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WATERCOURSE ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT AND AUTHORISATION PROCESS FOR THE KHWARA MANGANESE PROSPECTING RIGHTS APPLICATION NEAR HOTAZEL, NORTHERN CAPE

Prepared for

SLR Consulting

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EXECUTIVE SUMMARY

The results of the assessment indicate that the assessed reach of the Kuruman River, situated on the Farm Eersbegint 703/43 near Hotazel in the Northern Cape, is in a largely natural to moderately modified ecological state, although upstream impacts such as mining have potentially resulted in loss of recharge to the system, causing further moisture stress to riparian vegetation. The episodic nature of the system (last recorded surface flow was in 1988) reduces human reliance on the watercourse, however, it is deemed a vital component of the overall ecology of the focus area and greater region.

At the time this study was undertaken, the proposed exploration drilling schedule had not been finalised. Therefore, when applying the impact assessment, a "worst case scenario" was assumed in line with the precautionary principle as defined in NEMA. Based on this, it is presumed that exploratory drilling will be undertaken directly within the Kuruman River. Although the results of the impact assessment indicate that impact significance prior to mitigation is low to very low, this is attributed to the duration and spatial extent of impacts, as the intensity of impacts is high to very high. Additionally, the possible effects of impacts in the event of an unpredictable flood occurring during exploration activities cannot be accurately assessed but are anticipated to be of very high significance.

Overall, it is imperative that mitigation measures are implemented throughout the life of the project in order to ensure that not only are direct impacts prevented/minimised, but that cumulative impacts on the larger drainage network are also prevented. Provided that the mitigation measures supplied in this report are implemented in conjunction with those stipulated by other specialists, specifically the hydrological and groundwater specialists, impact significance may be reduced. Taking the above into account, it is therefore the opinion of the specialist that from a freshwater ecological perspective, the proposed exploratory drilling, be carefully considered, and that preferably, refinement of the of the proposed exploration drilling schedule (to exclude the Kuruman River), takes place before the project be authorised.

Scientific Terrestrial Services (STS) was appointed to conduct a watercourse delineation and assessment as part of the Environmental Impact Assessment and Authorisation process for the proposed Khwara Manganese Prospecting Rights Application Project within and adjacent to the Kuruman River, near Hotazel, Northern Cape. The proposed prospecting application is on the Farm Eersbegint 703/43. Since the focus of the prospecting application (and prospecting activities) is the Kuruman River, this study focused on the delineated boundary of the riparian zone of the river and a 200m assessment zone around the delineated riparian zone (hereafter referred to as the "focus area").

The purpose of this report is to provide detailed information to guide the activities associated with the proposed prospecting activities in the focus area, to ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and water resource management initiatives and the provision of ecological services in the local area. The study also aimed to identify and quantify any impacts on the watercourse associated with the focus area (i.e. the Kuruman River), and to present a set of mitigatory measures which could be employed to minimise impacts on the receiving freshwater environment.

The assessment took the following approach:

- A desktop study was conducted, and relevant national and provincial databases were consulted. The results of the desktop study are contained in Section 3 of this report;
- A field assessment took place in January 2020, to ground-truth pre-defined points of interest and delineate the reach of the Kuruman River within the focus area. During the site

assessment, factors influencing the habitat integrity of the river was noted, and the functioning and the environmental and socio-cultural services provided by the river were determined;
- A single watercourse – the Kuruman river – was identified within the focus area and was classified according to the Classification System (Ollis *et. al.,* 2013). The results of this classification are presented in Section 4.1 of this report;
- The characterisation of the watercourse is contained in Section 4.2 of this report and is summarised in the table below.

Table A: Summary of the results of the field assessment.

Present Ecological State (PES) Category	Ecological function and service provision	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Class (REC) / Recommended Management Objective (RMO) and Best Attainable State (BAS)
B/C	Intermediate	Low / Moderate	C / C / C

Following the assessment of the watercourses, a pre-determined impact assessment methodology was applied to ascertain the significance of perceived impacts on the receiving environment, should the proposed prospecting activities proceed. The results of the impact assessment are contained in Section 5 of this report, and key mitigation measures are provided in both Section 6 and Appendix E.

It should be noted that at the time of this study, a proposed prospecting plan was unavailable from the proponent, nor was any indication of the number of drill sites or exploration boreholes given. In line with the precautionary principle therefore, a worst case scenario was assumed when applying the impact assessment.

Mitigation measures were developed to aid in minimising potential direct, indirect, and cumulative impacts on the receiving freshwater environment. These measures are outlined in Section 5 of this report, however the key mitigation measures are summarised below:

- as far as possible, prospecting activities should be avoided within the active channel and riparian zone of the Kuruman River or within 32m thereof (i.e. the Zone of Regulation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998)). It is recommended that the drill plan be planned to exclude these areas if possible. If not, the necessary approvals will be obtained.;
- No access roads should be planned parallel to the watercourse. All access roads must be planned to access each drill site at 90 degree angles to minimise edge effects on the system. Keep vehicle movements close to the natural contours of the landscape as much as possible;
- If exploration within the watercourse cannot be avoided, then it is essential that each drill pad footprint is minimised and does not extend beyond 100m^2 per site and that vegetation clearing is limited to essential areas only. Access to any portions of the watercourse within which activities are not taking place are to be strictly 'off-limits' to all personnel and vehicles;
- A spill prevention and emergency spill response plan should be compiled to guide the proposed exploration activities, and an emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur;
- It is essential that a soil management programme is implemented and maintained to minimise erosion and sedimentation;
- Active re-vegetation of disturbed areas immediately after construction is essential;
- Implement and maintain an alien vegetation management programme;
- Ensure that appropriate mitigatory measures are developed to mitigate against concentration of runoff if deemed necessary;
- Appropriate waste management at each site is essential. No waste material is to be disposed of within the watercourse or surrounds, and all waste is to be removed from site and disposed of at a licenced disposal facility; and
- Rehabilitation measures must be developed and implemented at each site. Implementation must be overseen by a suitably qualified Environmental Site Officer with wetland/aquatic experience and the ESO must sign off the rehabilitation before the relevant contractors leave site. A Minimum of two years post-closure monitoring is to be undertaken.

It is imperative that mitigation measures are implemented throughout the life of the project in order to ensure that not only are direct impacts prevented/minimised, but that cumulative impacts on the larger drainage network are also prevented. Provided that the mitigation measures supplied in this report are implemented in conjunction with those stipulated by other specialists, specifically the hydrological and groundwater specialists, impact significance may be reduced. Taking the above into account, it is therefore the opinion of the specialist that from a freshwater ecological perspective, the proposed exploratory drilling, be carefully considered, and that preferably, refinement of the of the proposed exploration drilling schedule (to exclude the Kuruman River), takes place before the project be authorised.

DOCUMENT GUIDE

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix G
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix G
b)	A declaration that the specialist is independent	Appendix G
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.3
cA)	An indication of the quality and age of base data used for the specialist report	Section 2.1 and 3
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 4 and 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 2.1 and 4
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix C
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	Section 4
g)	An identification of any areas to be avoided, including buffers	Section 4.3
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	Section 4.3
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.4
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	Section 4, 5, and 6
k)	Any mitigation measures for inclusion in the EMPr	Section 5.1
l)	Any conditions for inclusion in the environmental authorisation	Section 5
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 5
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 6
(iA)	Regarding the acceptability of the proposed activity or activities	Section 6
(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	Section 6
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

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY OF TERMS

Alien 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.
Alluvial soil:	A deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.
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, animans 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.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Chroma:	The relative purity of the spectral colour which decreases with increasing greyness.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Ephemeral stream:	Ephemeral systems flow for less time than they are dry. Flow or flood for short periods of most years in a five-year period, in response to unpredictable high rainfall events. Support a series of pools in parts of the channel.
Episodic stream:	Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period, or may flow only once in several years**.**
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas.
Fluvial:	Resulting from water movement.
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Hydrophyte:	Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
Intermittent flow:	Flows only for short periods.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurences).
Perched water table:	The upper limit of a zone of saturation that is perched on an unsaturated zone by an impermeable layer, hence separating it from the main body of groundwater.
Perennial:	Flows all year round.
RAMSAR:	The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilisation of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is

	characterised by saturation from three to ten months of the year, within 50cm of the surface.
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks.
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius.
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
CSIR	Council of Scientific and Industrial Research
DD	Data Deficient
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Program
EN	Endangered
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	General Notice
GMP	Gold Mining Project
GPS	Global Positioning System
HGM	Hydrogeomorphic
LC	Least Concern
m	Meter
MPRDA	Mineral and Petroleum Resources Development Act
NBA	National Biodiversity Assessment
N/A	Not Applicable
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
RHP	River Health Program
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SAIAB	South African Institute of Aquatic Biodiversity
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
STS	Scientific Terrestrial Services
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WRC	Water Research Commission

1 INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a watercourse delineation and assessment as part of the Environmental Impact Assessment and Authorisation process for the proposed Khwara Manganese Prospecting Rights Application Project within and adjacent to the Kuruman River, Hotazel, Northern Cape. The proposed prospecting application is for the Farm Eersbegint 703/43, near Black Rock in the Joe Morolong Local Municipality, located in the John Taolo Gaetsewe District Municipality, Northern Cape Province. The focus of the proposed prospecting activities is the Kuruman River, however, at the time that this study was undertaken, the proposed locations of the prospecting boreholes had not been finalised nor provided to the specialist. Thus, a 200m zone around the delineated riparian zone associated with the river was defined in order to guide the site assessment. This 200m buffer around the riparian zone is henceforth referred to as the "focus area". Further to this, in order to identify all potential freshwater resources that may potentially be impacted by the proposed exploration activities, a 500m “zone of investigation” around the focus area, in accordance with Regulation 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), was used as a guide in which to assess possible sensitivities of the receiving environment. This area – i.e. the 500m zone of investigation around the focus area – will henceforth be referred to as the “investigation area”. The focus and investigation areas are depicted in Figures 1 and 2.

The purpose of this report is to provide detailed information to guide the activities associated with the proposed prospecting activities within and in the vicinity of the Kuruman River, to ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area. The study also aimed to identify and quantify any impacts on the watercourse associated with the proposed prospecting activities, and to present a set of mitigatory measures which could be employed to minimise impacts on the receiving freshwater environment.

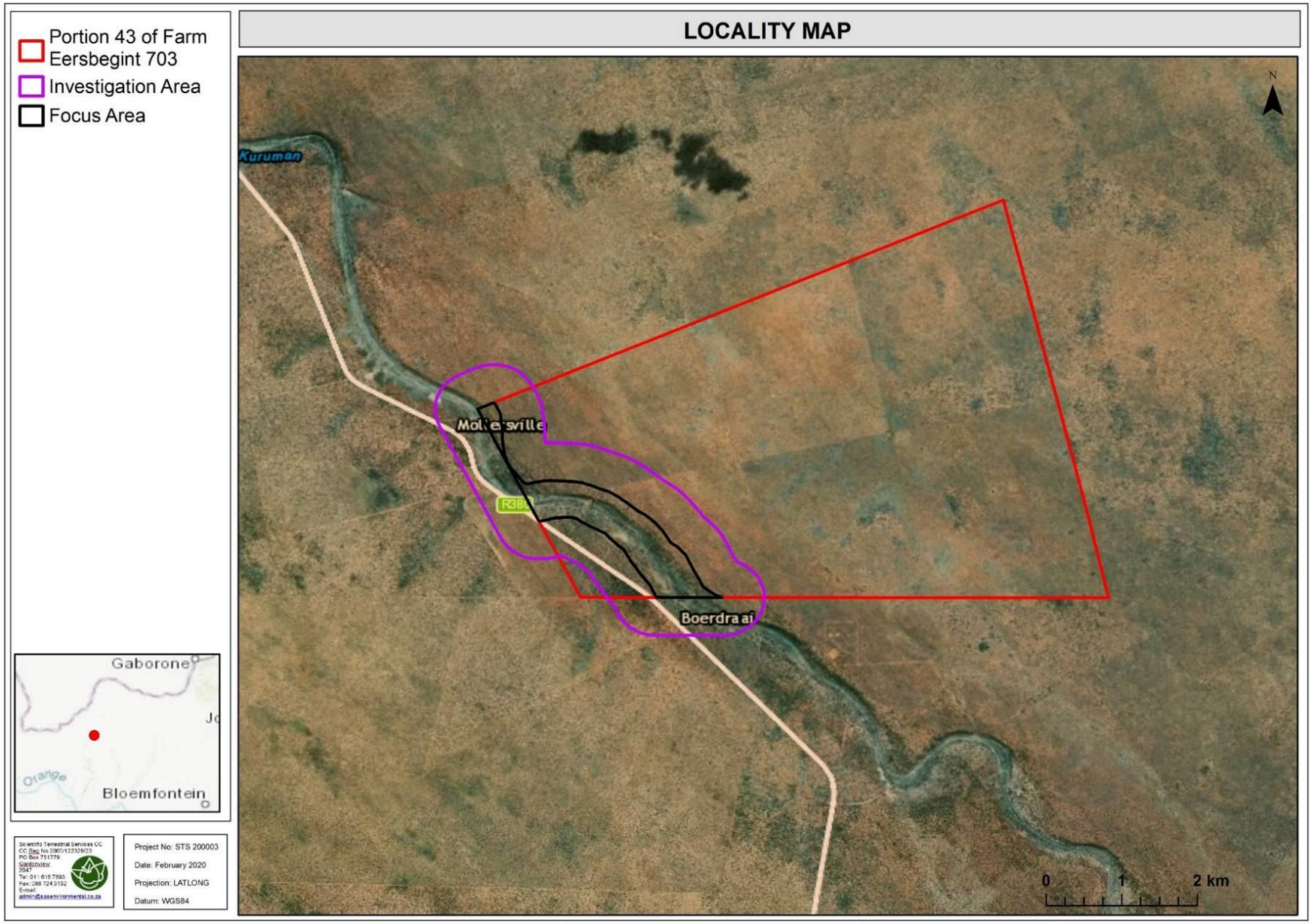


Figure 1: Digital satellite image depicting the location of the focus and investigation areas in relation to surrounding areas.

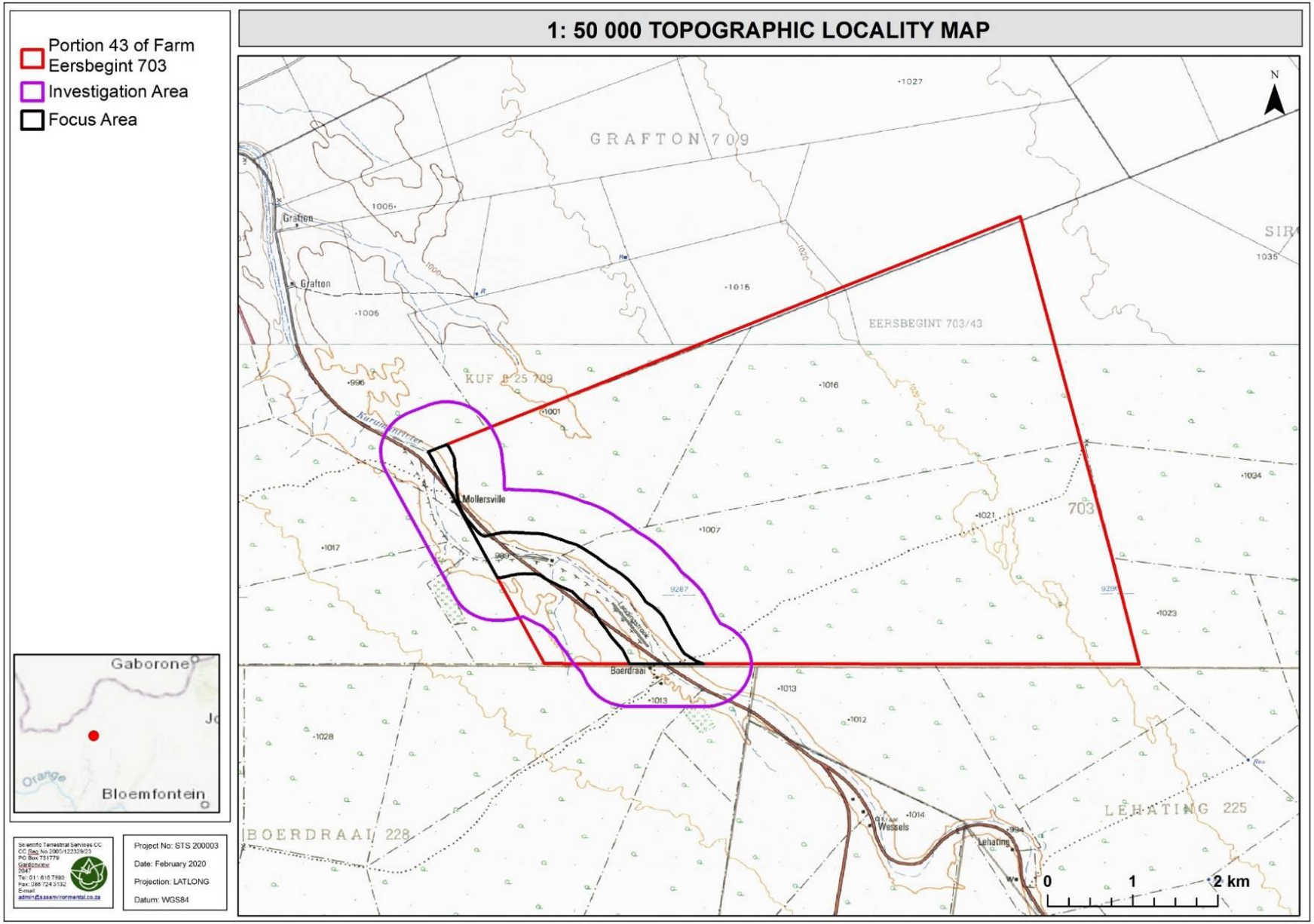


Figure 2: The focus and investigation areas depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.2 Project Description

The project will include invasive and non-invasive activities. Non-invasive activities comprise usage of ground penetrating radar to provide some detail of the geological structures. Once the non-invasive activities have been completed, the location of the prospecting boreholes (invasive activities) can be sited. The following facilities and activities are required at each of the prospecting borehole sites:

- Temporary ablution facilities for contractors;
- The establishment of a temporary access track;
- Plastic lined sumps;
- Temporary storage of hazardous and non-hazardous waste;
- HDPE sheet lined area and dill rig; and
- The demarcation of the prospecting site.

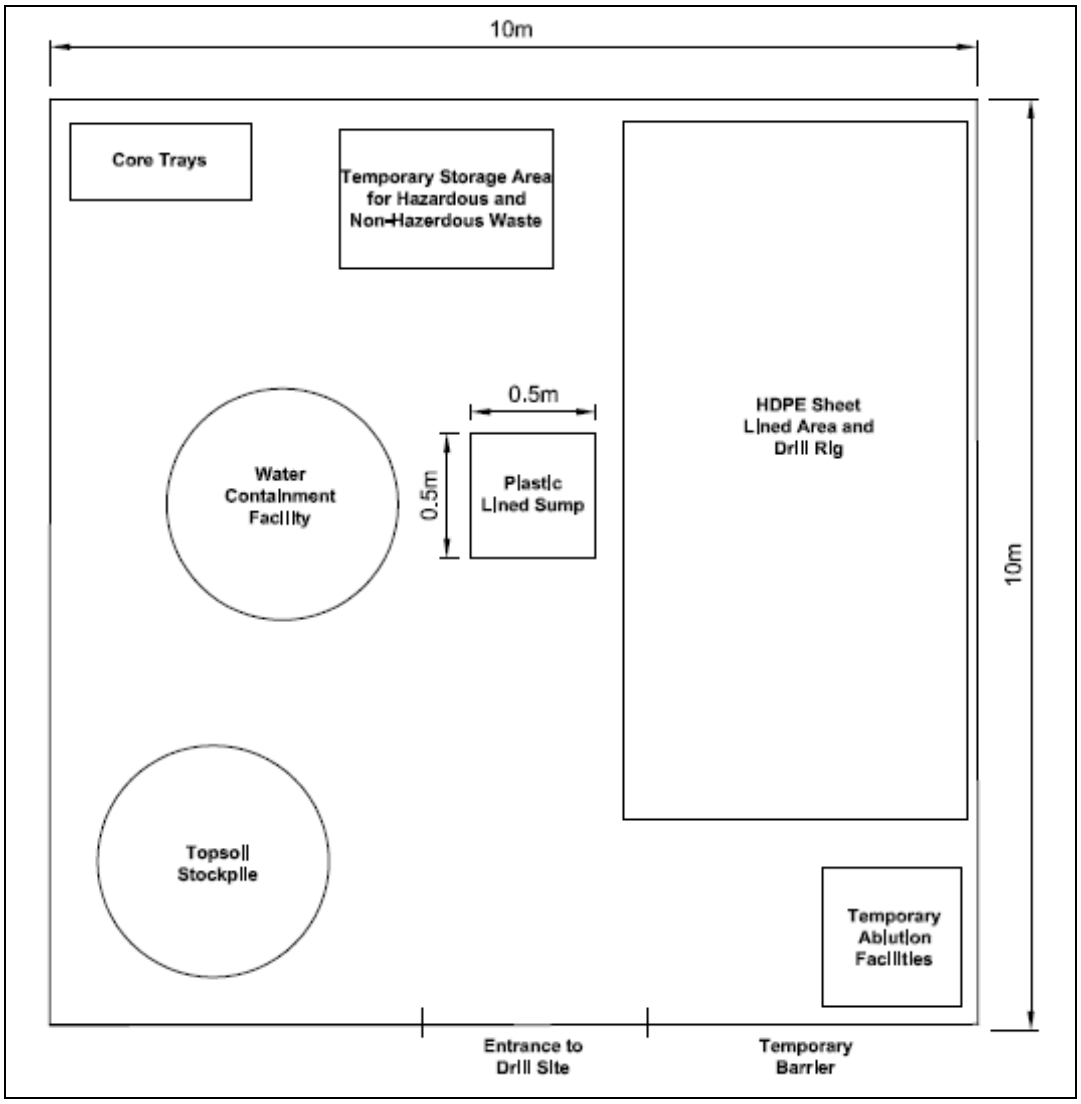


Figure 3: Conceptual layout of a drill site (SLR, 2019)

At the time of this investigation, it is envisaged that a total of ten prospecting boreholes will be drilled over a period of two years using diamond core drilling methods. For each drill site, once drilling is complete, the site will be decommissioned. Decommissioning will cater for the following:

- Capping and sealing of boreholes;
- Removal of any drilling equipment, chemicals, and
- Waste; removal and filling of sumps; and ripping of compacted soils (at drill sites and access tracks) to allow for re-vegetation of the site.

1.2.1 Project alternatives

The locations of the prospecting activities are dictated by the location of the ore body. It follows that no alternatives are being considered as prospecting activities will be limited to the farm Eersbegint 703/43.

1.3 Project Scope

Specific outcomes in terms of this report, pertaining only to the proposed, are outlined below:

- A background study of relevant national, provincial and municipal datasets (such as National Freshwater Ecosystem Priority Areas [NFEPA], the National Biodiversity Assessment [NBA] database and the DWS RQS PES/EIS database) was undertaken to aid in defining the Ecological Importance and Sensitivity (EIS) of the watercourse;
- The watercourse was delineated according to “DWAF, 2008: A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones”. Aspects such as soil morphological characteristics and vegetation indicators were used to delineate the riparian zone according to the guidelines. The applicable Zones of Regulation were then allocated to the watercourse;
- The classification assessment of the watercourse was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The EIS of the watercourse was determined according to the methods described by DWAF (1999) and Rountree & Kotze, (2013);
- The services provided by the watercourse within the focus area were assessed according to the method of Kotze *et al* (2009) in which services to the ecology of the site as well as services to the people of the area were defined;

- The PES of the watercourse was assessed according to the resource directed measures guideline as advocated by Kleynhans *et al*., (2008);
- Watercourse areas were mapped according to the ecological sensitivity of each hydrogeomorphic unit in relation to the focus area. In addition to the watercourse boundaries, the applicable zones of regulation of in terms of both Government Notice 509 as published in the Government Gazette 40229 of 2016 , and Government Notice 704 as published in the Government Gazette 20119 of 1999 as they relate to the National Water Act, 1998 (Act No. 36 of 1998), were depicted where applicable;
- The PES, EIS, and ecological service provision of the assessed reach of the watercourse were highlighted, and expected impacts on the system were assessed according to the impact assessment methodology; and
- Mitigation measures were presented in line with the impact mitigation hierarchy as advocated by the Department of Mineral Resources (DMR), the Department of Environmental Affairs (DEA) and the Department of Water and Sanitation (DWS).

1.4 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The watercourse assessment is confined to the focus area as illustrated in Figures 1 and 2 and does not include the neighbouring and surrounding properties outside of the focus area. The general surroundings were, however, considered in the desktop assessment of the focus area;
- With the exception of the Kuruman River, no watercourses within 500m of the focus area were identified using desktop assessment methods. The reach of the Kuruman River located within 500m of the northern portion of the focus area was delineated on a desktop basis using topographic maps and digital satellite imagery, in line with Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998). The reach located on the farm Boerdraai, south of the focus area, was delineated in the field according to the method defined by DWAF (2008). Only the reach located within the focus area was assessed as part of this investigation;
- The watercourse delineation as presented in this report is regarded as the best estimate of the watercourse boundaries based on the site conditions present at the time of assessment and based on the level of field verification possible. However, some limitations in the accuracy of the delineation due to historical and ongoing anthropogenic disturbances, in particular the alteration of the vegetation community composition and topography as a result of historical and current agricultural practices

is deemed possible, although every effort has been made to ensure accuracy of the delineation;

- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the watercourse zones will need to be surveyed and pegged according to surveying principles;
- Aquatic, riparian and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative/riparian zone species. Additionally, due to the naturally arid characteristics of the focus area, many species found in the riparian zone occur in terrestrial areas, albeit in diminished abundance and/or structure (e.g. height of individual plants may be greater in the riparian zone than in the adjacent terrestrial areas). Within the transition zone some variation of opinion on the riparian zone boundary may occur, however if the DWAF 2008 method is followed, all assessors should get largely similar results; and
- At the time that this study was conducted, the location of the proposed prospecting boreholes and layout of ancillary infrastructure such as access roads, was not provided. Based on information provided by the EAP, it is the intention of the proponent to focus the prospecting activities within and adjacent to the Kuruman River, and to utilise existing access roads where feasible. Information available at the time of the assessment indicated that a total of ten prospecting boreholes with a total footprint of 10m x 10m (including contractor laydown areas, sanitary facilities etc.) would be established within the focus area. Thus, in line with the precautionary principle, a "worst case scenario" was assumed when applying the impact assessment.

1.5 Legislative Requirements

The following legislative requirements were considered during the assessment:

- Constitution of the Republic of South Africa, 1996[1];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);

[1] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- Government Notice 704 as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The National Environmental Management: Biodiversity Act, 2014 (Alien and Invasive Species Regulations, 2014); and

  The Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA).

The details of each of the above as they pertain to this study, are provided in Appendix B of this report.

2 ASSESSMENT APPROACH

2.1 Freshwater Site Selection and Field Verification

For the purposes of this investigation, the following definitions as per the National Water Act, 1998 (Act No. 36 of 1998) are of relevance:

A **watercourse** means:

(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the *Gazette,* declare a watercourse.

Riparian habitat includes-

“The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas”.

Regulated Area of a Watercourse means -

(a) The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;

(b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or
(c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

Where the site characteristics had been significantly transformed (for example, complete loss of riparian vegetation adjacent to the farmstead) use was made of historical and current digital satellite imagery, topographic maps and available provincial and national databases to aid in the delineation of the watercourse following the field assessment. The following were taken into consideration when utilising the above desktop methods:

- Linear features: since water flows/moves through the landscape, watercourses often have a distinct linear element to their signature which makes them discernable on aerial photography or satellite imagery;
- Vegetation associated with watercourses: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often show as white/grey or black and outcrops or bare soils displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with watercourse vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

A field assessment was undertaken in February 2020 to conduct a watercourse delineation and ecological assessment. The delineation of the identified watercourse took place, as far as possible, according to the method presented in the “Updated manual for the identification and delineation of wetland and riparian resources” (DWAF, 2008). The foundation of the method is based on the fact that watercourses have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

In addition to the delineation process, a detailed assessment of the delineated watercourse was undertaken, at which time factors affecting the integrity of the watercourse were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the watercourse. A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

2.2 Sensitivity Mapping

All the freshwater ecological resources of the focus area were considered, and sensitive areas were delineated with the use of a GPS. A Geographic Information System (GIS) was used to project the watercourse onto digital satellite imagery and topographic maps. The sensitivity map provided in Section 4.4 should guide the design and layout of the proposed prospecting activities.

2.3 Impact Assessment and recommendations

Following the completion of the assessment, a pre-defined impact assessment methodology, provided by the EAP, was conducted (please refer to Appendix D for the method of approach) and recommendations were developed to address and mitigate impacts associated with the proposed activities. These recommendations also include general management measures which apply to the proposed prospecting activities as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the proposed activities. The detailed mitigation measures are outlined in Section 5 of this report, whilst the general management measures which are considered to be best practice mitigation applicable to a project of this nature, are outlined in Appendix F.

3 RESULTS OF THE DESKTOP ANALYSES

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard” report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for integration of results by the reader to take place. Where required, further discussion and interpretation is provided, and information that was considered of particular importance was emboldened.

It is important to note that although all data sources used provide useful and often verifiable, high quality data, the various databases used do not always provide an entirely accurate indication of the focus area’s actual site characteristics at the scale required to inform the Environmental Impact Assessment (EIA) process. Given these limitations, this information is

considered useful as background information to the study. It must however be noted that site verification of key areas may potentially contradict the information contained in the relevant databases, in which case the site verified information must carry more weight in the decision making process. Thus, this data was used as a guideline to inform the watercourse assessment and to focus on areas and aspects of increased conservation importance during the site assessment.

Table 1: Desktop data relating to the characteristics of the watercourse within the focus area and surrounding region.

Aquatic ecoregion and sub-regions in which the farm portion and focus area is located	
Ecoregion	Southern Kalahari
Catchment	Orange
Quaternary Catchment	D41M
WMA	Lower Vaal
subWMA	Molopo
Dominant characteristics of the Southern Kalahari (29.01) Aquatic Ecoregion Level 2 (Kleynhans *et al.*, 2007)	
Dominant primary terrain morphology	Plains; moderate relief, Closed Hills, mountains; moderate and high relief.
Dominant primary vegetation types	Karroid Kalahari Bushveld, Kalahari Mountain Bushveld, Kalahari Plateau Bushveld
Altitude (m a.m.s.l)	700 - 1500
MAP (mm)	0 - 500
The coefficient of Variation (% of the MAP)	30 - 40
Rainfall concentration index	60 - >65
Rainfall seasonality	Late Summer
Mean annual temp. (°C)	16 - 22
Winter temperature (July)	0 - 22
Summer temperature (Feb)	16 - >32
Median annual simulated runoff (mm)	<5 – 40

Detail of the farm portion and focus area in terms of the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database	
FEPACODE	The farm portion and focus area is situated within a SubWMA considered a River FEPA. River Freshwater Ecosystem Priority Area (FEPA) achieves biodiversity targets for river ecosystems and threatened fish species and were identified in rivers that, at the time of the NFEPA workshops, were indicated to be in a good ecological condition (A or B ecological category). Although the FEPA status applies to the actual river reach, shading of the whole sub-quaternary catchment reach indicate that that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition of the river reach.
NFEPA Wetlands	According to the NFEPA database (2011) a natural floodplain wetland traverses the focus area. The floodplain wetland is considered natural or good (Class AB).
Wetland Vegetation Type	The farm portion and focus area is situated within the Eastern Kalahari Bushveld Group 1 Wetland Vegetation Type considered Least Threatened according to SANBI, 2012 and Mbona *et al.* (2014),
NFEPA Rivers	According to the NFEPA Database the Kuruman River traverses the focus area. According to the NFEPA Database the Kuruman River is classified as a FEPA River and therefore, in terms of the NFEPA Implementation Manual (2011), mining (and/or prospecting) is not considered a compatible land use within 1km (1000m) of a riverine buffer around a river FEPA. The PES 1999 Classification as well as the NFEPA Database classifies the river as largely natural (Class B).

National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) [2]
According to the NBA (2018): SAIIAE there are no wetland features associated with the farm portion and focus area, thus corresponding with the NFEPA Database (2011). The NBA (2018) Database indicates the Kuruman River traversing the focus area. Currently the Kuruman River is poorly protected (Ecosystem Protection Level) and it is critically endangered (Ecosystem Threat Status).

Detail of the farm portion and focus area in terms of the Northern Cape Critical Biodiversity Areas (2016)	
Critical Biodiversity Area (CBA) Category 1	CBA 1 area areas that are irreplaceable or near-irreplaceable (i.e. high selection frequency) for meeting biodiversity targets. There are no or very few other options for meeting biodiversity targets for the features associated with these areas. The entire focus area is situated within a Category 1 Critical Biodiversity Area (CBA).
Ecological Support Area (ESA)	ESAs are areas which must retain their ecological processes in order to meet biodiversity targets for ecological processes that have not been met in

[2] The NBA (2018) Dataset includes the National Wetland Map 5 Information.

	CBAs or protected areas; meet biodiversity targets for representation of ecosystem types or Species of special concern when it's not possible to meet them in CBAs; support ecological functioning of protected areas or CBAs or a combination of these (SANBI, 2017). The majority of the farm portion falls within Ecological Support Areas.
Other Natural Area	ONA consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI, 2017). The remaining portions of the farm portion fall within an area classified as "Other Natural Areas".

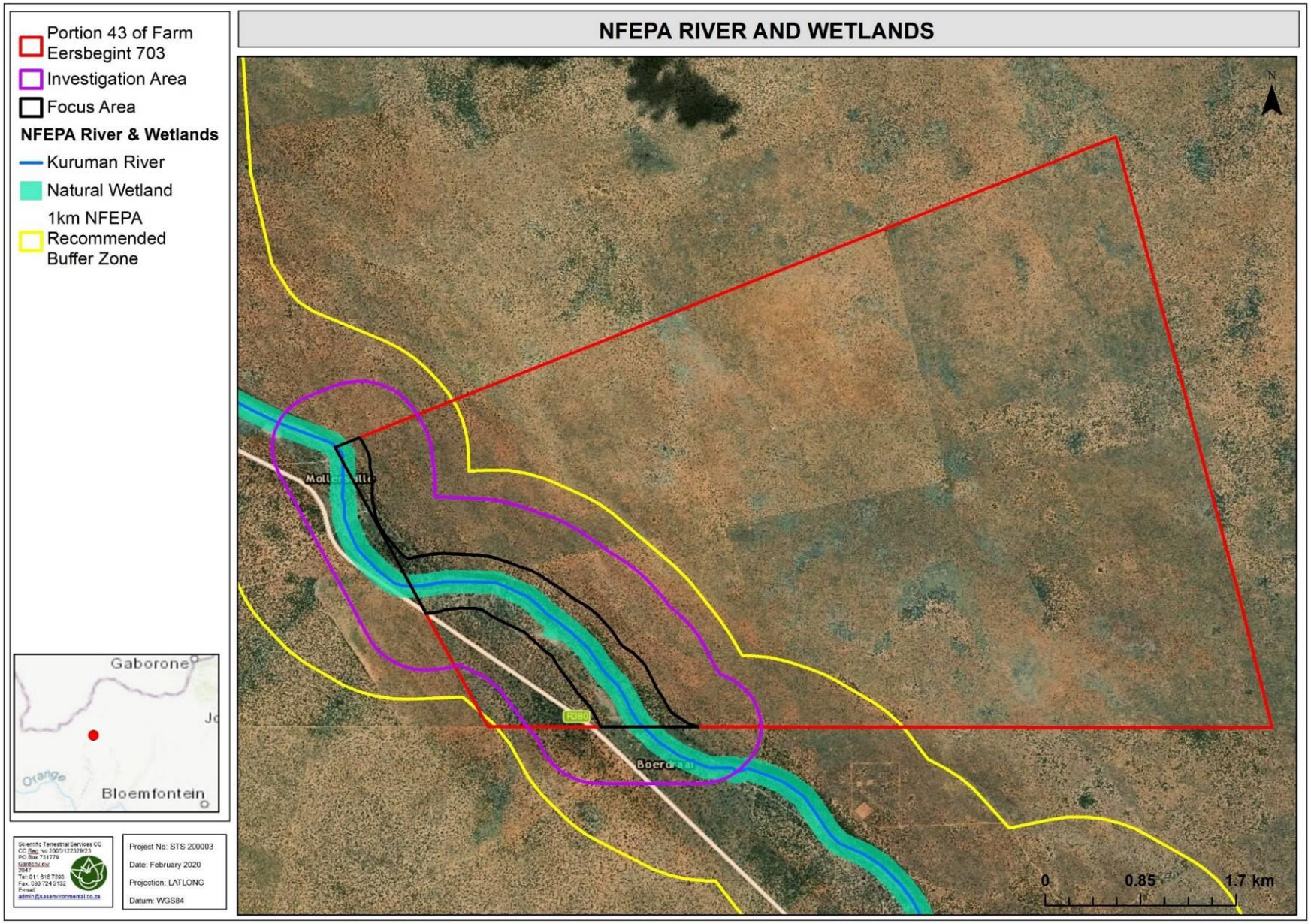


Figure 4: Wetlands associated with the focus and investigation area, according to the NFEPA Database (2011).

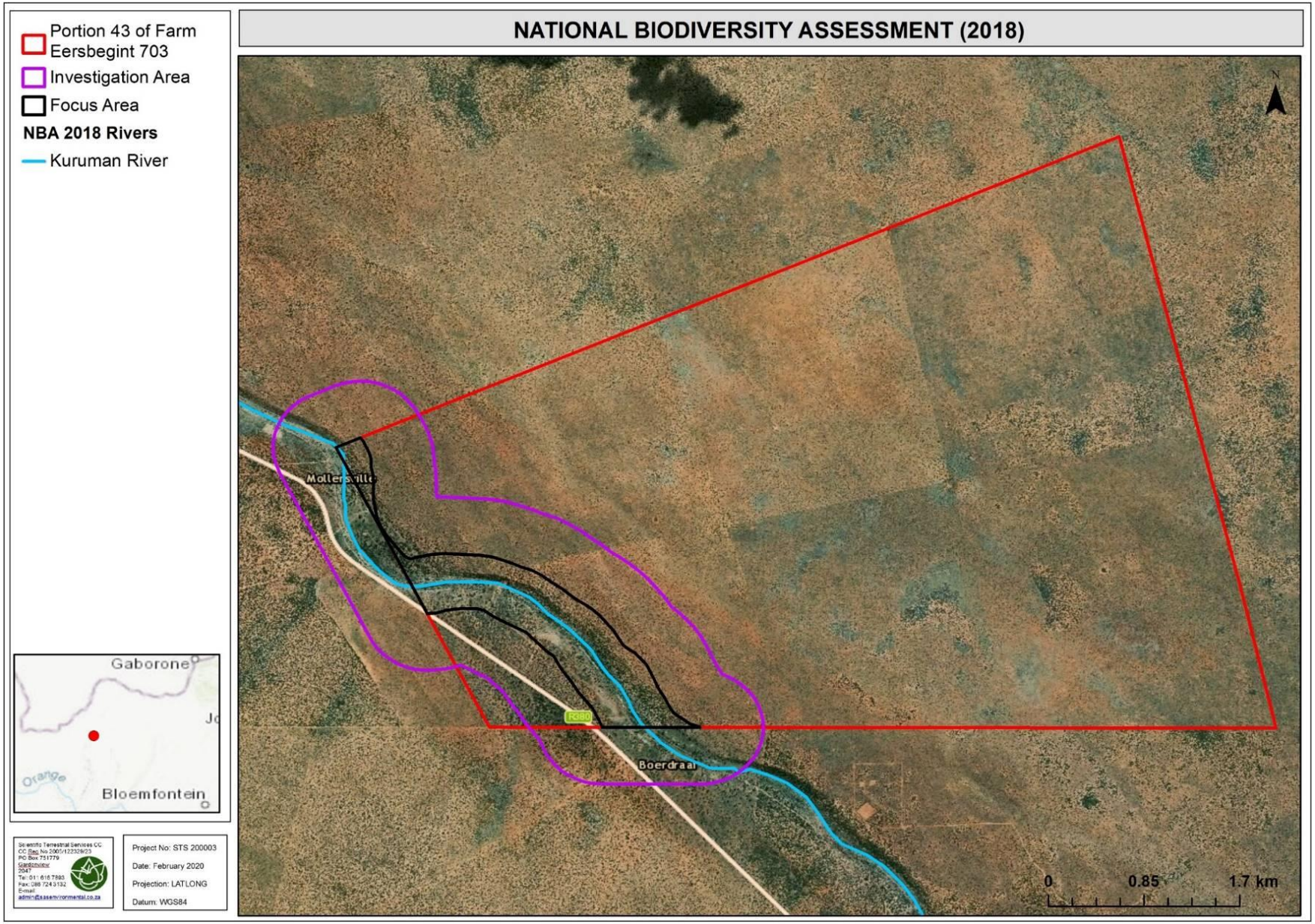


Figure 5: The watercourse (Kuruman River) associated with the focus area according to the National Biodiversity Assessment (2018).

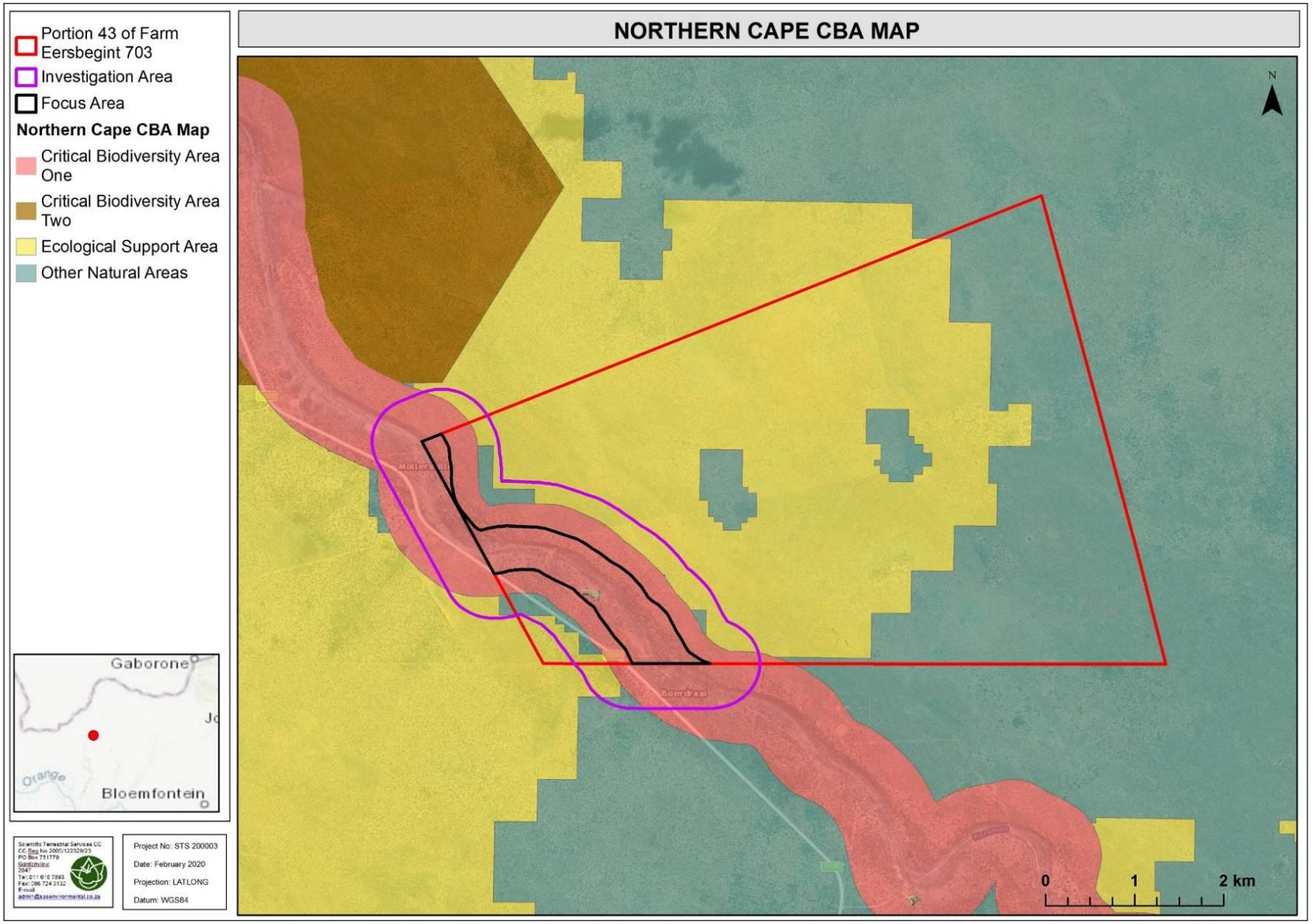


Figure 6: Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) associated with the focus and investigation areas (NCCBA, 2016).

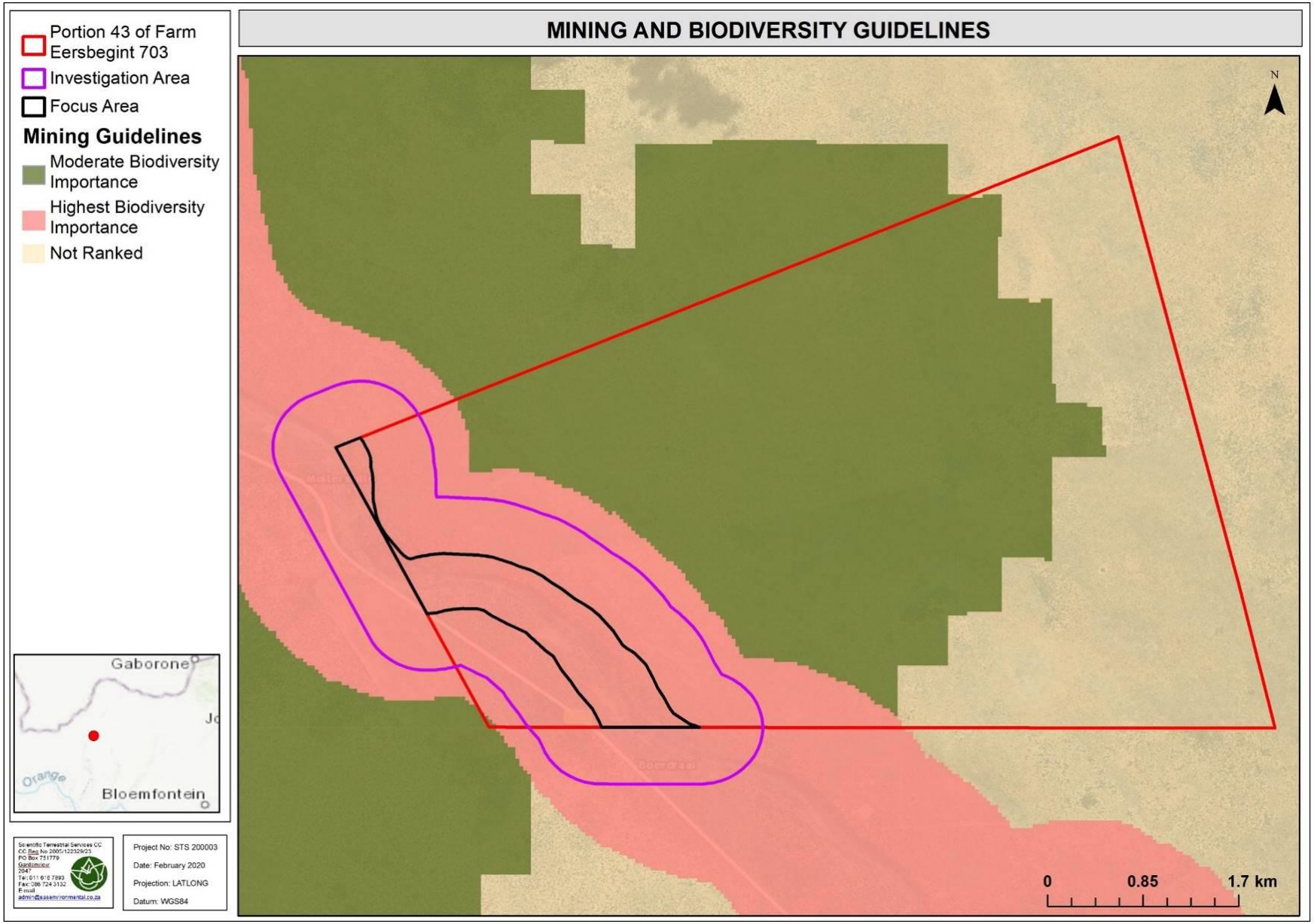


Figure 7: Importance of the focus area according the Mining and Biodiversity Guidelines (2013).

3.1 Ecological Status of Sub-Quaternary Catchments [Department of Water and Sanitation (DWS) Resource Quality Services (RQS) PES/EIS Database]

The PES/EIS database, as developed by the DWS RQS department, was utilised to obtain additional background information on the project area. The information from this database is based on information at a sub-quaternary catchment reach (SQR) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as South Africa River Health Programme (SA RHP) sites, Ecological Water Requirement (EWR) sites and Hydro Water Management System (WMS) sites.

In this regard, information for sub-quaternary catchment reach (SQR) for the Kuruman River (D41M – 01756) is applicable. Key information on background conditions associated with the focus area, as contained in this database and pertaining to the Present Ecological State (PES), ecological importance and ecological sensitivity for the Kuruman River, is tabulated in Table 3.

According to the Ecological Importance (EI) data for the Kuruman River (D41M – 01756) there are no fish species or macro-invertebrate species expected to occur at this site.

Table 2: Summary of the ecological status of the sub-quaternary catchment (SQ) reach Kuruman River (D41M – 01756) based on the DWS RQS PES/EIS database.

Synopsis (SQ reach Kuruman River (D41M – 01756))					
PES[1] category median	**Mean EI[2] class**	**Mean ES[3] class**	**Length**	**Stream order**	**Default EC[4]**
B (Largely Natural)	Moderate	Very Low	76.18	4	C (Moderate)
PES details					
Instream habitat continuity MOD		None	**Riparian/wetland zone MOD**		Moderate
RIP/wetland zone continuity MOD		Small	**Potential flow MOD activities**		Small
Potential instream habitat MOD activities		None	**Potential physico-chemical MOD activities**		Small
EI details					
Fish spp/SQ		NA	**Fish average confidence**		NA
Fish representativity per secondary class		NA	**Fish rarity per secondary class**		NA

Invertebrate taxa/SQ	NA	**Invertebrate average confidence**	NA
Invertebrate representativity per secondary class	NA	**Invertebrate rarity per secondary class**	NA
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	Very Low	**Habitat diversity class**	Low
Habitat size (length) class	Very Low	**Instream migration link class**	NA
Riparian-wetland zone migration link	Very High	**Riparian-wetland zone habitat integrity class**	High
Instream habitat integrity class	NA	**Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m**	Very High
Riparian-wetland natural vegetation rating based on expert rating			Very Low
ES details			
Fish physical-chemical sensitivity description	NA	**Fish no-flow sensitivity**	NA
Invertebrates physical-chemical sensitivity description	NA	**Invertebrates velocity sensitivity**	NA
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description			Very Low
Stream size sensitivity to modified flow/water level changes description			Low
Riparian-wetland vegetation intolerance to water level changes description			Very Low

[1] PES = Present Ecological State; confirmed in the database that assessments were performed by expert assessors;
[2] EI = Ecological Importance;
[3] ES = Ecological Sensitivity
[4] EC = Ecological Category; default based on median PES and highest of EI or ES mean.

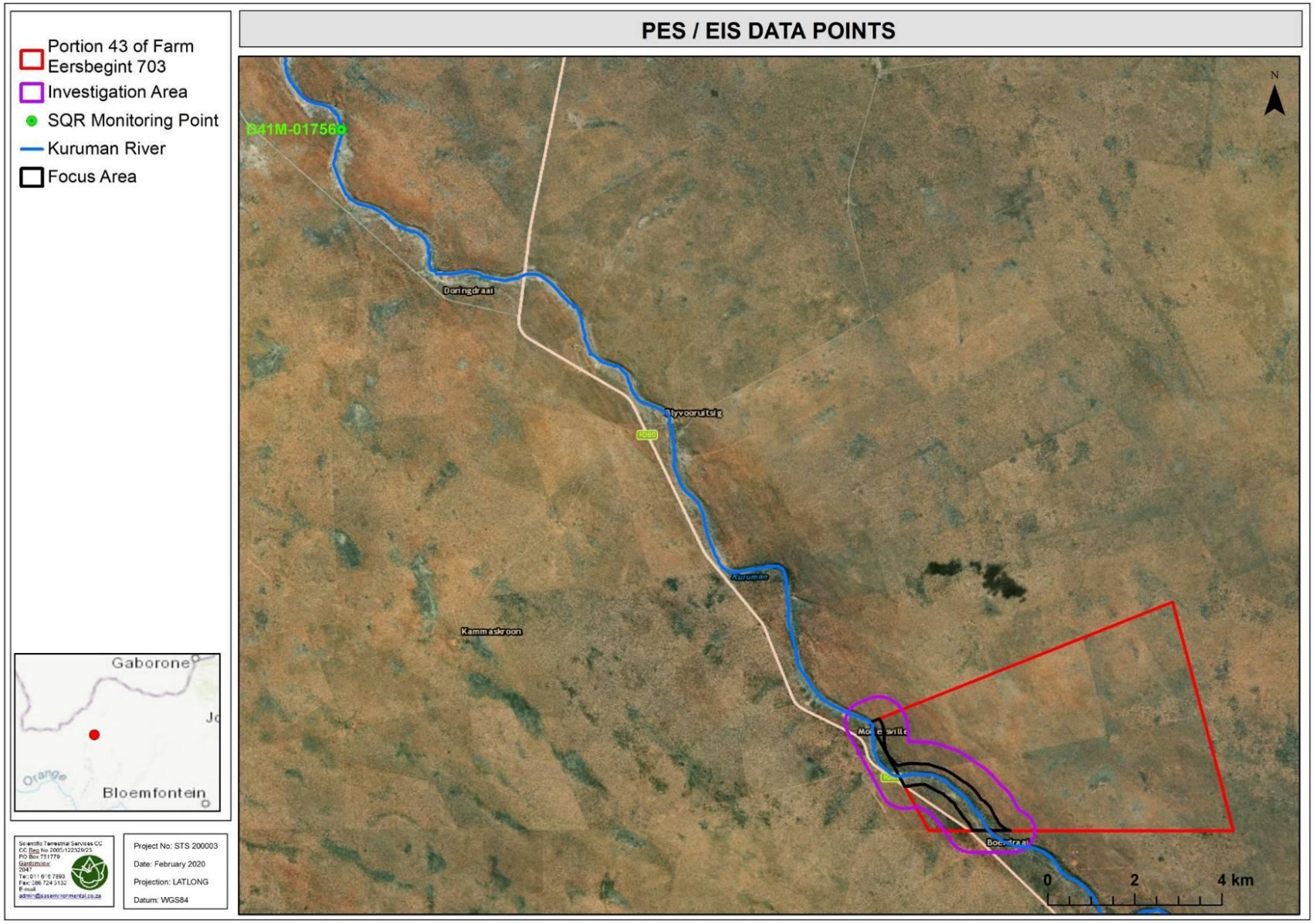


Figure 8: The location of the applicable SQR point (situated downstream of the focus area) according to the DWS PES/EIS database.

4 RESULTS: WATERCOURSE ASSESSMENT

4.1 Delineation

During the site assessment undertaken in February 2020, one watercourse, namely the Kuruman River, was identified within the focus area. This watercourse was delineated in the field according to the method described by DWAF (2008). Due to the episodic[3] characteristics of the Kuruman River, the primary indicators utilised to delineate the riparian zone were topography and vegetation. Although there is little difference in the species composition of the vegetation assemblage comprising the riparian zone and adjacent terrestrial areas, noticeable differences in the levels of greening and structure of the two vegetation assemblages provided a distinct guide in most areas (Figure 8). However, it must be noted that some portions of the site have been transformed, for example by the construction of the farmstead and vegetation losses due to grazing by domestic livestock (Figure 8). In these areas, as noted previously, use was made of historical digital satellite imagery to refine the delineation. The delineations as presented in this report are nevertheless regarded as a best estimate of the riparian zone boundaries based on the site conditions present at the time of the assessment undertaken in February 2020.

Figure 9: Representative photographs of a portion of the Kuruman River within the focus area, indicating: (left) a clear riparian zone (indicated approximately by the yellow dashed lines) and (right) the area near the farmstead which has been completely cleared of riparian vegetation.

Soil morphological characteristics (such as mottling and gleying), which are typically associated with a fluctuating water table, were not found during the site assessment, nor was soil wetness considered a reliable indicator due to the naturally arid conditions of the

[3] Episodic streams are highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period or may flow only once in several years.

region and exacerbated by several years of drought conditions in the area. However, there was a clear correlation between the occurrence of riparian vegetation and a transition from the characteristic red Kalahari sandy soils, to leached calcrete soils which were dominant in the river itself as well as the associated riparian zone. This distinct difference is illustrated in Figure 9 below.

Figure 10: Illustration of the distinct change in soil morphology, between the red Kalahari sand and the calcrete bedrock associated with the river (the approximate point of change is indicated by red arrow).

4.2 Drainage System Characterisation

The reach of the Kuruman River within the focus area was noted to have been subjected to various impacts, some of which have likely occurred over a period of several decades.

Although the Kuruman River is an episodic system, it is perennial for the first 10km from the dolomitic Kuruman Eye (located in the town of Kuruman), and according to Shaw *et al* (1992), is considered more responsive to precipitation and is more hydrologically active in comparison to other rivers in what is termed by Shaw *et al* (1992) as the Southern Kalahari drainage network (which includes the Ga-Mogara, Moshaweng, Molopo, Nossop and Auob Rivers in addition to the Kuruman River). SLR (2019) note in the Basic Information Document prepared as part of the proposed prospecting application that the last documented occurrence of surface water flow in the Kuruman was in 1974. However, Shaw *et al* (1992) refer to flood conditions experienced in Southern Africa in 1988, during which

the Kuruman River, certainly in the reach between Hotazel and its confluence with the Moshaweng River (approximately 46km north of the focus area), flowed for several months as a result. During the site assessment in February 2020, it was apparent that some sections of the active channel have eroded, although this erosion does not appear to be active (Figure 11). Although available literature regarding the ecological characteristics of the Kuruman River is scarce, based on literature the most recent documented flow in the assessed reach was in 1988, and the observed erosion is attributed to that event.

Figure 11: Representative photographs of an eroded section of the watercourse in the northern portion of the focus area. The photograph on the right clearly depicts rock deposits in the channel bed and shows how these eroded areas are utilised by fauna as habitat.

According to Shaw *et al* (1992), the Kuruman River maintains a distinctive “duricrust-sided valley form, but with the presence of two terraces at average heights of 3m and 8m above the valley floor” throughout most of its length from the vicinity of Hotazel to its confluence with the Molopo River. These terraces were more pronounced along the length of the river which drains through the southern neighbouring property (Boerdraai) as depicted in Figure 12 below but were noted in sections of the reach situated within the Eersbegint property. Whilst these terraces form part of the river, they did not necessarily display characteristics consistent with a well-defined riparian zone, however this may be attributable to vegetation removal as well as over-grazing by livestock (as is clearly illustrated in the figure below). They were however included in the delineation of the system, since available literature indicates that they form part of the “active” river channel.

Figure 12: Representative photograph of the terracing described by Shaw *at el*, 1992. This photograph was taken on the Farm Boerdraai, although less pronounced terracing was identified on the farm Eersbegint. Although no riparian vegetation zone is associated with these terraces at present, this may be due to removal of vegetation and overgrazing (the latter is apparent in this photograph).

The vegetation community of the riparian zone has been transformed in some areas by removal of vegetation (e.g. in the vicinity of the farmstead), grazing and trampling by domestic livestock, and bush encroachment and proliferation of the alien invasive *Prosopis glandulosa.* Dominant species in the riparian zone include *Ziziphus mucronata, Vachellia karoo,*and *Vachellia erioloba*. As previously mentioned, these species were not confined to the riparian zone, occurring throughout the focus area, however, within the riparian zone they were noted to generally be of increased frequency, density and size, and increased levels of greening were noted. Although some graminoids occurred within the riparian zone, these were difficult to positively identify due to grazing, and were also not unique to the riparian zone. Isolated occurrences of some forb species were noted but were not deemed to be of significant frequency or density to be considered definitive indicators of the riparian zone boundary.

It should be further noted that although the watercourse extends beyond the focus area, only those portions located within the focus area were assessed and ground-truthed. Nevertheless, the potential impacts of activities within the greater catchment such as agriculture, construction of infrastructure within and adjacent to the river, transformed

vegetation assemblages, clearing of natural vegetation and erosion were taken into consideration during the assessment.

The Kuruman River (Figure 13) was classified according to the Classification System (outlined in Appendix C of this report) as an Inland Systems falling within the Highveld Aquatic Ecoregion, and within the Eastern Kalahari Bushveld Group 1 Wetland Vegetation Type, considered 'Least Threatened' according to SANBI (2012) and Mbona *et al* (2015). The table below presents the classification of the watercourse at Levels 3 and 4 of the Classification System (Ollis *et al,* 2013).

Table 3: Characterisation of the watercourse associated with the focus area, according to the Classification System (Ollis *et al*., 2013).

Watercourse	Level 3: Landscape unit	Level 4: Hydrogeomorphic Unit
Kuruman River	**Valley floor:** The base of a valley, situated between two distinct valley side-slopes.	**River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.

The locality and extent of the watercourse in relation to the focus area and property boundaries is depicted in the figure below.

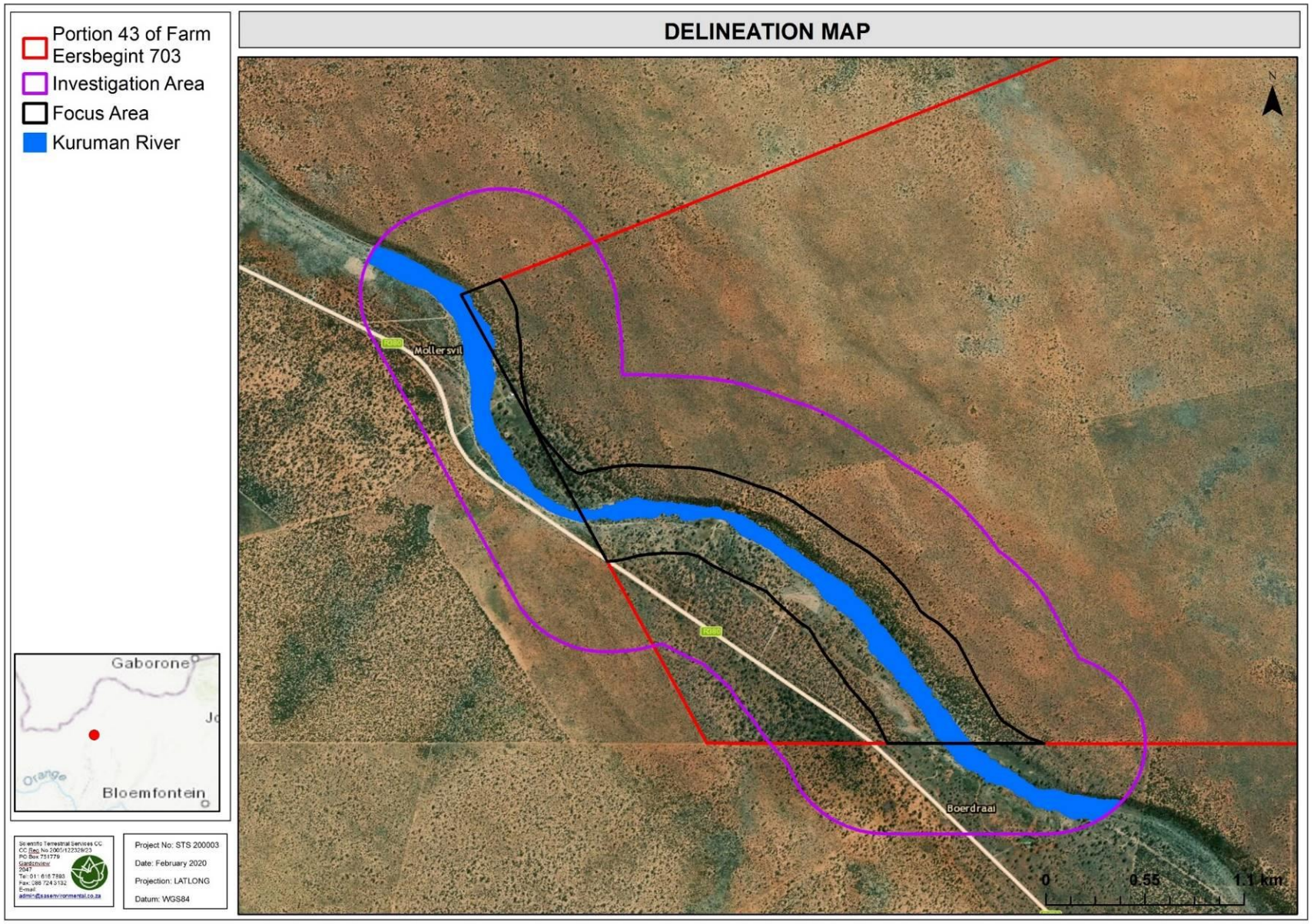


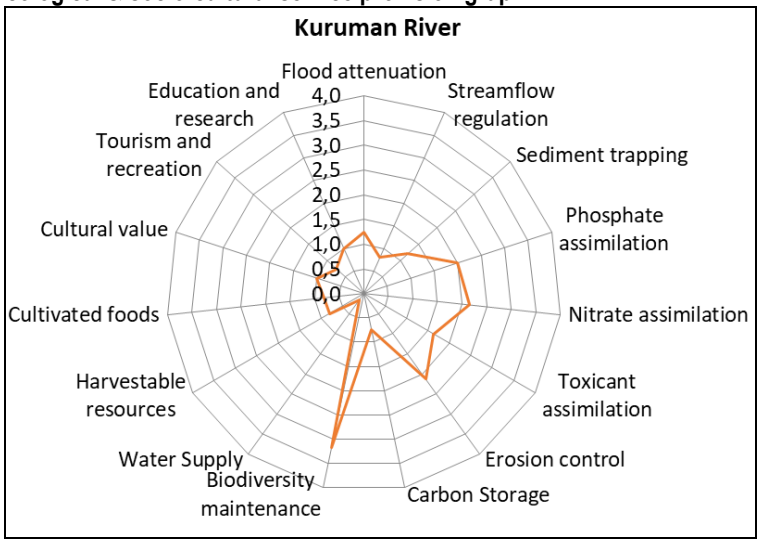
Figure 13: The Kuruman River (including associated riparian zone and characteristic terraces) associated with the focus and investigation areas.

4.3 Field Verification Results

The tables below summarise the findings of the field verification in terms of relevant aspects (hydrology, geomorphology and vegetation components) of freshwater ecology. The details pertaining to the method of assessment used to assess the watercourse are contained in Appendix C of this report. It should be noted that although water quality parameters are included in the method of assessment used, due to the episodic nature of the watercourse, testing of these parameters could not be undertaken. Given the surrounding landuses (predominantly agriculture though some mining occurs in the catchment) it is likely that when surface water is present, it is not likely to be impacted significantly by pollutants. Therefore, whilst the tables below include a discussion on water quality, information contained therein was based on information contained within available databases, as well as the anticipated impacts of the surrounding land uses within the catchment on water quality. The results of the assessments are presented in the table below.

Table 4: Summary of results of the assessment of the reach of the Kuruman River within the focus area.

Ecological & socio-cultural service provision graph:



PES discussion

PES Category: B/C
Riparian IHI: B / VEGRAI: C

As previously noted, literature pertaining to the ecological characteristics of the Kuruman River is limited. Thus, ascertaining reference conditions is difficult, and as noted by Economou (2002), the definition of biological reference conditions is ambiguous in ecological terms and is "usually perceived as the "pristine" state of the environment prior to, or in the absence of, major human disturbances". Based on available information however, it is likely that the river has remained relatively unimpacted for several decades with the exception of loss of catchment yield and recharge, particularly from the Ga-mogara River, which has been significantly impacted by mining activities, and changes to floral assemblages. Anthropogenic influences which may have bearing on the PES of the system include various farm road crossings which may over time erode, causing hydraulic dysconnectivity between sections of the system, as well as impacts on the riparian vegetation. As discussed previously, it was

Fatal Flaw?	**Potentially very high impacts.**	**Photograph notes**	Left: illustration of a section of the reach of the river in the northern portion of the focus area, depicting vegetation loss. The blue arrow indicates the direction of flow (south east to north west). Right: Representative photograph of the reach of the river in the southern portion of the focus area, showing more intact riparian vegetation than that observed in the northern part of the focus area.

Watercourse characteristics:

a) Hydraulic regime

The Kuruman River is an episodic drainage system, relying on precipitation. Located in one of the most arid regions of South Africa receiving an average annual rainfall of under 400m, it is rare that sufficient precipitation falls to induce flows in the reaches of the river downstream of the dolomitic springs which feed it. However, it is also important to note that the Ga-Mogara River, a tributary of the Kuruman River, has been impacted by the formation of river-bed swallets (i.e. sinkholes) as a result of dewatering activities by Sishen Mine[4]. These swallets intercept all surface flow in the upper reach of the Ga-Mogara River, preventing recharge of the downstream system – i.e. the Kuruman River. This, in addition to the likely abstraction of water from the Kuruman Eye, be responsible for the highly episodic character of the Kuruman River.

Although some road crossings were observed, these were minor and did not include bridges, therefore even during times of flow are not

[4] http://www.overendstudio.co.za/online_reports/kumba_ar2011/sustainability/sus_environmental.php retrieved 14 February 2020.

	apparent that bush encroachment has occurred within some sections of the riparian zone, whilst vegetation loss has occurred in others. The dominant encroacher species noted were *V. karoo* (indigenous) and *P. glandulosa* (alien). Whilst some management of these species has been undertaken, it does not appear to be extensive. With the exception of the aforementioned road crossings, none of which are considered serious impacts, and some areas of erosion, no obvious alterations to the hydraulic regime were discerned.	considered likely to affect hydraulic processes (e.g. by causing turbulent flows, which might typically be expected in a perennial drainage system). Furthermore, because the system is episodic, no abstraction is possible, as local residents are solely reliant on groundwater.
Ecoservice provision	**Intermediate** Although the assessed reach of the Kuruman River is considered important primarily for biodiversity maintenance, ecological and socio-cultural service provision is generally low due to the episodic nature of the system. Minimal opportunity exists for the system to provide services such as flood attenuation, assimilation of excess nutrients or toxicants, or sediment trapping since stormflows are so rarely spread through the watercourse, although aspects such as good vegetation cover throughout the assessed reach increase the potential for these ecological processes to occur in the event of surface flow. Similarly, due to the episodic character of the river, local communities are unable to rely on the river for water, and generally crop cultivation does not take place due to the arid conditions of the region.	**b) Water quality** Water quality sampling could not be undertaken at the time of the assessment. Although runoff from the local catchment may potentially contain increased levels of nutrients due to the surrounding agricultural activities (specifically livestock husbandry), it is not likely to contain other pollutants. Additionally, due to the porous nature of the surrounding soils, the volume of stormwater runoff reaching the river is likely to be minimal. **c) Geomorphology and sediment balance** Minimal anthropogenic impacts on geomorphological processes were observed during the site assessment. As noted previously the extent and type of the road crossings are not considered a significant impact, and although some trampling is anticipated from increased livestock activity in the area, the calcrete soils associated with the river and its riparian zone are not as susceptible to such impacts as 'softer' soils. Erosion was observed in some sections of the system as depicted in Section 4.2, however, it was not extensive, and was most likely the result of natural processes.
EIS discussion	**EIS Category: Low (DWAF, 1999) /moderate (Rountree & Kotze, 2013)** Two EIS indices were applied: the aquatic index (DWAF, 1999) to assess the instream EIS, and the method advocated by Rountree and Kotze (2013) to assess the EIS of the river in terms of riparian habitat, ecological services and socio-cultural benefits. The instream EIS is low due to the episodic nature of the river which prevents the occurrence of unique or intolerant aquatic biota. However, on a landscape scale and from a biodiversity maintenance perspective, the Kuruman River is deemed to be of moderate EIS.	**a) Habitat and biota** Although very little faunal activity was directly observed (largely due to the high ambient temperatures during the assessment as well as the crepuscular nature of many species), numerous indirect observations of such activity in the form of scat, feathers, quills, burrows and spoor were made. It was apparent that the riparian areas provide valuable refugia, breeding and foraging habitat and connectivity between the neighbouring properties (farm fences crossing the river had clearly been breached by burrowing fauna in several locations). Insectivorous and avifaunal activity within the river and adjacent riparian zone was directly observed at the time of the assessment. Given the arid conditions and the sparse distribution of vegetation in surrounding areas, particularly trees and shrubs which provide roosting habitat as well as shelter from both predators and extreme temperatures, the denser vegetation in the river and associated riparian zone provides essential faunal habitat. The expected loss of recharge to the downstream portions of the Kuruman River (as discussed above), in combination with the naturally arid conditions of the region, may have caused moisture stress, potentially altering the species composition and community structure, and zonation, of the riparian zone.
REC, RMO and BAS Categories	**REC Category: B** **RMO Category: Maintain** **BAS Category: B** As noted in the PES discussion, few modifiers of the system were discerned at the time of the site assessment, with the exception of removal of vegetation and encroachment of both indigenous and alien pioneer species. Under present circumstances, maintenance of the PES and EIS is deemed feasible. However, the proposed prospecting activities carry the potential to greatly alter the PES and EIS of the Kuruman River, especially if prospecting occurs directly within the river.	**Business case, Impact Significance, Conclusion and Mitigation Requirements:** The proposed prospecting activities may potentially result in high to very high impacts on the Kuruman River, depending on the location of the prospecting boreholes. If prospecting occurs directly within the watercourse, potential impacts include loss of instream and riparian habitat, changes to riparian vegetation community composition and structure, and further reduced ecological service provision. Although the Kuruman River has not flowed in a little over thirty years, the possibility of an unexpected flash flood (particularly in the context of changing climatic patterns) cannot be ruled out. Should such an event occur during exploration activities, the impacts of the exploratory drilling on the riverine habitat could potentially be high. Although the results of the impact assessment (refer to section 5) indicate that prior to mitigation, impact significance is likely to be of low to very low levels, this is attributed to the duration and extent of impacts, since the impact intensity is expected to be high/very high. It is strongly recommended the during the planning phase, all exploratory activities are planned to remain outside of the delineated Kuruman River and associated riparian zone, and preferably out of the 1:100 year floodline.

4.4 Sensitivity Mapping

4.3.2 Legislative requirements and national guidelines pertaining to the application of buffer zones

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered to be "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered to be important to provide protection of basic ecosystem processes (in this case, the protection of wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted however that buffer zones are not considered effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015). Therefore, it is highly recommended that a specialist hydrologist be appointed (if a study has not already been undertaken) to determine the risk of contamination of groundwater which could in turn manifest as surface water impacts. Mitigation measures contained in such an assessment must then be implemented.

Legislative requirements were taken into consideration when determining a suitable buffer zone for the watercourse. The definition and motivation for a regulated zone of activity as well as buffer zone for the protection of the watercourse can be summarised as follows:

Table 5: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998).	**General Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998)** In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21c and 21i is defined as: • the outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • in the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • a 500m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation, as well as General Notice no. 509 of 2016 as it relates to the NWA.
	Government Notice 704 Regulations as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act 36

Regulatory authorisation required	Zone of applicability
	of 1998) regarding the use of water for mining and related activities aimed at the protection of water resources. These Regulations were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the proposed project complies with Regulation GN 704 of the National Water Act, 1998 (Act no. 36 of 1998) which contains regulations on use of water for mining and related activities aimed at the protection of water resources. GN 704 states that: *No person in control of a mine or activity may:* *(a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year floodline or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become waterlogged, undermined, unstable or cracked;* According to the above, the activity footprint must fall outside of the 1:100 year floodline of the aquatic resource or 100m from the edge of the resource, whichever distance is the greatest.
Listed activities in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) EIA Regulations (2014).	**Activity 12** of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act 107 of 1998) EIA regulations, 2014 (as amended) states that: *The development of:* *(xii) Infrastructure or structures with a physical footprint of 100 square meters or more;* *Where such development occurs—* *a) Within a watercourse;* *b) In front of a development setback; or* *c) If no development setback has been adopted, within **32 meters of a watercourse**, measured from the edge of a watercourse.*

The Kuruman River and the applicable zones of regulation as summarised above are conceptually depicted in the figure below.

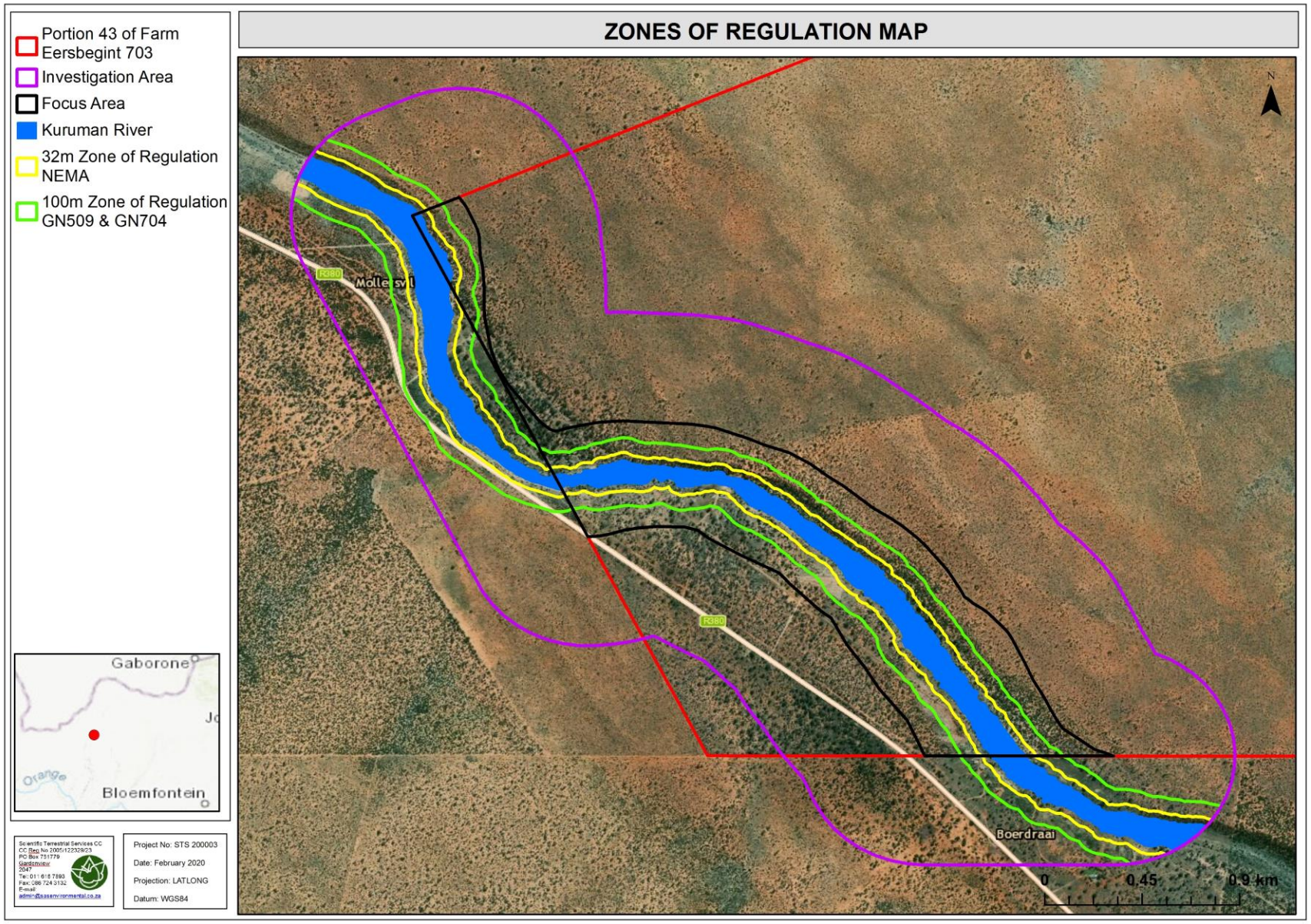


Figure 14: Conceptual presentation of the watercourse within the focus and investigation areas and the applicable zones of regulation in terms of NEMA and GN509 and GN704 of the NWA.

5 IMPACT ASSESSMENT

This section presents the significance of potential impacts on the ecology of the reach of the Kuruman River associated with the proposed prospecting activities. In addition, it also indicates the required mitigatory measures needed to minimise the perceived impacts of the proposed activities and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures and assuming that they are fully implemented.

5.1 Impact Analyses

5.1.1 Mitigation hierarchy and considerations given to application of mitigation measures

Following the assessment of the reach of the Kuruman River, a pre-determined impact assessment method was applied. The method was applied twice: once assuming that no mitigation takes place, and the second time, assuming that the recommended mitigation measures are applied.

As noted in Section 1.4 of this report, it was assumed that some, if not all, the proposed drill sites will be located directly within the Kuruman River and associated riparian zone, and therefore a “worst case scenario” was assumed when applying the impact assessment, in line with the precautionary principle. Key to minimising the perceived impact significance of possible impacts on the watercourse will be ensuring that no exploration activities occur directly within the watercourse, its delineated riparian zone, and the associated 1:100 year floodline. When applying the impact assessment in a ‘post-mitigation’ scenario, it was assumed that no exploration would occur within these pre-defined areas.

The impact assessment was based on the typical layout and size of an exploration drill site as presented in Figure 3 in Section 1.2, i.e. a footprint area of 100m^2 per site, within which temporary infrastructure such as the drill rig, ablution facilities, sump, water containment area and storage facilities will be contained.

The points below summarise the considerations undertaken:

- The impact assessment was applied assuming that a high level of mitigation is implemented (i.e. that the exploration activities would not be undertaken directly within the Kuruman River), thus the post-mitigation results of the impact assessment

provided in this report present the perceived impact significance based on the location of exploration activities outside of the watercourse and associated riparian zone and floodline;

- At the time that this study was undertaken, the proposed drill plan and locations of drill pads was unknown. Thus a “worst case scenario” was assumed in line with the precautionary principle;
- In applying the impact assessment, it was assumed that the mitigation hierarchy as advocated by the DEA *et al* (2013) would be followed, i.e. the impacts would first be avoided (e.g. not undertaking exploration activities directly within the watercourse), minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- At the time that this study was conducted a surface water study for the proposed exploration project had not been undertaken. Therefore, whilst potential risks such as surface runoff from the drill sites and loss of catchment yield were considered in the risk assessment, a true reflection of the significance thereof could not be determined since the aforementioned data had not been generated. The recommendations of the hydrologist must therefore be implemented to avoid potential impacts on surface water; and
- The perceived impacts of the various activities on the watercourse ecology took into consideration the chronological order in which the activities will occur. Thus, for example, the impact intensity pertaining to habitat loss during the ‘construction phase’ (i.e. establishment of the drill pads) is considered “very high” (without mitigation) but is deemed “medium” in terms of the operation phase, as the habitat will have already been affected during construction. Similarly, the impact intensity during prospecting is likely to be sustained, hence impact intensity was rated ‘high’ to ‘very high’ for certain activities, although the overall impact significance is lowered due to the anticipated probability, duration and limited footprint of the proposed activities.

Watercourse impact discussion

Four aspects of freshwater ecology are considered when assessing the impacts of the proposed mining related activities: loss of habitat and ecological structure, changes to ecological and sociocultural service provision, hydrological function and sediment balance, and water quality impacts.

Although the Kuruman River is a highly episodic system, flowing once every few decades, changing climatic conditions and rainfall patterns may result in changes to the hydraulic

regime of the system. Furthermore, the risk of occurrence of a flash flood during the proposed exploration activities cannot be ruled out. Thus, potential impacts on hydrological function, sediment balance and water quality were rated as 'high' (pre-mitigation), whilst the probability was rated as 'low'. Exploration activities directly within a river, including a river such as the Kuruman with its episodic nature, have the potential to result in 'medium' to 'high' impacts to the watercourse habitat, ecological structure and related ecological service provision, particularly given the susceptibility of the riparian zone to bush encroachment and proliferation of alien vegetation under current circumstances, which would be exacerbated with disturbances. The assessed reach of the Kuruman River is deemed of increased ecological integrity, and although capacity to provide specific ecological and socio-cultural services is restricted by the episodic nature of the system, it nevertheless forms part of the continuum of ecological processes within the focus area, immediate surrounds, and downstream areas.

A summary of the impact assessment is provided in the table below.

Table 6: Summary of the impact assessment conducted for the proposed exploration activities.

Project Phase	Activity	Aspect	Unmanaged						Managed					
			Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
Pre-construction / Planning Phase	Proposed exploration drilling within the active channel of the Kuruman River, leading to disturbances to the bed, banks and instream habitat including loss of instream habitat and loss of marginal and non-marginal vegetation.	**Potential loss of watercourse habitat and ecological structure**	VH	VL	VL	L	VH	Low	L	VL	VL	L	M	Very low
		Potential changes to ecological and sociocultural service provision	H	VL	VL	L	H	Low	L	VL	VL	L	M	Very low
		Potential hydrological function and sediment balance	H	VL	L	M	VL	Very low	VL	VL	VL	VL	L	Insignificant
		Potential impacts on water quality	H	VL	L	M	VL	Very low	VL	VL	VL	VL	L	Insignificant
Construction and Operations Phase	Clearing of vegetation and site preparation, including: • Associated disturbances to soils; • Altered drainage patterns due to reduced vegetation cover and increased impermeable surfaces; • Risk of contaminated storm water runoff (e.g. hydrocarbons, sediment, originating from impermeable	**Loss of watercourse habitat and ecological structure**	VH	VL	VL	L	VH	Low	L	VL	VL	L	M	Very low
		Changes to ecological and sociocultural service provision	H	VL	VL	L	H	Low	L	VL	VL	L	M	Very low
		Hydrological function and sediment balance	H	VL	L	M	VL	Very low	VL	VL	VL	VL	L	Insignificant

Project Phase	Activity	Aspect	Unmanaged							Managed						
			Intensity	Duration	Extent	Consequence	Probability	Significance		Intensity	Duration	Extent	Consequence	Probability	Significance
	surfaces) entering the river; • Stockpiling of topsoils, earthworks, movement of vehicles within the delineated river and associated riparian zone; and • Potential disposal of hazardous and non-hazardous materials in freshwater resource areas. **Operation of drill rigs, potentially leading to:** • Increased risk of pollution of surface water resulting from spills (hydrocarbons) from drill rigs, in turn leading to impaired water quality and soil contamination; and • Increased risk of sediment transport due to movement of drill rigs and activities within freshwater resources, leading to altered water quality and sedimentation of freshwater system, potentially causing altered channel competency, altered vegetation community composition and erosion.	**Impacts on water quality**	H	VL	L	M	VL	Very low		VL	VL	VL	VL	L	Insignificant

Based on the findings of the freshwater ecological assessment, several recommendations are made to further minimise potential impacts on the freshwater ecology of the area, should the proposed exploration activities proceed, are provided below:

- as far as possible, prospecting activities should be avoided within the active channel and riparian zone of the Kuruman River or within 32m thereof (i.e. the Zone of Regulation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998)). It is recommended that the drill plan be planned to exclude these areas if possible. If not, the necessary approvals will be obtained;
- If exploration within the watercourse cannot be avoided, then it is essential that each drill pad footprint is minimised and does not extend beyond 100m^2 per site and that vegetation clearing is limited to essential areas only. Access to any portions of the watercourse within which activities are not taking place are to be strictly 'off-limits' to all personnel and vehicles;
- No access roads should be planned parallel to the watercourse unless essential. All access roads must be planned to access each drill site at 90 degree angles to minimise edge effects on the system. Keep vehicle movements close to the natural contours of the landscape as much as possible;
- A spill prevention and emergency spill response plan should be compiled to guide the proposed exploration activities, and an emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur;
- It is essential that a soil management programme is implemented and maintained to minimise erosion and sedimentation;
- Monitor areas in the vicinity of soil stockpiles and proactively manage any areas of erosion which may form as a result of the formation of preferential flow paths.
- Active re-vegetation of disturbed areas immediately after prospecting is essential;
- Implement and maintain alien vegetation management programme;
- In the event of rainfall during prospecting (which is considered unlikely due to the arid nature of the region but cannot be entirely discounted), prospecting sites should be monitored for concentration of runoff and formation of preferential surface flow paths, and if necessary such areas must be appropriately rehabilitated as provided for in the Environmental Management Programme;
- Appropriate waste management at each site is essential. No waste material is to be disposed of within the watercourse or surrounds, and all waste is to be removed from site and disposed of at a licenced disposal facility;
- Ensure that soils are replaced in the correct layers, ripped and re-reprofiled post-closure, and that vegetation is restored to a point where succession will lead to the same conditions as the pre-mining state as a minimum; and

- Rehabilitation measures must be developed and implemented at each site. The success of the rehabilitation will be determined as part of Environmental Management Programme performance reviews.

6 CONCLUSION

The results of the ecological assessment indicate that the assessed reach of the Kuruman River is in a largely natural ecological state (PES category B/C) although the riparian zone has been impacted in places by loss of, or transformation of the vegetation assemblage. Erosion was also observed in portions of the active channel, and this was attributed to the flood event in 1988, which is the last documented year that the river flowed. Although the Kuruman River is an episodic system and is therefore not necessarily a valuable resource from an anthropocentric perspective, it forms a crucial component of the overall ecology of the area, being a key contributor to biodiversity maintenance as well as providing valuable breeding and foraging habitat and connectivity to surrounding natural areas.

As noted in Section 5, although surface flow in the system was last documented over thirty years ago, the risk of flash flooding in the system cannot be ruled out altogether, particularly in the context of changing climatic patterns (including rainfall patterns). Thus, whilst the likelihood of impacts on aspects such as hydrological patterns and water quality arising from the proposed exploration activities may be low, the impact significance may potentially be 'high' in the event that such a flood event occurs during exploration. The impact significance presented in this report is lowered due to the anticipated probability, duration and limited footprint of the proposed activities, although in the event of flooding, the impacts may extend beyond the project footprint and have a residual effect.

The risk of an extreme flood event aside, exploration activities within the Kuruman River and associated riparian zone will nevertheless lead to loss of, or changes to, the watercourse habitat, ecological structure, and the associated ability of the system to provide various ecological and socio-cultural benefits.

Based on the findings of this study, it is the opinion of the ecologists that the project is regarded as having potentially medium to high impact significance *without* mitigation, although the results of the impact assessment indicate that the pre-mitigation impact significance is of low to very low levels. This is attributed entirely to the limited duration and extent of the proposed activities. With suitable management and strict implementation of mitigation measures, impact significance can be further reduced. It is imperative, however,

that mitigation measures are implemented throughout the life of the project in order to ensure that not only are direct impacts prevented/minimised, but that cumulative impacts on the larger drainage network are also prevented. Provided that the mitigation measures supplied in this report are implemented in conjunction with those stipulated by other specialists, specifically the geohydrological specialist, impact significance may be reduced. Taking the above into account, it is therefore the opinion of the specialist that from a freshwater ecological perspective, the proposed exploratory drilling, be carefully considered, and that preferably, refinement of the of the proposed exploration drilling schedule (to exclude the Kuruman River), takes place before the project be authorised.

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APPENDIX A – Indemnity and Terms of Use

INDEMNITY AND TERMS OF USE OF THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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APPENDIX B - Legislation

LEGISLATIVE REQUIREMENTS

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act (Act No. 107 of 1998) (NEMA)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
National Environmental Management: Biodiversity Act (2004) (Act 10 of 2004) (NEMBA)	**Ecosystems that are threatened or in need of protection** (1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection. *(b)* An MEC for environmental affairs in a province may, by notice in *the Gazette,* publish a provincial list of ecosystems in the province that are threatened and in need of protection. (2) The following categories of ecosystems may be listed in terms of subsection (1): *(a)* critically endangered ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation; *(b)* endangered ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems; (c) vulnerable ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and *(d)* protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs *(a), (b)* or (c).
The National Water Act 1998 (Act No. 36 of 1998) (NWA)	The National Water Act (NWA) (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998)	In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: a) The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; b) In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or c) A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines

	through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and stormwater management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.
Government Notice 704 Regulations as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)	These Regulations were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the proposed project complies with Regulation GN 704 of the NWA which contains regulations on the use of water for mining and related activities aimed at the protection of water resources. GN 704 states that: *No person in control of a mine or activity may:* *(b) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year floodline or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become waterlogged, undermined, unstable or cracked;* According to the above, the activity footprint must fall outside of the 1:100 year floodline of the aquatic resource or 100m from the edge of the resource, whichever distance is the greatest.
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA)	The obtaining of a New Order Mining Right (NOMR) is governed by the MPRDA. The MPRDA requires the applicant to apply to the DMR for a NOMR which triggers a process of compliance with the various applicable sections of the MPRDA. The NOMR process requires environmental authorisation in terms of the MPRDA Regulations and specifically requires the preparation of a Scoping Report, an EIA, an Environmental Management Programme (EMP), and a Public Participation Process (PPP).

APPENDIX C – Method of Assessment

WATERCOURSE ASSESSMENT APPROACH

1. Literature Review

A desktop study was compiled with all relevant information as presented by the South African National Biodiversity Institutes (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org). Wetland specific information resources taken into consideration during the desktop assessment of the subject property included:

- National Freshwater Ecosystem Priority Areas (NFEPAs, 2011)
  - NFEPA water management area (WMA)
  - FEPA (sub)WMA % area
  - Sub water catchment area FEPAs
  - Water management area FEPAs
  - Fish sanctuaries
  - Wetland ecosystem types
- Limpopo Conservation Plan V2, 2013
- Mining and Biodiversity Guidelines, 2013.

1.1 National Freshwater Ecosystem Priority Areas (NFEPA; 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), Department of Water Affairs (DWA), South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland resources present within the subject property.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa (2013)

All wetland or riparian resources encountered within the focus area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the "Classification System" (Ollis *et. al*., 2013). A summary on Levels 1 to 4 of the classification system are presented in the tables below.

Table C1: Classification System for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems
From the classification system, Inland Systems are defined as **aquatic ecosystems that have no existing connection to the ocean**[5] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically.** It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups
For Inland Systems, the regional spatial framework that has been included in Level 2 of the classification system is that of the DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et. al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.
The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups' vegetation types across the country, according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting
At Level 3 of the classification system for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et. al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units
Seven primary HGM Types are recognised for Inland Systems at Level 4A of the classification system (Table C2), on the basis of hydrology and geomorphology (Ollis *et. al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates;
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and

[5] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for "channel", "flat" and "valleyhead seep") is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et. al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et. al*., 2009).

3. Wet-Ecoservices (2009)

"The importance of a water resource, in ecological, social or economic terms, acts as a modifying or motivating determinant in the selection of the management class" (DWA, 1999). The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland.

Table C3: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

4. Index of Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans et al. 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in Table C3 below.

5. Table C4: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans et al. 2008]

Class	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60 - 79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40 – 59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 – 39
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0 - 19

5. Aquatic Ecological Importance and Sensitivity (EIS) Method of assessment (DWAF, 1999)

The EIS method considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale (Table C10). The median of the resultant score is calculated to derive the EIS category (Table C11).

Table C5: Definition of the four-point scale used to assess biotic and habitat determinants presumed to indicate either importance or sensitivity

Four point scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale (i.e. SA Red Data Books)

Table C6: Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General Description	Range of median
Very high	Quaternaries/delineations that are considered to be unique on a national and international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3

Moderate	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/ marginal	Quaternaries/delineations that are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

6. Ecological Importance and Sensitivity (EIS) (Rountree and Kotze, 2013)

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 (Rountree & Kotze, 2013).

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C5) of the wetland system being assessed.

Table C5: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

7. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure" (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the freshwater resource (sections above), with the objective of either maintaining, or improving the ecological integrity of the freshwater resource in order to ensure continued ecological functionality.

Table C6: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
PES	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unacceptable (Malan and Day, 2012) and therefore, should a freshwater resource fall into one of these PES categories, a REC class D is allocated by default, as the minimum acceptable PES category.**

A freshwater resource may receive the same class for the REC as the PES if the freshwater resource is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the freshwater resource.

Table C7: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

8. Watercourse Delineation

The freshwater resource delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" published by DWAF in 2008. The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

According to the DWA (2005) like wetlands, riparian areas have their own unique set of indicators. It is possible to delineate riparian areas by checking for the presence of these indicators. Some areas may display both wetland and riparian indicators, and can accordingly be classified as both. If you are adjacent to a watercourse, it is important to check for the presence of the riparian indicators described below, in addition to checking for wetland indicators, to detect riparian areas that do not qualify as wetlands. The delineation process requires that the following be taken into account:

- topography associated with the watercourse;
- vegetation; and
- alluvial soils and deposited material.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWA, 2005).

APPENDIX D – Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the ITY of environmental s	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE							
			EXTENT				
			A part of the site/property	Whole site	Beyond the site, affecting neighbours	Local area, extending far beyond site.	Regional/ National
			VL	L	M	H	VH
INTENSITY = VL							
DURATION	Very long	VH	Low	Low	Medium	Medium	High
	Long term	H	Low	Low	Low	Medium	Medium
	Medium term	M	Very Low	Low	Low	Low	Medium
	Short term	L	Very low	Very Low	Low	Low	Low
	Very short	VL	Very low	Very Low	Very Low	Low	Low
INTENSITY = L							
DURATION	Very long	VH	Medium	Medium	Medium	High	High
	Long term	H	Low	Medium	Medium	Medium	High
	Medium term	M	Low	Low	Medium	Medium	Medium
	Short term	L	Low	Low	Low	Medium	Medium
	Very short	VL	Very low	Low	Low	Low	Medium
INTENSITY = M							
DURATION	Very long	VH	Medium	High	High	High	Very High
	Long term	H	Medium	Medium	Medium	High	High
	Medium term	M	Medium	Medium	Medium	High	High
	Short term	L	Low	Medium	Medium	Medium	High
	Very short	VL	Low	Low	Low	Medium	Medium
INTENSITY = H							
DURATION	Very long	VH	High	High	High	Very High	Very High
	Long term	H	Medium	High	High	High	Very High
	Medium term	M	Medium	Medium	High	High	High
	Short term	L	Medium	Medium	Medium	High	High
	Very short	VL	Low	Medium	Medium	Medium	High
INTENSITY = VH							
DURATION	Very long	VH	High	High	Very High	Very High	Very High
	Long term	H	High	High	High	Very High	Very High
	Medium term	M	Medium	High	High	High	Very High
	Short term	L	Medium	Medium	High	High	High
	Very short	VL	Low	Medium	Medium	High	High

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	VH	Very Low	Low	Medium	High	Very High
	Probable	H	Very Low	Low	Medium	High	Very High
	Possible/ frequent	M	Very Low	Very Low	Low	Medium	High
	Conceivable	L	Insignificant	Very Low	Low	Medium	High
	Unlikely/ improbable	VL	Insignificant	Insignificant	Very Low	Low	Medium
			VL	L	M	H	VH
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely to be required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

APPENDIX E – Results of the Field Investigation

PRESENT ECOLOGICAL STATE (PES), ECOSERVICES AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table E1: Presentation of the results of the Index of Habitat Integrity (IHI) applied to the assessed reach of the Kuruman River.

RIPARIAN IHI	
Base Flows	0,0
Zero Flows	0,0
Moderate Floods	0,0
Large Floods	0,0
HYDROLOGY RATING	**0,0**
Substrate Exposure (marginal)	1,0
Substrate Exposure (non-marginal)	1,0
Invasive Alien Vegetation (marginal)	1,0
Invasive Alien Vegetation (non-marginal)	1,0
Erosion (marginal)	1,0
Erosion (non-marginal)	1,0
Physico-Chemical (marginal)	0,0
Physico-Chemical (non-marginal)	0,0
Marginal	1,0
Non-marginal	1,0
BANK STRUCTURE RATING	**1,0**
Longitudinal Connectivity	1,0
Lateral Connectivity	1,0
CONNECTIVITY RATING	**1,0**
RIPARIAN IHI %	**86,7**
RIPARIAN IHI EC	**B**
RIPARIAN CONFIDENCE	**2,3**

Table E2: Presentation of the results of the VEGRAI assessment applied to the assessed reach of the Kuruman River within the focus area.

LEVEL 3 ASSESSMENT					
METRIC GROUP	**CALCULATED RATING**	**WEIGHTED RATING**	**CONFIDENCE**	**RANK**	**% WEIGHT**
MARGINAL	72,6	45,4	2,5	1,0	100,0
NON MARGINAL	80,0	30,0	0,0	2,0	60,0
	2,0				160,0
LEVEL 3 VEGRAI (%)				75,4	
VEGRAI EC				**C**	
AVERAGE CONFIDENCE				1,3	

Table E3: Presentation of the results of the Ecoservices assessments applied to the assessed portion of the Kuruman River in the focus area.

Ecosystem service	Kuruman River
Flood attenuation	1,3
Streamflow regulation	0,8
Sediment trapping	1,2
Phosphate assimilation	2,0
Nitrate assimilation	2,1
Toxicant assimilation	1,6
Erosion control	2,1
Carbon Storage	0,8
Biodiversity maintenance	3,2
Water Supply	0,2
Harvestable resources	0,8
Cultivated foods	0,8
Cultural value	1,0
Tourism and recreation	0,8
Education and research	1,0
SUM	**19,6**
Average score	**1,3**
	Intermediate

Table E4: Presentation of the results of the EIS assessment (DWAF 1999) applied to the assessed reach of the Kuruman River within the focus area.

Category	Score
Biotic Determinants	
Rare and endangered biota	0
Unique biota	0
Intolerant biota	0
Species/taxon richness	1
Aquatic Habitat Determinants	
Diversity of aquatic habitat types or features	1
Refuge value of habitat type	0
Sensitivity of habitat to flow changes	3
Sensitivity of flow-related water quality changes	3
Migration route/corridor for instream and riparian biota	2
Nature Reserves, Natural Heritage sites, Natural areas, PNEs	0
RATINGS	**1**
EIS CATEGORY	**Low/marginal**

Table E5: Presentation of the results of the EIS assessment (Rountree & Kotze, 2013) applied to the assessed reach of the Kuruman River within the focus area.

Ecological Importance and Sensitivity	Score (0-4)	*Confidence (1-5)*
Biodiversity support	A (average)	(average)
	0,67	3,33
Presence of Red Data species	0	3
Populations of unique species	0	3
Migration/breeding/feeding sites	2	4
Landscape scale	B (average)	(average)
	2,00	3,60
Protection status of the wetland	3	4
Protection status of the vegetation type	2	3
Regional context of the ecological integrity	2	3
Size and rarity of the wetland type/s present	2	4
Diversity of habitat types	1	4
Sensitivity of the wetland	C (average)	(average)
	2,00	4,00
Sensitivity to changes in floods	3	4
Sensitivity to changes in low flows/dry season	0	4
Sensitivity to changes in water quality	3	4
ECOLOGICAL IMPORTANCE & SENSITIVITY	**(max of A,B or C)**	*(average of A, B or C)*
Fill in highest score:	**B**	**2,00**

Moderate: Wetlands 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 and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.

Hydro-Functional Importance			Score (0-4)	*Confidence (1-5)*
Regulating & supporting benefits	**Flood attenuation**		1	4
	Streamflow regulation		1	4
	Water Quality Enhancement	***Sediment trapping***	1	4
		Phosphate assimilation	2	4
		Nitrate assimilation	2	4
		Toxicant assimilation	2	4
		Erosion control	2	4
	Carbon storage		1	4
HYDRO-FUNCTIONAL IMPORTANCE			2	4
Direct Human Benefits			Score (0-4)	Confidence (1-5)
Subsistence benefits	***Water for human use***		0	4
	Harvestable resources		0	4
	Cultivated foods		0	4
Cultural benefits	***Cultural heritage***		1	4
	Tourism and recreation		1	4
	Education and research		1	4
DIRECT HUMAN BENEFITS			0,50	4

APPENDIX F – Impact Analysis and Mitigation

IMPACT ANALYSIS AND MITIGATION MEASURES

1. General management and good housekeeping practices

The following essential mitigation measures are considered to be standard best practice measures applicable to development of this nature and must be implemented during all phases of the proposed prospecting activities, in conjunction with those stipulated in Section 5 of this report which define the mitigatory measures specific to the minimisation of impacts on the Kuruman River.

Development and operational footprint

- Sensitivity maps have been developed for the focus area, indicating the watercourses, and their relevant regulatory zones in accordance with NEMA, Regulation GN509 and Regulation GN704, as shown in Figure 11 (Section 4.3.2). It is recommended that these sensitivity maps be considered during all phases of the development and with special mention of the planning of any future infrastructure layout, to aid in the conservation of the watercourse habitat within the focus area;
- All prospecting footprint areas should remain as small as possible and should not encroach onto surrounding, more sensitive areas. Prospecting must only take place in the demarcated areas. If prospecting is to occur within the watercourse, strict regulation of activities therein must take place, and non-prospecting areas are to be considered off-limits to personnel and vehicles;
- The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- Planning of temporary roads and access routes should take the site sensitivity plan into consideration, and wherever possible, existing roads should be utilised. If additional roads are required, then wherever feasible such roads should be constructed a distance from the watercourse areas and not directly adjacent thereto. If crossings are required they should cross the system at right angles, as far as possible to minimise impacts in the receiving environment, and any areas where bank failure is observed due to the effects of such crossings should be immediately repaired by reducing the gradient of the banks to a 1:3 slope and where needed necessary, installing support structures. This should only be necessary if existing access roads are not utilised;
- All areas of increased ecological sensitivity should be marked as such and be off limits to all unauthorised construction and maintenance vehicles and personnel;
- Appropriate sanitary facilities must be provided for the life of the proposed project and all waste removed to an appropriate waste facility;
- All hazardous chemicals should be stored on bunded surfaces and no storage of such chemicals should be permitted within the freshwater buffer zones;
- No informal fires should be permitted in or near the construction areas;
- Ensuring that an adequate number of rubbish and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills; and
- Edge effects of activities, particularly erosion and alien/weed control need to be strictly managed.

Vehicle access

- All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil; and
- All spills, should they occur, should be immediately cleaned up and treated accordingly.

Alien plant species

- Proliferation of alien and invasive species is expected within any disturbed areas. These species should be eradicated and controlled to prevent their spread beyond the project

footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;

- Removal of the alien and weed species encountered on the property must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Removal of species should take place throughout the construction, operational, closure/decommissioning and rehabilitation/ maintenance phases; and
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - Footprint areas should be kept as small as possible when removing alien plant species*;*
  - No vehicles should be allowed to drive through designated sensitive watercourse areas during the eradication of alien and weed species.

Freshwater habitat

- Ensure that as far as possible all infrastructure is placed outside of watercourse areas and applicable regulatory zones. A minimum buffer of 100m around all watercourse/freshwater systems should be maintained in line with the requirements of regulation GN704 of the NWA for all non-resource dependent infrastructure. If these measures cannot be adhered to, strict mitigation measures will be required to minimize the impact on the receiving watercourses. Such measures include those stipulated in Section 5 of this report, in addition to the following:
  - Ensuring that measures are implemented to prevent dirty runoff water entering the watercourse habitat; and
  - Ensuring that where necessary, exposed soils in the vicinity of watercourse habitat are protected from erosion by means of reinstating natural vegetation following construction,
- Permit only essential personnel within 100m of the watercourse habitat, if absolutely necessary that they enter the regulatory zone;
- Limit the footprint area of the construction activities to what is absolutely essential in order to minimise environmental damage;
- During prospecting, no vehicles should be allowed to indiscriminately drive through the freshwater areas;
- All waste materials generated during any phase of the proposed activities must be prevented from entering the watercourses; and
- Implement effective waste management in order to prevent construction related waste from entering the watercourse environments.

Soils

- To prevent the erosion of soils, management measures may be determined by the site engineer at their discretion and may include mechanisms such as temporary silt traps or hessian curtains. Revegetation with indigenous graminoid species is however recommended for long-term protection of soils and it is suggested that such revegetation of disturbed areas is undertaken concurrently with prospecting;
- Maintain topsoil stockpiles below 5 meters in height;
- As far as possible, all construction activities should occur in the low flow season, during the drier winter months;
- All soils compacted as a result of construction activities falling outside of project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas; and
- Monitor all areas for erosion and incision. Any areas where erosion is occurring excessively quickly should be rehabilitated as quickly as possible.

Rehabilitation

- All soils compacted as a result of construction activities falling outside of project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all construction and rehabilitation phases to prevent loss of floral habitat;
- Edge effects of activities including erosion and alien/ weed control need to be strictly managed in these areas;
- As far as possible, all rehabilitation activities should occur in the low flow season, during the drier winter months.

- As much vegetation growth (of indigenous/endemic floral species) as possible should be promoted within the proposed development area in order to protect soils;
- All alien vegetation in the watercourse areas should be removed from rehabilitated areas and reseeded with indigenous grasses as specified by a suitably qualified specialist (ecologist);
- All areas affected by prospecting activities should be rehabilitated upon completion of the activities.

APPENDIX G – Specialist CVs and Declaration

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1.(a)(i) Details of the specialist who prepared the report

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

Amanda Mileson NDip Nature Conservation (UNISA)

1.(a).(ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	2007	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvironmental.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource discipline lead, Managing member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum;
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000
Tools for wetland assessment short course Rhodes University	2016
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2013

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

SELECTED PROJECT EXAMPLES OUT OF OVER 2000 PROJECTS WORKED ON

1 Mining: Coal, Chrome, PGM's, Mineral Sands, Gold, Phosphate, river sand, clay, fluorspar
2 Linear developments
3 Energy Transmission, telecommunication, pipelines, roads
4 Minerals beneficiation
5 Renewable energy (wind and solar)
6 Commercial development
7 Residential development
8 Agriculture
9 Industrial/chemical

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant species and Landscape Plan
- Freshwater Offset Plan
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Soil Monitoring
- Soil Mapping

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits

Freshwater Resource Management and Monitoring as part of EMPR **and WUL conditions**

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF AMANDA MILESON

PERSONAL DETAILS

Position in Company	Ecologist Wetland Ecology
Joined SAS Environmental Group of Companies	2013

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Wetland Society (SAWS)
Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

N. Dip Nature Conservation (UNISA)	2017

Short Courses

Wetland Management: Introduction and Delineation (University of the Free State)	2018
Tools for Wetland Assessment (Rhodes University)	2017
Wetland Rehabilitation (University of the Free State)	2015

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Free State, North West, Limpopo, Northern Cape, Eastern Cape
Africa – Zimbabwe, Zambia

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater EcoService and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species Plan
- Freshwater Offset Plan

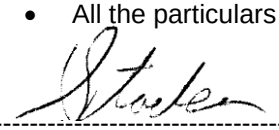
Biodiversity Assessments

- Ecological Scan
- Biodiversity Offset Plan

1.(b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, declare that -

- I act as the independent specialist in this application;
- 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 report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the 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 form are true and correct



Signature of the Specialist