table 7: Significance ratings matrix for the impacts without mitigation measures being implemented for the Proposed Koppie Mining Project's Preferred Option.

No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph + Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level
1	Construction phase	**Proposed Koppie Mining Project Preferred Option**	Altering of stream banks Work Revetments New access routes Site clearing Placement of stockpiles Use of heavy machinery	Flow alterations due to erosion and sedimentation	3	2	2	2	2,25	3	2	7,25	3	3	5	3	14	101,5	M	80
2	Construction phase	**Proposed Koppie Mining Project Preferred Option**	Use of heavy machinery using oils and fuels during site clearing Accidental spillages of chemicals, cements, oils, etc.	Pollution of watercourse	2	3	2	3	2,5	3	2	7,5	3	3	5	3	14	105	M	80
3	Construction phase	**Proposed Koppie Mining Project Preferred Option**	New access route Use of heavy machinery Placement of stockpiles Bank trampling leading to erosion	Spread of alien vegetation	2	2	3	2	2,25	3	2	7,25	3	3	5	2	13	94,25	M	80
4	Operational phase	**Proposed Koppie Mining Project Preferred Option**	Increased traffic Use of heavy machinery Runoff from dumps and stockpiles Bank Erosion	Flow alterations due to erosion and sedimentation	3	2	3	3	2,75	4	4	10,75	5	5	5	4	19	204,3	H	80
5	Operational phase	**Proposed Koppie Mining Project Preferred Option**	Increased traffic leading to potential accidential spills of hydrocarbon materials Hazardous materials entering the watercourses Increased road runoff during rainfall events	Pollution of watercourse	3	4	3	4	3,5	4	4	11,5	5	5	5	4	19	218,5	H	80
6	Operational phase	**Proposed Koppie Mining Project Preferred Option**	Increased runoff from hardened surfaces Increased traffic	Spread of alien vegetation	3	2	3	2	2,5	4	4	10,5	4	4	5	4	17	178,5	H	70

Table 8: Significance ratings matrix for the impacts without mitigation measures being implemented for the Proposed Koppie Mining Project's Alternative Option.

No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph + Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level
1	Construction phase	**Proposed Koppie Mining Project Alternative Option**	Altering of stream banks Work Revetments New access routes Site clearing Placement of stockpiles Use of heavy machinery	Flow alterations due to erosion and sedimentation	3	2	2	2	2,25	3	3	8,25	3	3	5	3	14	115,5	M	80
2	Construction phase	**Proposed Koppie Mining Project Alternative Option**	Use of heavy machinery using oils and fuels during site clearing Accidental spillages of chemicals, cements, oils, etc.	Pollution of watercourse	2	3	2	3	2,5	3	3	8,5	3	3	5	3	14	119	M	80
3	Construction phase	**Proposed Koppie Mining Project Alternative Option**	New access route Use of heavy machinery Placement of stockpiles Bank trampling leading to erosion	Spread of alien vegetation	2	2	3	2	2,25	3	3	8,25	3	3	5	2	13	107,3	M	80
4	Operational phase	**Proposed Koppie Mining Project Alternative Option**	Increased traffic Use of heavy machinery Runoff from dumps and stockpiles Bank Erosion	Flow alterations due to erosion and sedimentation	4	3	3	4	3,5	4	4	11,5	5	5	5	4	19	218,5	H	80
5	Operational phase	**Proposed Koppie Mining Project Alternative Option**	Increased traffic leading to potential accidential spills of hydrocarbon materials Hazardous materials entering the watercourses Increased road runoff during rainfall events	Pollution of watercourse	3	5	3	5	4	4	4	12	5	5	5	4	19	228	H	80
6	Operational phase	**Proposed Koppie Mining Project Alternative Option**	Increased runoff from hardened surfaces Increased traffic	Spread of alien vegetation	3	3	4	3	3,25	4	4	11,25	4	4	5	4	17	191,3	H	70

Table 9: Significance ratings matrix for the impacts with mitigation measures being implemented for the Proposed Koppie Mining Project's Preferred Option.

No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph + Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level
1	Construction phase	**Proposed Koppie Mining Project Preferred Option**	Altering of stream banks Work Revetments New access routes Site clearing Placement of stockpiles Use of heavy machinery	Flow alterations due to erosion and sedimentation	2	1	1	1	1,25	3	2	6,25	3	3	5	3	14	87,5	M	80
2	Construction phase	**Proposed Koppie Mining Project Preferred Option**	Use of heavy machinery using oils and fuels during site clearing Accidental spillages of chemicals, cements, oils, etc.	Pollution of watercourse	1	2	1	2	1,5	3	2	6,5	3	3	5	3	14	91	M	80
3	Construction phase	**Proposed Koppie Mining Project Preferred Option**	New access route Use of heavy machinery Placement of stockpiles Bank trampling leading to erosion	Spread of alien vegetation	1	1	2	2	1,5	3	2	6,5	3	3	5	2	13	84,5	M	80
4	Operational phase	**Proposed Koppie Mining Project Preferred Option**	Increased traffic Use of heavy machinery Runoff from dumps and stockpiles Bank Erosion	Flow alterations due to erosion and sedimentation	3	2	2	1	2	4	3	9	5	5	5	3	18	162	M	80
5	Operational phase	**Proposed Koppie Mining Project Preferred Option**	Increased traffic leading to potential accidential spills of hydrocarbon materials Hazardous materials entering the watercourses Increased road runoff during rainfall events	Pollution of watercourse	3	4	3	3	3,25	4	3	10,25	5	5	5	3	18	184,5	H	80
6	Operational phase	**Proposed Koppie Mining Project Preferred Option**	Increased runoff from hardened surfaces Increased traffic	Spread of alien vegetation	2	2	3	2	2,25	4	3	9,25	4	4	5	4	17	157,3	M	70

Table 10: Significance ratings matrix for the impacts with mitigation measures being implemented for the Proposed Koppie Mining Project's Alternative Option.

No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph + Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level
1	Construction phase	**Proposed Koppie Mining Project Alternative Option**	Altering of stream banks Work Revetments New access routes Site clearing Placement of stockpiles Use of heavy machinery	Flow alterations due to erosion and sedimentation	2	2	1	1	1,5	3	2	6,5	3	3	5	3	14	91	M	80
2	Construction phase	**Proposed Koppie Mining Project Alternative Option**	Use of heavy machinery using oils and fuels during site clearing Accidental spillages of chemicals, cements, oils, etc.	Pollution of watercourse	1	2	1	3	1,75	3	2	6,75	3	3	5	3	14	94,5	M	80
3	Construction phase	**Proposed Koppie Mining Project Alternative Option**	New access route Use of heavy machinery Placement of stockpiles Bank trampling leading to erosion	Spread of alien vegetation	1	1	2	2	1,5	3	2	6,5	3	3	5	2	13	84,5	M	80
4	Operational phase	**Proposed Koppie Mining Project Alternative Option**	Increased traffic Use of heavy machinery Runoff from dumps and stockpiles Bank Erosion	Flow alterations due to erosion and sedimentation	3	2	2	2	2,25	4	3	9,25	5	5	5	4	19	175,8	H	80
5	Operational phase	**Proposed Koppie Mining Project Alternative Option**	Increased traffic leading to potential accidential spills of hydrocarbon materials Hazardous materials entering the watercourses Increased road runoff during rainfall events	Pollution of watercourse	3	4	3	4	3,5	4	3	10,5	5	5	5	4	19	199,5	H	80
6	Operational phase	**Proposed Koppie Mining Project Alternative Option**	Increased runoff from hardened surfaces Increased traffic	Spread of alien vegetation	3	2	4	3	3	4	3	10	4	4	5	4	17	170	H	70

5.2 Wetland Buffer

The wetland assessed within the Proposed Koppie Mining Project boundary, namely the floodplain wetlands and pans associated covers a great area and the buffer calculated for the wetland study should be implemented and adhered to by mine management.

The buffer tool aims to provide a method for determining appropriate buffer-widths for developments associated with wetlands, rivers or estuaries. This method takes into account a number of different factors in determining the buffer width including the impact on water resources, climatic factors and the sensitivity of the water resource

The calculated results indicate that a 110 m buffer is appropriate for the protection of the ecosystem services provided by the wetland systems (**Figure 14 and Figure 15**). Any activity must occur outside of the recommended 110 m buffer zone.

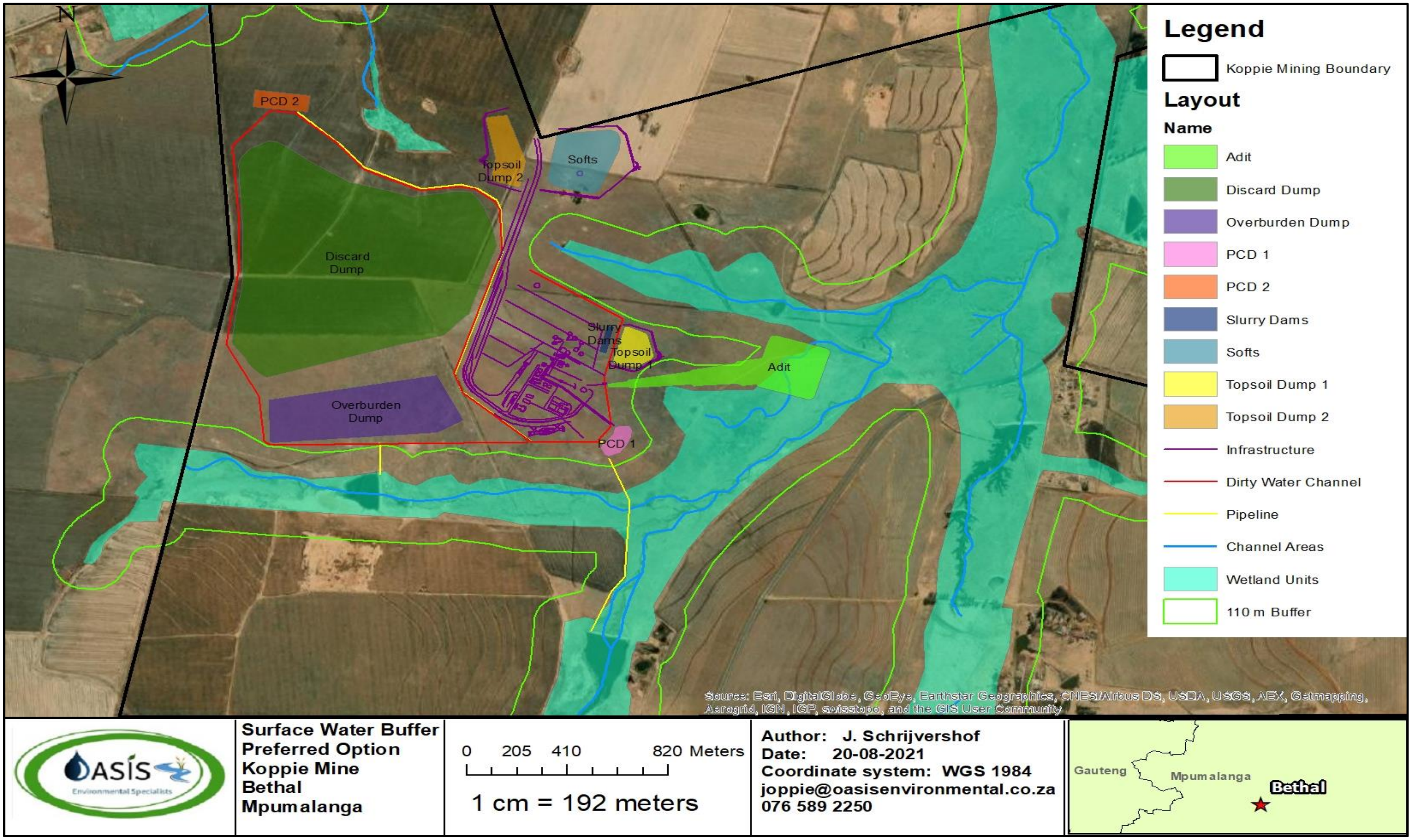

Figure 14: Proposed Koppie Mining Project - 110 m Wetland Buffer map for the Preferred Option.

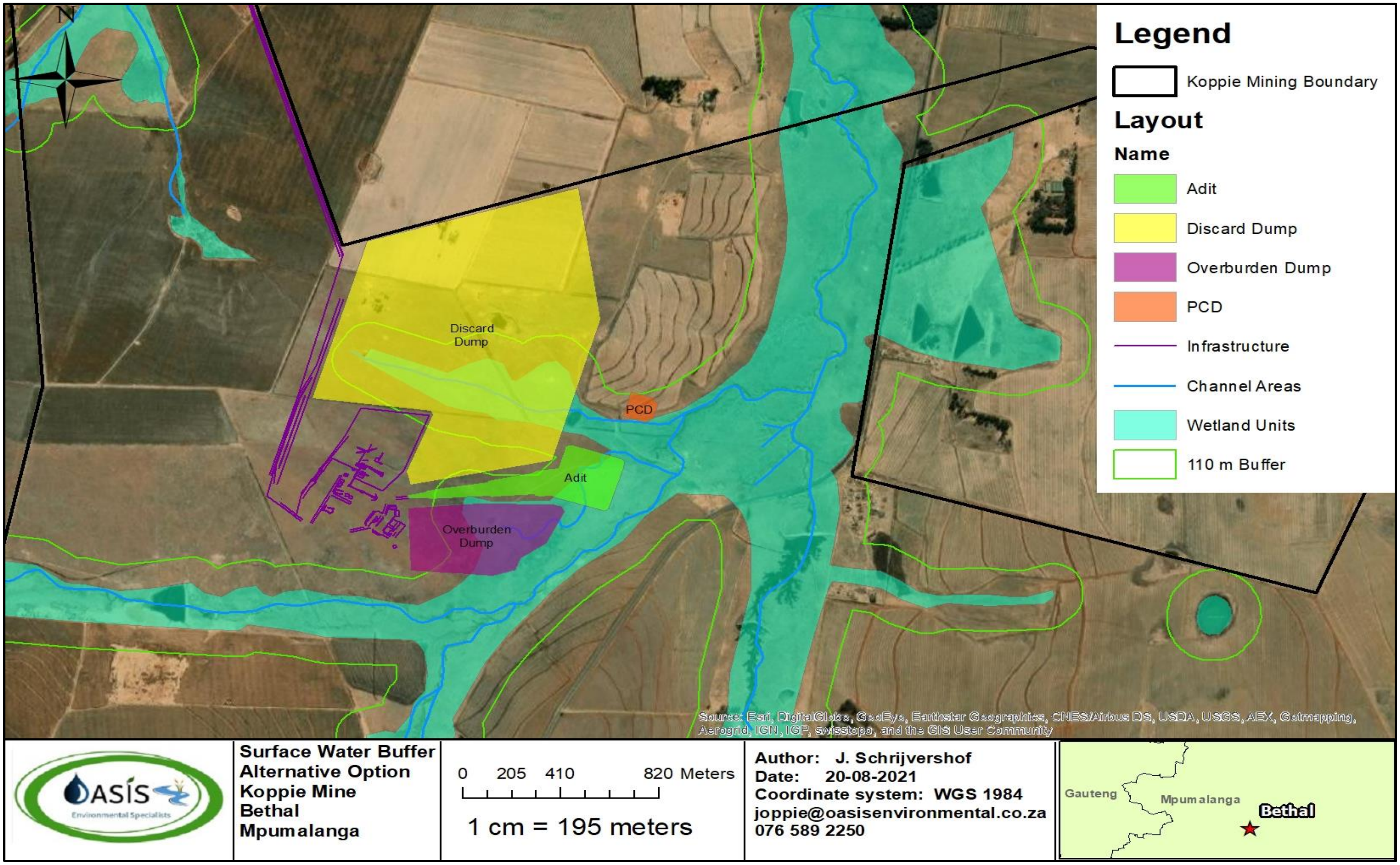

Figure 15: Proposed Koppie Mining Project - 110 m Wetland Buffer map for the Alternative Option.

6 CONCLUSION & RECOMMENDATIONS

A site assessment was conducted on the 27th of November 2020 to assess the surface water quality and features for the Proposed Koppie Mining Project. During the site visit it was evident that alien invasive plant infestation and extensive crop cultivation affected the functionality of the watercourses within the area. It must be noted that the study sites had stagnant water in certain sections of the stream at the time at the assessment. Litter and sewage from a small community were observed within the systems. The upstream site for the Joubertsvleispruit was dry at the time of the assessment, where the downstream site and the Viskuile River has pockets of water at the time of the assessment.

In situ water quality variables was within acceptable limits compared to the Target Water Quality Ranges (TWQRs) for aquatic ecosystems of South Africa. The pH remained relatively constant throughout the sites and within the neutral range. Temperatures were relatively stable, where electrical conductivity levels were above recommended guideline levels for the Joubertsvleispruit. Dissolved oxygen (DO) levels were below guideline levels at both upstream and downstream sites, this may be attributed to a lack of suitable flow conditions. Agriculture and mining activities were observed at the time of the assessment near these systems. It must be noted that *in situ* water quality testing cannot identify specific chemicals for the basis for the health determination of a river system.

The physical and chemical water quality results were evaluated in respect of the RQO's for the Oliphant's Catchments guidelines for Aquatic Ecosystems for the B11A catchment and to assess the conditions of the watercourses.

Water samples were obtained during the field survey for the analysis of the physical and chemical properties of the Viskuile and Joubertsvlei systems and to compare them to these reference conditions. All variables measured were found to be within guideline levels indicating that these systems are within a good condition based on water quality.

The study site can be characterised as having rolling hills with relatively steep sloping topography. The site ranges in altitude from 1593 m to 1717 m above sea level. A Digital Elevation Model (DEM) of the aerial photography of the site revealed 2 depressions in landscape cutting in the middle of the mining boundary

Several 'A' Section and 'B' Section channels were delineated. The main drainage channels were identified as 'B' Section channels without any riparian plant species identified and any other drainage features were found to be 'A' section channels feeding the 'B' section channels during rainfall. These channels are associated with the floodplain wetland areas.

From the wetland study, two floodplain etland systems were identified with the Proposed Koppie Mining Project. The floodplain wetland received poor scores, indicating that these wetland is heavily transformed system.

The DWS based risk assessment (GN 509) found that the impact on the wetland areas from the Proposed Koppie Mining Project were rated as an overall **moderate impact during construction** and as an overall **high impact during operation for** the Alternative Option. The Preferred Option's an overall risk is considered **moderate impact during construction** and as an overall **moderately-high impact during operation**. This is considering and taking into account that the mitigations measures as provide being implemented appropriately, otherwise the impacts will be significantly higher for both options. Identified impacts pertaining to erosion, sedimentation, water quality and quantity alterations and the continued spread of alien invasive species and the main concern is the placement of the proposed Adit within the wetland areas.

Provided mitigation measures are to be implemented within an environmental management programme (EMPr) and the significance of any negative impacts reduced. Potential impacts associated with the construction and operational phase include:

- Increased sedimentation;
- Water quality contamination due to runoff;
- Alteration of natural flow regime;
- Increased utilisation of aquatic; and
- Habitat loss associated with sedimentation and erosion.

Mitigation measures, aimed at minimising the afore-mentioned impacts, include (but are not limited to):

- Design and implementation of a suitable stormwater system;
- Rehabilitation of the disturbed areas;
- Limiting instream sedimentation;
- Minimising pollutants entering the watercourses;
- Implement a programme for the clearing/eradication of alien species including long term control of such species;
- A 110 m buffer was implemented for the wetland systems;
- Ongoing water quality monitoring must take place every month during operational phases; and
- Biomonitoring where/if flow conditions allow for effective sampling analysis must take place bi-annually to determine any trends in ecology and hydrology.

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