VAN ZYL'S BLASTING EN GRONDWERKE CC

PROPOSED SAND MINING PERMIT APPLICATION: FARM JANNELSEPAN NO. 39, DAWID KRUIPER LOCAL MUNICIPALITY, ZF MGCAWU DISTRICT MUNICIPALITY, NORTHERN CAPE

DRAFT BASIC ASSESSMENT REPORT (DBAR) & ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT (EMPr)

DMR REF: NCS 30/5/1/1/2/1 (10658) MP

Date: 19 March 2018

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Revision No.:	1
Signature:	
FOR THE APPLICANT BY:	*Green Direction Sustainability Consulting (Pty) Ltd*
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mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

BASIC ASSESSMENT REPORT

And

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT:	**VAN ZYL'S BLASTING EN GRONDWERKE**
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FILE REFERENCE NUMBER SAMRAD: NCS 30/5/1/1/2/1 (10658) MP

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE BASIC ASSESSMENT PROCESS

The objective of the basic assessment process is to, through a consultative process–

a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;

b) identify the alternatives considered, including the activity, location, and technology alternatives;

c) describe the need and desirability of the proposed alternatives,

d) through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage , and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on the these aspects to determine:
   (i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
   (ii) the degree to which these impacts—
      (aa) can be reversed;
      (bb) may cause irreplaceable loss of resources; and
      (cc) can be managed, avoided or mitigated;

e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to—
   (i) identify and motivate a preferred site, activity and technology alternative;
   (ii) identify suitable measures to manage, avoid or mitigate identified impacts; and
   (iii) identify residual risks that need to be managed and monitored.

CONTENTS

PART A: SCOPE OF ASSSSMENT AND BASIC ASSESSMENT REPORT

1 CONTACT PERSON & CORRESPONDENCE ADDRESS

1.1 Details of the EAP

Name of The Practitioner: Jennifer Barnard (Green Direction Sustainability Consulting (Pty) Ltd)
Tel No.: 082 4444364
Fax No. : N/A
e-mail address: jenny@greendirection.co.za

1.2 Expertise of the EAP

The qualifications of the Environmental Assessment Practioner (EAP)

- Masters in Environmental Science: University of KwaZulu-Natal, Durban
- SACNASP: Pr.Sci.Nat. (Professional Natural Scientist)
- EAPASA: Registered with Interim Certification Board of Assessment Practioners in South Africa

Refer to **Appendix A** for CV of EAP.

2 LOCATION OF THE ACTIVITY

Farm Name:	Farm Jannelsepan No. 39
Application area (Ha)	5ha
Magisterial district:	ZF Mgcawu Magisterial District
Distance and direction from nearest town	12km south-west of Upington
21 digit Surveyor General Code for each farm portion	**C0360000000003900000**

2.1 Locality Map

Refer to **Diagram 1** which shows that the nearest Town is Upington located approximately 12km in a south-westerly direction via the R359 from Upington. The site is located to the north-east and approximately 5km from Louisvale. Access to the site is off the R359 to the site where it passes along existing farm roads and tracks.

Diagram 2 shows the Layout Plan of the Proposed Sand Mining on a section of the Donkerhoekspruit. Immediately upstream is an existing sand mining permit area with reference 10113MP.

3 DESCRIPTION OF THE PROPOSED ACTIVITIES

3.1 The Scope of the Proposed Activities

The proposed sand mining area is situated on a 5ha section of the Donkerhoekspruit on Farm Jannelsepan No. 39, located 12km south-west of Upington. The sand mining operation is to be carried out by the Applicant, Van Zyl's Blasting en Grondwerke CC.

Mining is in the form of a simple process that only includes loading and hauling of river sand from the Donkerhoekspruit. The excavations in the river bed will be on average 1.5 metres deep.

Refer to **Diagram 3: Site Plan** which shows the location of the proposed sand mining permit area, laydown areas and access routes.

Diagram 1: Locality Plan

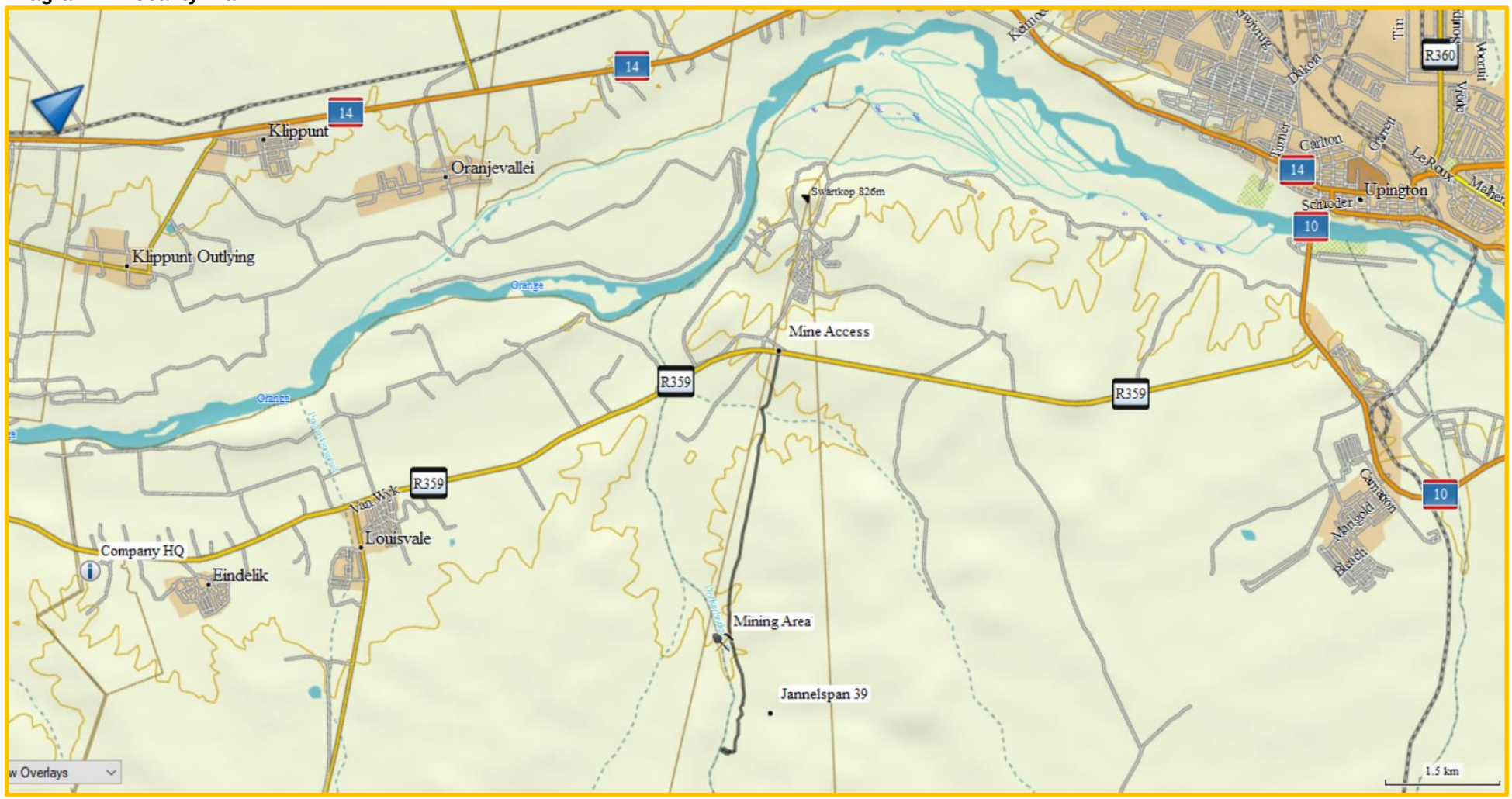


Diagram 2: Layout Plan

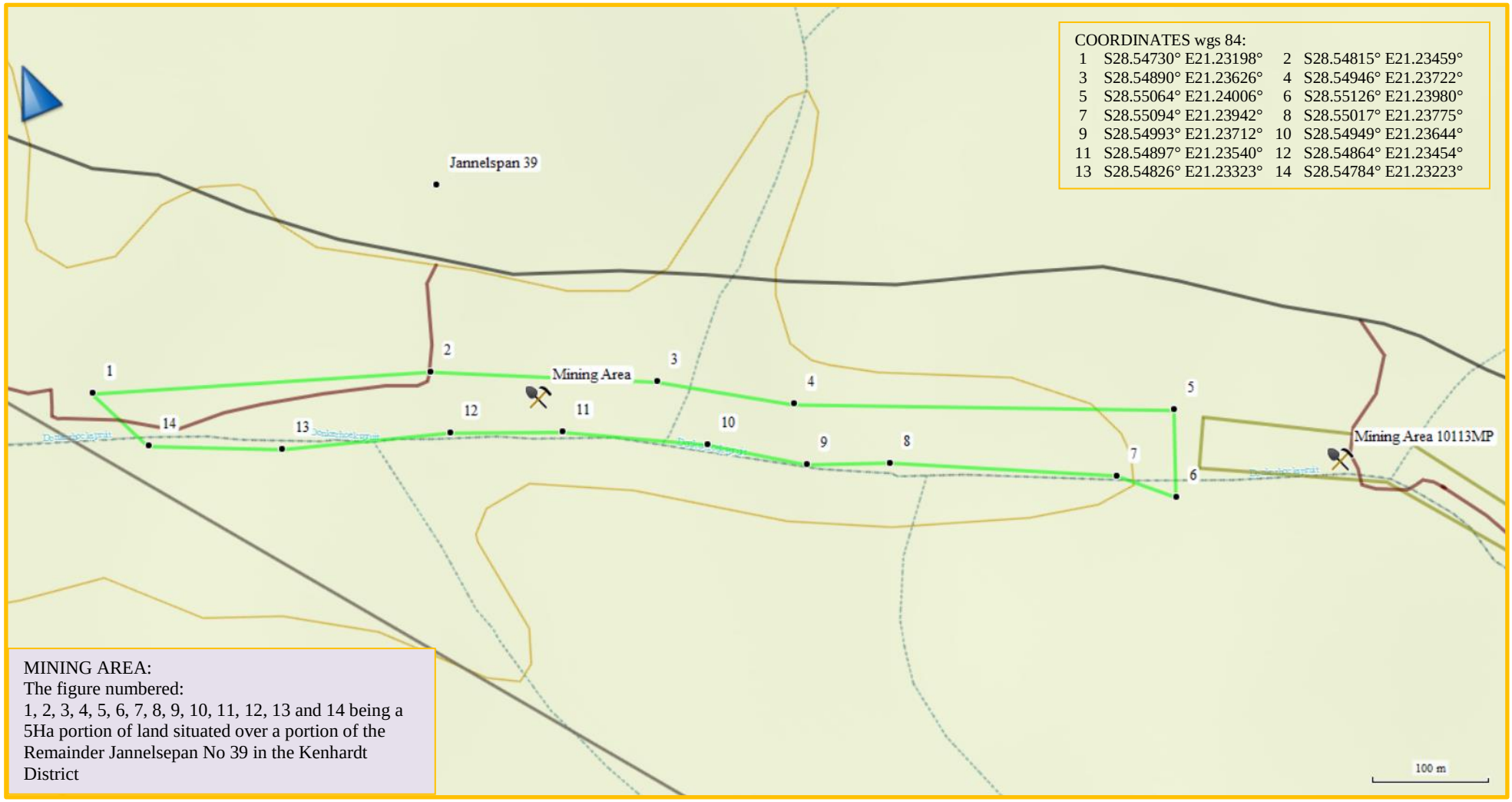
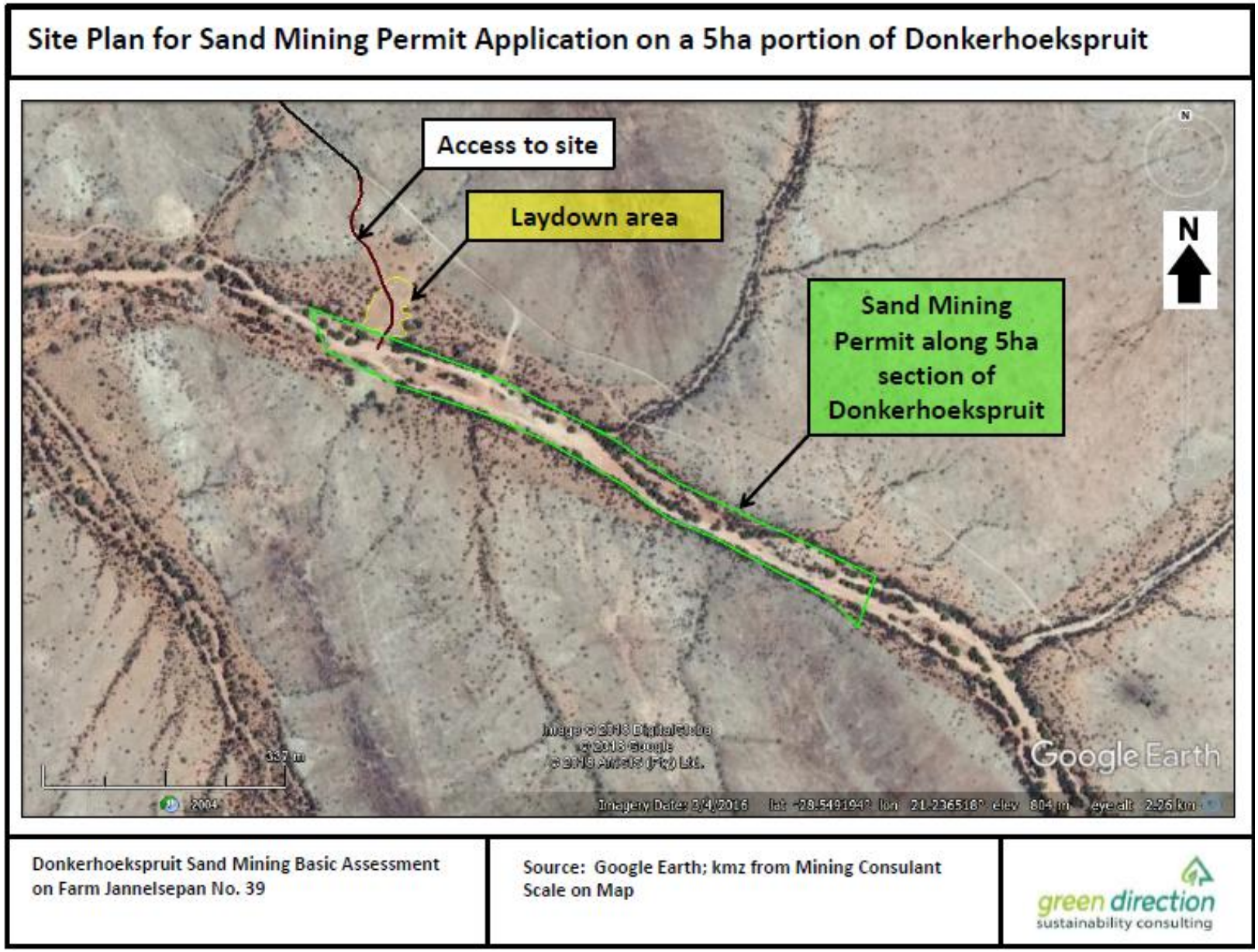


Diagram 3: Site Plan



3.1.1 Construction Phase: Development of infrastructure and logistics

- Access and service roads:
  - Access to the mine works will be via the R359 and existing farm tracks as shown in **Diagram 1, Diagram 2** and on the Site plan attached as **Diagram 3.**
  - Existing farm tracks will be used as haul roads and no new roads will be developed.
- Water supply:
  - No process water is used in the mining process.
- Electricity supply:
  - No electricity is used in the mining area.
- Logistics:
  - No infrastructure is present or will be required due to the small scale and simple mining method.
  - Limited waste management facilities will be supplied that will consist of the following:
    - Plastic containers for domestic waste, which will be transported daily to the Applicant's Headquarters south-west of Louisvale;
    - A temporary storage area for used lubrication products and other hazardous chemicals needs to be provided for the collection of the small volume of waste before it is removed to the company headquarters; and,
    - Only one 200-litre container is needed for the small amount of waste.
- Maintenance Oil/grease/diesel management systems will consist of a drip trays for stationary equipment to be provided in the parking area outside the drainage channel.

3.1.2 Operational Phase

- This operation will only involve the loading and hauling of raw river sand. Only one Front End Loader (FEL) will be used for loading and hauling and no processing will take place. The only surface disturbance except for the mining excavation within the drainage channel, will be a small stockpile area and parking for equipment outside the drainage channel, referred to as a laydown area (Refer to **Diagram 3: Site Plan**).
- The depth of the mining operations will be an average depth of 1.5 metres as only the top layer of sand is mined. The total area under excavation will be approximately 4 ha and sand will be removed over the total area. Backfilling is not an option as the sand is completely removed, as it is washed in from upstream.
- No industrial or mine waste is generated during the mining process. All material consisting mainly of river sand is removed from the seasonal drainage channel to an average depth of 1.5m and sold as a FoT[1] product. No processing is taking place except for limited stockpiling so no mining waste or overburden and Fine Residue Dumps (FRD) will be created.
- Domestic or any other waste generated during the mining operation will be stored in a temporary storage area provided as part of the parking area from where it will be removed to the Applicant's Headquarters.
- Only minor repairs are done on site. A PVC lining and drip trays are used during maintenance and accidental spills are cleaned up immediately by removing of the contaminated sand. The small volume of contaminated sand is sold with the rest of the sand to be used in the building industry. Only one FEL is used in the mining process that is transported to the Applicant's headquarters for major repairs.

3.1.3 Decommissioning and Closure Phase

Planning for closure and restoration from the beginning of an operation makes the process more efficient:

- Waste can be removed as it is created,
- Excavation can be planned so that topography restoration is less complicated, and
- Topsoil can be re-used at shorter interval.
- Site rehabilitation can make the land more valuable and attractive for resale. Additionally, establishing a closure strategy (and communicating that activity to the public) can help enhance the company's reputation as a socially-responsible operation.
- The decommissioning and closure phase at the end of the life of the mine will consist of implementing the Rehabilitation, Decommissioning and Closure Plan (attached at **Appendix D**).

[1] FoT: "Free on Truck ", which means there is no processing and that it's a raw product.

3.2 Listed Activities

Table 1: Listed and Specified Activities

NAME OF ACTIVITY	Aerial extent of the Activity Ha or m²	LISTED ACTIVITY Mark with an X where applicable or affected.	APPLICABLE LISTING NOTICE
Mining of river sand from the Donkerhoekspruit, including: • Removal of topsoil from laydown areas adjacent to river bank, access areas to river bed, and stockpiling of topsoil. Refer to **Diagram 3: Site Plan.** • Accessing the site via existing farm tracks. • Temporary stockpiling of extracted sand in laydown areas prior to hauling in trucks. • Refuse collection containers. • Mobile ablution facilities. • Removal of natural and alien vegetation.	Total footprint is 5 hectares	**X**	**GNR 983 Listing Notice 1 of 2014 (dated 8 December 2014), as amended by GNR 327 (dated 7 April 2017):** **Activity 21:** Any activity including the operation of that activity which requires a mining permit in terms of section 27 of MRPDA, including - (a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or (b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing.
The rehabilitation, decommissioning and closure of the sand mining site on the Donkerhoekspruit, which will only be required at final decommissioning and closure.	Total footprint is 5 hectares	**X**	**GNR 983 Listing Notice 1 of 2014 (dated 8 December 2014), as amended by GNR 327 (dated 7 April 2017):** **Activity 22:** The decommissioning of any activity requiring – (i) a closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
Mining of river sand from the Donkerhoekspruit will require the clearance of an area of 1 hectare or more of indigenous vegetation.	Total footprint is 5 hectares	**X**	**GNR 983 Listing Notice 1 of 2014 (dated 8 December 2014), as amended by GNR 327 (dated 7 April 2017):** **Activity 27:** The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation.
Mining of river sand from the Donkerhoekspruit, including: • Removal of topsoil from laydown areas adjacent to river bank, access areas to river bed, and stockpiling of topsoil. Refer to **Diagram 3: Site Plan.** • Temporary stockpiling of extracted sand prior to hauling in trucks.	Total footprint is 5 hectares	**X**	**GNR 983 Listing Notice 1 of 2014 (dated 8 December 2014), as amended by GNR 327 (dated 7 April 2017):** **Activity 28:** Commercial or industrial developments where such land was used for agriculture on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.
Removal of indigenous vegetation in disturbed areas earmarked for laydown areas adjacent to the access tracks at the river, located outside the drainage channel. Refer to **Diagram 3: Site Plan.**	Area could be more than 300m²		**Not Listed** The site is not located within a critically endangered or endangered ecosystem, or in a CBA gazetted by the Minister, or on land zoned as open space or conservation, and is not designated for protection or conservation in an adopted Environmental Management Framework or Spatial Development Framework.
Temporary hydrocarbon waste storage and general domestic waste	Less than 0.5m³		**Not Listed**
Sanitation requirements (chemical toilets)			**Not Listed**

3.3 Description of the activities to be undertaken

(Describe Methodology or technology to be employed, including the type of commodity to be prospected/ mined and for a linear activity, a description of the route of the activity)

The methodology and technology to be employed in each phase is described below:

3.3.1 Construction phase: Development of infrastructure and logistics

- Due to the small scale of operations no permanent infrastructure will be developed and only existing farm tracks will be used. Upgrading of the existing tracks will be done as part of the construction phase. Refer to **Diagram 2** for the location of the existing farm tracks that provide access off the R359 to the site, and to the proposed project site on the Donkerhoekspruit. Existing access tracks to the mine area are shown in **Diagram 3**, to access the sections being worked in a phased manner. This is the method preferred by DMR to keep vehicles and roads out of the drainage channel as much as possible. With regard to access to the mine the existing roads must be used and must be upgraded and maintained as haul roads for trucks as needed by the mine.
- No buildings and infrastructure will be required as the operation will be run from the company headquarters were all logistics will be available.
- No water or electricity is used in the mining operation and no permanent infrastructure will be required due to the small scale and simple mining method to be employed.
- Domestic waste will be collected in plastic containers and transported daily to the company headquarters. A temporary storage area for used lubrication products and other hazardous chemicals needs to be provided for the collection of the small volume of waste before it is removed to the company headquarters. Only one 200 litre container is needed for the small amount of waste.
- Maintenance Oil/grease/diesel management systems will be required for the parking area, and will consist of drip trays for stationary equipment to be provided outside the drainage channel.

3.3.2 Operational phase

- This operation will only involve the loading and hauling of raw river sand. Only one Front End Loader (FEL) will be used for loading and hauling and no processing will take place. The only surface disturbance that will take place, except for the mining excavation within the drainage channel, is a small stockpile area and parking for equipment outside the drainage channel. During operations mining will only consist of loading and hauling of river sand. Only temporary product stockpiles will be developed as sand will be transported to the Applicant's headquarters for stockpiling and distribution as it is loaded.
- The depth of the mining operations will be on average 1.5m as only the top layer of sand is mined. The total footprint will be 5 hectares and sand will be removed over the total area. Backfilling is not an option as the sand is completely removed as it is washed in from upstream.
- No industrial or mine waste is generated during the mining process. All material consisting mainly of river sand is removed from the seasonal drainage channel to a depth of 1.5m and sold as a Free on Truck (FoT) product. No processing is taking place except for limited stockpiling so no mining waste or overburden and Fine Residue 0eposits (FRD) will be created.
- Domestic or any other waste generated during the mining operation will be stored in a temporary storage area provided as part of the parking area from where it will be removed to the company HQ.
- Only minor repairs are done on site. A PVC lining and drip trays are used during maintenance and accidental spills are cleaned up immediately by removing of the contaminated sand. The small volume of contaminated sand is sold with the rest of the sand to be used in the building industry. Only one FEL is used in the mining process that is transported to the company headquarters for major repairs.
- The trucks will transport sand from the site 5 days a week, operating during the week only between 7h30 and 17h00 during normal working hours. No operations will take place over weekends or during the builder's break at year end.
- As part of this phase training of personnel in the implementation of the EMPr will be undertaken and the implementation of the environmental awareness plan as part of the EMPr will be an ongoing process.

3.3.3 Decommissioning phase

Planning for closure and restoration from the beginning of an operation makes the process easier; waste can be removed as it is created, excavation can be planned so that topography restoration is less complicated, and topsoil can be re-used at shorter intervals. Site rehabilitation can make the land more valuable and attractive for resale. Additionally, establishing a closure strategy (and communicating that activity to the public) can help enhance the company's reputation as a socially-responsible operation. The decommissioning and closure phase at the end of the life of the mine will consist of implementing the Rehabilitation, Decommissioning and Closure plan (**Appendix D**).

4 POLICY & LEGISLATIVE CONTEXT

4.1 Table of Applicable Legislation and Guidelines

Table 2: Applicable Legislation and Guidelines

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE LEGISLATION AND POLICY CONTEXT.
Constitution of South Africa, specifically everyone has a right; **a. to an environment that is not harmful to their health or wellbeing; and** **b. to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:** **i. prevents pollution and ecological degradation;** **ii. promote conservation; and** **iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.**	Mining Permit activities	The mining permit activities shall be conducted in such a manner that significant environmental impacts are avoided, where significant impacts cannot all together avoided be minimised and mitigated in order to protect the environmental right of South Africans.
Minerals and Petroleum Resources Development Act (No 28 of 2002) [MPRDA] Section 27 (as amended)	Application to the DMR for a mining permit in terms of Section 27 for an area not exceeding 5 hectares in extent.	The conditions and requirements attached to the granting of the Mining Permit will apply to the mining activities. DMR is the Competent Authority (CA) for this NEMA application
National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA] **GNR 983 Listing Notice 1 of 2014 (dated 8 December 2014), as amended by GNR 327 (dated 7 April 2017) Listing Notice 1, Activity 21**	Application to the DMR for Environmental Authorisation in terms of the 2014 EIA Regulations	An Application for Environmental Authorisation must be submitted to DMR for an Environmental Authorisation. The listed activities that are triggered determine the Environmental Authorisation (EA) application process to be followed. The appropriate EA will be obtained before proceeding with any sand mining activities. Measures will be implemented to prevent any pollution occurring during the mining activities. The disturbed area shall be rehabilitated in such a way that is stable, non-polluting, non-eroded, free from alien invasive species and suitable for the agreed post closure land use. The compilation of this Basic Assessment Report and the Public Participation Process are required in terms of NEMA.
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) [NEMBA] National list of ecosystems that are threatened and in need of protection, 2011 (in GN 1002 dated 2 December 2011)	Section 8.2.6; 8.2.7 & 8.2.8. Figures 2, 3 and 4.	There are no listed Critically Endangered, Endangered or Vulnerable ecosystems on site. The site is not located within a River FEPA. The eastern portion of the site is located within a CBA2 area and the eastern portion in an ESA.

National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) [NEMBA] **Alien and Invasive Species List, 2016 (in GN No. 864 dated 29 July 2016)**	Sections 8.2.6	Species 289. *Prosopis species* are classified as Category 3 in the Northern Cape, which means that it is prohibited to spread or to allow the spread of any specimen.
National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004). National Dust Control Regulations in GN R827 of 1 November 2013	Part B: EMP and Sections 13.8; 13.9; 13.10 & Section 15	Dust control measures are included in the EMPr
National Environmental Management: Waste Act, (Act 59 of 2008) [NEMWA] (as amended)	Part B: EMP and Sections 13.8; 13.9; 13.10 & Section 15 Management measures are included in the EMPr and as part of the environmental awareness plan.	The generation of potential waste will be minimized through ensuring employees of the Applicant are subjected to the appropriate environmental awareness campaign before commencement of sand mining. All waste generated during the mining activities will be disposed of in a responsible legal manner. Proof of legal disposal will be maintained on site.
National Heritage Resources Act, 1999 (Act No. 25 of 1999)	Section 8.2.10	The sand mining will take place in a non-perennial river bed to an average depth of 1.5metres. Refer to **Appendix E1** for the Heritage Impact Assessment and **Appendix E2** for the Paleontological Assessment
National Water Act, 36 (Act 36 of 1998) and General Authorisation (GA) (No. 509 of 2016) in terms of Section 39 of the NWA for Section 21(c) and 21(i).	Section 8.2.7	The applicable Water Use activities are Section 21(c) related to impeding or diverting the flow of water in a watercourse, and Section 21(i) related to altering the bed, banks, course or characteristics of a watercourse. An application for a General Authorisation in terms of GN 509 of 2016 for Section 21(c) and (i) has been submitted to DWS.
Promotion of Administrative Justice Act, 2000 (Act 3 of 2000) [PAJA]	Decision by the Competent Authority	Gives effect to section 33 of the Constitution that requires that "Everyone has the right to administrative action that is lawful, reasonable and procedurally fair". All administrative actions must be based on the relevant considerations
Land Use Planning Act, 2014 (Act 3 of 2014) (LUPA)	Comments required from the Dawid Kruiper Local Municipality.	Consent use in terms of the Dawid Kruiper Municipal Planning By-Law, 2015 is required to permit mining on properties that are zoned for Agricultural purposes.
Municipal Plans and Policies		
Dawid Kruiper Integrated Development Plan (IDP)	Section 5.3	The Need & Desirability of the project is referenced in terms of the LM IDP, specifically relating to employment creation and sustainable development. Relevant mitigation measures have been included in the EMPr.
ZF Mgcawu District Municipality IDP	Section 5.4	The Need & Desirability of the project is referenced in terms of the District Municipality IDP, specifically relating to employment creation, skills transfer, alien invasive vegetation management climate change and impacts on biodiversity, which are included in the EMPr
Northern Cape Provincial Spatial Development Framework (NCPSDF)	Section 5.5	Sustainable development is a key consideration as addressed in this

		impact assessment report.
Northern Cape Provincial Growth and Development Strategy 2004-2014 (NCPGDS)	Section 5.6	Sustainable development is a key consideration as addressed in this impact assessment report.
Standards, Guidelines and Spatial Tools		
Mining and Biodiversity Guideline: 2013 Mainstreaming biodiversity into the mining sector. Pretoria.	Section 5.1 & 8.2.7 Figure 5	The mitigation measures contained in **Appendix C** and carried through to the EMPr address and mitigate the potential impacts of the proposed mining site within an area zoned (in 2013) as "Category B: Highest Biodiversity Importance – highest risk for mining" as per this Guideline. According to the 2017 conservation status (not yet gazetted) the eastern portion of the site would be zoned as "C: High biodiversity importance – high risk to mining".
DEA Guideline on Need & Desirability (2017)	Section 5.7	Refer to Section 5.7.
DEA Guideline on PPP DMR Guideline on Consultation with Communities and I&APs (undated)	Section 7	Refer to Section 7 and **Appendix B.**
DEAT Integrated Environmental Management Information Series 5: Impact Significance (2002)	Section 8	Refer to **Appendix C.**
DEAT Integrated Environmental Management Information Series 7: Cumulative Effects Assessment (2004)	Section 8	Refer to **Appendix C.**
SANBI BGIS databases (www.bgis.sanbi.org)	Baseline environmental description and Figures 1 to 5	Used during desktop research to identify sensitive environments within the mining permit area.
SANS 1929:2005 Edition 1.1 – Ambient Air Quality Limits for Common Pollutants	Management and monitoring measures	Standard for dust fallout. The activity in question for this application is driving on farm tracks.

5 NEED & DESIRABILITY OF THE PROPOSED ACTIVITIES

5.1 Mining and Biodiversity Guidelines (2013)

The Mining and Biodiversity Guidelines (2013)[2] state that: "Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act (No. 10 of 2004) (hereafter referred to as the Biodiversity Act), and is fundamental to the notion of sustainable development. International guidelines and commitments as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa".

DMR, as custodian of South Africa's mineral resources, is tasked with enabling the sustainable development of these resources. This includes giving effect to the constitutional requirement to "prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development"[3].

The primary environmental objective of the MPRDA is to give effect to the "environmental right"[4] contained in the South African Constitution. The MPRDA further requires the Minister to ensure the sustainable development of South Africa's mineral resources, within the framework of national environmental policies, norms and standards, while promoting economic and social development.

[2] Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute. 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Pretoria.
[3] Constitution of the Republic of South Africa (No. 108 of 1996).
[4] Section 24 of the Constitution states that "everyone has the right (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that: prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

The Mining and Biodiversity Guidelines (2013) document identifies four categories of biodiversity priority areas in relation to their biodiversity importance and implications for mining. The category of relevance to the (western portion of the) proposed sand mining project is "Category B: Highest Biodiversity Importance - highest risk for mining" as per this Guideline as it is zoned as a CBA (in this project as CBA2).

According to the 2017 conservation mapping status (not yet gazetted) the eastern portion of the site would then be zoned as "C: High biodiversity importance – high risk to mining" based on an updated database for mining and biodiversity as the site is zoned as Ecological Support Area (ESA).

Refer to Section 8.2.8 and **Figure 5**. This DBAR and EMPr is the environmental impact assessment required for the activities triggered.

5.2 Building Material Supply and Employment benefits

Building sand is commonly used for the manufacture of plaster, mortar and concrete. Upington fulfils an important urban niche in the Northern Cape region, where the Applicant's cement and sand supply company is located. The project site is located within 12km of Upington with direct access to the R359 Road corridor. The area's development potential in terms of renewable energy has seen an increase in the need for construction materials.

The proposed sand mining activity is considered to be a temporary land use, and the area will be rehabilitated in accordance with the Mining Closure and Rehabilitation Plan, attached as **Appendix D.** The benefits of the project can be divided into social and economic classifications. The mine will provide limited direct employment for local persons. The operation further creates indirect employment opportunities in equipment supply industries, transport and sand mining, and the construction environment.

5.3 Dawid Kruiper Draft Integrated Development Plan (2017 - 2022) & Spatial Development Framework

The Dawid Kruiper Local Municipality (DKLM) comprises an area of about 44 231km² 1 and is formally the largest Local Municipality in the whole of South Africa. DKLM makes up 12% of the total Northern Cape Province and about 4% of the whole of South Africa.

Integrated Development Plan (IDP)
In the Constitution of South Africa (108 of 1996) the objectives of a municipality or local government structure are described as follows under "section 152. (1) the objects of local government are-
(a) to provide democratic and accountable government for local communities;
(b) to ensure the provision of services to communities in a sustainable manner;
(c) to promote social and economic development;
(d) to promote a safe and healthy environment; and
(e) To encourage the involvement of communities and community organisations in the matters of local government".

In terms of economic indicators, the Dawid Kruiper Municipality enjoys comparative advantages in all of the economic sectors, except mining, compared to the District. The Municipality should therefore capitalise on these advantages to further strengthen its position in the District. Furthermore, the fastest growing sectors in the Municipality were those of the agriculture, electricity and water, and mining sectors. The current growth occurring in these sectors should be exploited to ensure the creation of new job opportunities for local people.

The long term vision for socio-economic development and environmental sustainability for the municipality is expressed in the SDF, in addition to the guidelines for a land use management.

The IDP lists various minerals and highlights the potential for diamond mining, and does not refer to sand mining in rivers.

The proposed sand mining project will provide job security, local employment, local skills transfer, economic upliftment and building material supply for the solar renewable energy sector, in a sustainable manner as ensured through this environmental impact assessment process and implementation of the Closure and Rehabilitation Plan.

Spatial Development Framework (Draft Report August 2017; Section A)

The SDF contains “Principle 2: Spatial Sustainability: which states that spatial planning and land use management systems must promote the principles of socio-economic and environmental sustainability through encouraging the protection of prime and unique agricultural land; promoting land development in locations that are sustainable and limit urban sprawl; consider all current and future costs to all parties involved in the provision of infrastructure and social services so as to ensure for the creation of viable communities.”

This report serves to address the sustainability of the proposed sand mining operation.

5.4 ZF Mgcawu District Municipality Draft IDP 2017 - 2018

The ZF Mgcawu District Municipality accounts for about 30% of the Northern Cape economy, and the ZF Mgcawu's economy is largely dominated by mining and agriculture. The vision of this DM is: “Quality support to deliver quality services”. The IDP’s strategic objective of relevance to this project is considered to be “(v) To Facilitate the Development of Sustainable regional land use, economic, spatial and environmental planning frameworks that will support and guide the development of a diversified, resilient and sustainable district economy”, with Local Economic Development (LED) objectives of business development and support highlighted under this objective.

The provision of job security, employment and skills transfer are identified as positive environmental impacts in this DBAR.

The ZF Mgcawu District Municipality acknowledges that climate change poses a threat to the environment, its residents, and future development. Actions are required to reduce carbon emissions (mitigation) and prepare for the changes that are projected to take place (adaptation) in the District. ZF Mgcawu District Municipality has therefore prioritised the development of a Climate Change Vulnerability Assessment and Climate Change Response Plan. Through this program key climate change vulnerability indicators were identified. These are indicators where ZF Mgcawu District Municipality may be at risk to the impacts of climate change, and include biodiversity and the environment, and water.

Changes in climate are predicted to result in the shifting of bioregions in South Africa. In the ZF Mgcawu District Municipality, it is projected that with the warmer temperatures that there will be a replacement of Nama Karoo biome with Savanna and Desert biomes. A large amount of Nama Karoo and Nama Karoo related species will be lost. Terrestrial and river ecosystems and their associated species will also be negatively impacted. The proposed priority responses in the biodiversity and environmental Sector are:

1. Research on better veld/land management practices (overgrazing) & awareness conservation.
2. Monitoring and enforcement of municipal by-laws focusing on conservation and pollution issues.
3. Pursue formal conservation of threatened, endangered and unprotected vegetation types not represented in formal conservation areas.

The ZF Mgcawu District Municipality is currently experiencing issues of water scarcity and quality. Climate change is expected to exacerbate this problem. Drought, reduced runoff, increased evaporation, and an increase in flood events will impact on both water quality and quantity.

The effects of climate change, such as flood events, on the proposed sand mining project will be mitigated as per the measures contained in the EMPr. The mitigation for emissions of greenhouse gases from vehicles associated with the sand mining activities is included in **Appendix C** and included in the EMPr.

5.5 Northern Cape Provincial Spatial Development Framework (NCPSDF)

The NCPSDF states that the: “Cape is not one of South Africa’s richest provinces in monetary terms. Accordingly, there is a need for coherent prioritisation of projects within a spatial economic framework that takes due cognisance of environmental realities and the imperative to create a developmental state”. The NCPSDF was designed as an integrated planning and management tool for all spheres of government to facilitate on-going sustainable development throughout the province.

The NCPSDF, together with the Provincial Growth and Development Strategy (PGDS), is set to fulfil an important role as a spatial and strategic guideline that addresses the key challenges of poverty, inequality and environmental degradation through the innovative use of the resources (capital) of the province for the benefit of all concerned.”

The potential for job security, employment and skills transfer are identified as positive environmental impacts in this DBAR. The potential negative environmental impacts can be mitigated through the implementation of the EMPr and the Closure and Rehabilitation Plan, to ensure a sustainable sand mining activity.

5.6 Northern Cape Provincial Growth and Development Strategy 2004 – 2014 (NCPGDS)

The NCPGDS has the following vision for the Province: "Building a prosperous, sustainable growing provincial economy to reduce poverty and improve social development." The strategy for the growth and development of the Province is guided by the following key principles:

- Equality – notwithstanding the need to advance persons previously disadvantaged, development planning should ensure that all persons should be treated equally;
- Efficiency –the promotion of the optimal utilisation of existing physical, human and financial resources;
- Integration – the integration of spatially coherent regional and local economic development and improved service delivery systems.
- Good Governance – the promotion of democratic, participatory, cooperative and accountable systems of governance and the efficient and effective administration of development institutions;
- Sustainability – the promotion of economic and social development through the sustainable management and utilisation of natural resources and the maintenance of the productive value of the physical environment;
- Batho Pele – the placement of people and their needs at the forefront of its concern and serve their physical, psychological, developmental, economic, social and cultural interests equitably.

5.7 DEA Guideline on Need and Desirability (2017)

As referenced in the DEA Guideline on Need and Desirability (2017), NEMA defines "evaluation" as "the process of ascertaining the relative importance or significance of information, in the light of people's values, preferences and judgements, in order to make a decision." In evaluating each impact (negative and positive) in terms of each of the aspects of the environment, "need and desirability" must specifically be considered in the analysis of each impact of the proposed activity. However, to determine if the proposed activity is the best option when considering "need and desirability", it must also be informed by the sum of all the impacts considered holistically. In this regard "need and desirability" also becomes the impact summary with regard to the proposed activity. Refer to Sections 8 and 9 below which provides the impact process and summary, and **Appendix C** (the impact assessment tables).

These Guidelines state that: "In considering the impact summary it must be remembered that ultimately the aim of EIA is to identify, predict and evaluate the actual and potential risks for and impacts on the geographical, physical, biological, social, economic and cultural aspects of the environment, in order to find the alternatives and options that best avoid negative impacts altogether, or where negative impacts cannot be avoided, to minimise and manage negative impacts to acceptable levels, while optimising positive impacts, to ensure that ecological sustainable development and justifiable social and economic development outcomes are achieved".

The **principles of Integrated Environmental Management (EIM)** as set out in Section 23 of NEMA have been considered in this environmental assessment, EMPr and Closure Report, as explained below.

- **Environmental management placing people and their needs at forefront of its concern, and serve their physical, physiological, developmental, cultural and social interests equitably** – This process will be undertaken in a transparent manner and all effort will be made to involve all the relevant stakeholders and Interested and Affected Parties. I.e. Public participation will be undertaken to obtain the issues / concerns / comments of the affected people for input into the process.

- **Socially, environmentally and economically sustainable development** – All aspects of the receiving environment and how this will be impacted has been considered and investigated to ensure a minimum detrimental impact to the environment. Where the impact could not be avoided, suitable and effective mitigation measures were proposed to ensure that the impact is mitigated. i.e. this report along with the EMPr proposes mitigation measures which will minimise the negative impacts of the proposal on the environment.

- **Consideration for ecosystem disturbance and loss of biodiversity** – the Donkerhoekspruit is classified as a "Category C: Moderately Modified" water resource. The proposed site is located in a Critical Biodiversity Area 2 (CBA2), and in an Ecological Support Area (ESA). The Bushmanland Arid

Grassland vegetation type found on site is not listed in the "National List of Threatened Ecosystems that are Threatened and in Need of Protection" in GN 1002 dated 9/12/2011. Ecosystem disturbance and loss of biodiversity are considered in the impact assessment. There is a high occurrence of alien invasive vegetation on the river banks and in the dry river bed. The sand extraction process is considered to be a relatively short-term type of mining. Rehabilitation back to the natural state is a key component, and will be undertaken in a phased manner as the mining activities progress. This report together with the EMPr and Closure Plan proposes mitigation measures which will minimise the impacts of the proposal on the environment.

- **Pollution and environmental degradation** – The implementation of recommendations made and proposed mitigations in the Environmental Management Programme Report (EMPr) will ensure minimum environmental degradation.

- **Landscape disturbance** – All aspects of the receiving environment and how this will be impacted has been considered and investigated to ensure a minimum detrimental impact to the environment. Where the impact could not be avoided, suitable and effective mitigation measures were proposed to ensure that the impact is mitigated. I.e. Landscape disturbance impacts associated with the development such as erosion and dust has been identified and mitigation measures have been proposed to minimise the impacts.

- **Waste avoidance, minimisation and recycling** – These aspects were considered and incorporated into the operational component of the project.

- **Responsible and equitable use of non-renewable resources** – These aspects have been considered and there is not much scope to reduce the use of non-renewable resources, such as vehicle transport. The sand will be washed down river into the mined and rehabilitated area over time.

- **Avoidance, minimisation and remedying of environmental impacts** - All aspects of the receiving environment and how this will be impacted have been considered and investigated to ensure a minimum detrimental impact to the environment. Where the impact could not be avoided, suitable and effective mitigation measures were proposed to ensure that the impact is mitigated. A number of mitigation measures have been proposed to minimise the impact of the proposal on the environment.

- **Interests, needs and values of Interested and Affected Parties** – This process has been undertaken in a transparent manner and all effort is being made to involve all the relevant stakeholders and Interested and Affected Parties (I&APs). The report being made available to all identified I&APs to obtain comments on the proposed development.

- **Access of information** – Potential Interested and Affected Parties will be notified of the proposal and the availability of the Draft Basic Assessment Report (DBAR). They will also be notified of having the opportunity to register as an I&AP and they will be kept informed during the course of the BA process.

- **Promotion of community well-being and empowerment** – This process will be undertaken in a transparent manner and all effort will be made to involve all the relevant stakeholders and I&APs.

Potential impacts on the environment, socio-economic conditions, and cultural heritage have been assessed, and steps have been taken to mitigate negative impacts, and enhance positive impacts. Adequate and appropriate opportunity will be provided for public participation. Environmental attributes have been considered, and environmental management practices have been identified and established to ensure that the proposed activities would proceed in accordance with the principles of IEM.

6 MOTIVATION FOR THE PREFFERED SITE, ACTIVITY & ALTERNATIVE

Refer to Section 8 for the description of the alternatives.

The site was selected as it contains good quality building sand located in a convenient position in close proximity to transport routes to the Applicant's business premises where the concrete is manufactured. The layout and technology of this sand mining project has been determined by the shape, position and orientation of the mineral resource, which is the sand in the Donkerhoekspruit.

Refer to the Site Plan included as **Diagram 3**. The operational approach is practical and based on best practice to ensure a phased approach of mining followed by rehabilitation in sequential stages.

- The preferred and only location of the sand mining activity is on the earmarked section of the Donkerhoekspruit on Farm Jannelsepan No. 39.
- The preferred and only activity is the mining of sand.
- The preferred and only technology is the use of a Front End Loader to remove the sand from the river, and for trucks to transport the sand to the Applicant's cement batching plant.
- The Site Plan or layout of the activity on the site is shown in **Diagram 3.**

There are therefore no other reasonable or feasible sites, layouts, activities, technologies, or operational alternatives for further consideration in the impact assessment component, other than the mandatory "no-go" alternative that must be assessed for comparison purposes as the environmental baseline.

7 PUBLIC PARTICIPATION PROCESS

7.1 Introduction

The public participation process has been conducted according to the requirements as prescribed in Regulations 40 to 44 of the EIA Regulations, 2014 (as amended). Full details of the public participation process conducted including copies of all supporting documents (e.g. the information provided to Interested & Affected Parties (I&APs) and the comments received) will be included in **Appendix B** in the Final BAR.

7.2 Project Notification, BID and I&AP Registration

A Notice of Project and Background Information Document (BID) attached as **Appendix B,** will be emailed to the Organs of State. Hard copies of Registered Letters and the BID will be sent via registered post to the adjacent landowners.

The newspaper advertisement will be placed in the Gemsbok Newspaper to appear on the 23rd March 2018, and the site notice will be placed at the entrance to the farm adjacent to the R359 and at various public places.

Proof will be included in the Public Participation Report to be included at **Appendix B** in the Final BAR.

The commenting period of 30 days on this Draft Basic Assessment Report and EMPr is from 23 March 2018 to 26 April 2018.

Comments received will be included in the Final Report submitted to DMR for consideration.

Registered I&APs will be notified of the outcome of the Environmental Authorisation issued by DMR.

7.3 Summary of Issues Raised by I&APs

This table will be completed following comments received on the Draft Basic Assessment Report.

Table 3: Summary of Issues Raised by I&APs

Interested and Affected Parties **List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.**		**Date Comments Received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Section and paragraph reference in this report where the issues and or response were incorporated.**
AFFECTED PARTIES					
Landowner/s	**X**				
Louisvale Irrigation Board					
Lawful occupier/s of the land					
N/A					
Landowners or lawful occupiers on adjacent properties	**X**				
David Kruiper Local Authority (Erf 1075; Olyvenhoutsdrift Settlement)					
Riaan Strauss representative of Johan Strauss Family Trust					
Municipal councillor	**X**				
David Kruiper Local Municipality					
Municipality	**X**				
David Kruiper Local Municipality:					
Organs of state (Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWA	**X**				
Ms Nicole Abrahams: National Department of Transport: Environmental Co-ordinator					
Communities					
N/A					
Dept. Land Affairs					
N/A					
Traditional Leaders					
N/A					

Dept. Environmental Affairs & Nature Conservation	**X**				
Mr. Ordain Riba					
Other Competent Authorities affected	**X**				
Dept. Water & Sanitation					
Dept. Agric., Land Reform & Rural Development					
SAHRA					
OTHER AFFECTED PARTIES					
Sizwe Plant Hire CC: NC30/5/1/3/2/10113MP (existing sand mining upstream from proposed new site)					
INTERESTED PARTIES					

8 PROCESS TO REACH THE PROPOSED PREFERRED ALTERNATIVE

8.1 Process to Reach the Proposed Preferred Alternative

With reference to the site plan provided as **Diagram 3** and the location of the individual activities on site, provide details of the alternatives considered with respect to:

(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity; and
(f) the option of not implementing the activity.

8.1.1 Location or site alternatives

This site was selected because it contains good quality building sand and it is located in a convenient position close to the R359, Upington and Louisvale (where the Applicant's business operations are located). The proposed site is located within a section of the Donkerhoekspruit on Farm Jannelsepan No. 39, based on the landowners' willingness to permit sand mining activities on their farm, and due to the fact that the river sand is suited for building purposes. The section of the river selected for sand mining has a flat gradient providing a large surface area suitable for excavation, with no permanent surface water and little vegetation. There are no wetlands on site. The vegetation found growing in the river channel is infested with alien invasive pant species, such as *Prosopis sp*. The rural nature of the area effectively means that the proposed mining activities will not disturb any local communities. There are no reasonable or feasible location alternatives for further consideration.

8.1.2 Type of activity

The Applicant is not the land owner, so it would not be realistic for this company to propose another type of activity, as their core business is the supply of building materials. The holder of a mining permit is required to rehabilitate the environment affected by mining to its natural state or to another predetermined land use. The mining activity takes place over a relatively short time period, so the selection of the best post-mining long term land use is an important consideration. In the case of this application the best post-mining land use alternative is to return the river to its natural state. Other activity alternatives have therefore not been considered as the purpose of the proposed project is to mine sand from the section of the Donkerhoekspruit as indicated in **Diagram 3**. The only other activity required to be assessed in terms of NEMA is the "do-nothing" alternative, as detailed further in section 8.1.6 below.

8.1.3 Design or Layout of activity

The design or layout of a mining project is determined by the shape, position and orientation of the mineral resource, which in this case is linear along an existing river bed lying in an east-west orientation. There would be two feasible ways of mining this resource. It could be mined from east to west or in the opposite direction. Best practice dictates that it is better to mine and rehabilitate the area sequentially in mining blocks from either direction, as this minimises the disturbance to the mining blocks once they have been rehabilitated. The significance of the environmental impacts associated with different possible design or layout alternatives would be very similar, therefore layout alternatives have not been assessed in the impact ratings table.

8.1.4 Technology Alternatives

The technology used in a mining project is determined by the shape, position and orientation of the mineral resource, with the technology alternative for sand mining being restricted to the use of a Front End Loader to remove the sand to an average depth of 1.5 metres, and includes trucks for the hauling of the sand to Upington. There are no technology alternatives for further consideration.

8.1.5 Operational alternatives

The proposed sand mining activities will take place during normal working hours from 07h30 to 17h00 on week days only. The hauling of the sand will therefore also take place during these hours. There are no operational alternatives for further consideration.

8.1.6 The No-go Alternative

The No-Go Alternative will mean that sand mining will not take place. There will no supply of sand for the building and renewable energy industry from this site, resulting in the need to look for suitable sand deposits in other river channels. There will be no new employment opportunities or guaranteed job security provided for those people that the Applicant, van Zyl's Blasting en Grondwerke CC currently employs.

The No-Go Alternative will result in the status quo remaining of the section of the Donkerhoekspruit earmarked for sand mining. The Donkerhoekspruit is considered to be a Category C River, which means that it is Moderately Modified (refer to Section 8.2.6 below). The alien vegetation that is present in the river is required by the National Environmental Management Biodiversity Act to be removed by the landowners, with or without the sand mining operation in the river.

The assessment of alternatives must at all times include the "no-go" option as a baseline against which all other alternatives must be measured. The "no go" alternative is therefore assessed together with the preferred alternative.

8.2 The Environmental Attributes Associated with the Alternatives (Baseline Environment)

8.2.1 Regional Setting

The proposed sand mining area is located on a section of the Donkerhoekspruit on Farm Jannelsepan No. 39, located 12km south-west of Upington in the Dawid Kruiper Local Municipality of the ZF Mgcawu District Municipality, Northern Cape. The site is located approximately 5.5km east of the Orange River and 4.5 km's east of Louisvale.

8.2.2 Landscape and Land Use

As described in the Heritage Impact Assessment (Appendix E1): "The surrounding landscape is typical of that occurring generally away from the Orange River in this region, tending to be rocky with shallow sandy soils and relatively to extremely sparse vegetation. This particular stretch of the Donkerhoekspruit has quite marked riverine vegetation, where patches of deeper sediment are preserved."

The proposed project site is located within an 860m section of the Donkerhoekspruit. Farm Jannelsepan No. 39 is boarded by mostly undeveloped natural areas as shown on **Figure 1**. There is an existing sand mining operation immediately upstream of the proposed site operating under approval of 10113MP registered to Sizwe Planthire CC.

Refer to **Figure 1** which shows that the land-use is "low shrubland" along the water course as per the SANBI BGIS map viewer database dated 2009.

8.2.3 Geology

According to Mucina and Rutherford (2006) most of the area associated with the vegetation type (Bushmanland Arid Grassland) is covered by alluvium and calcrete, with superficial deposits of the Kalahari Group also present in the east. The extensive Palaeozoic diamictites of the Dwyka Group[5] also outcrop in the area as do gneisses and metasediments of Mokolian age. The soils of most of the area are red-yellow

[5] The Dwyka Group is the group of sedimentary geological formations laid down in the Karoo Basin of Southern Africa in the Late Carboniferous and possibly extending into the Asselian of the early Permian. It consists mainly of tillites, laid down along the sandy shorelines of swamplands. The Dwyka is the oldest and lowermost unit of the Karoo Supergroup that is recognized throughout sub-Saharan Africa. (Sourced from https://en.wikipedia.org/wiki/Dwyka_Group)

apedal[6] soils (sandy soils), freely drained, with a high base status and less than 30mm deep with one fifth of the area deeper than 300mm.

The river sand in the Donkerhoekspruit that has been identified as suitable for the construction industry is fine to medium sand.

8.2.4 Slope

Refer to **Figure 1** which shows the contours at a 20 metre interval.

8.2.5 Climate

According to Mucina and Rutherford (2006), the rainfall is largely in summer and early autumn and is very variable for year to year. The Mean Annual Precipitation (MAP) ranges from about 70mm in the west to 200mm in the east. Mean maximum and minimum monthly temperatures for Kenhart are 40.6°C and -3.7°C for January and July respectively. Frost incidence ranges from around 10 frost days per year in the northwest to about 35 days in the east. Wind swirls (dust devils) are common on hot summer days. Refer to the climate diagram inserted below as Diagram 1 for NKb 3 Bushmandland Arid Grassland [referenced from Figure 7.2 in Mucina and Rutherford (2006)].

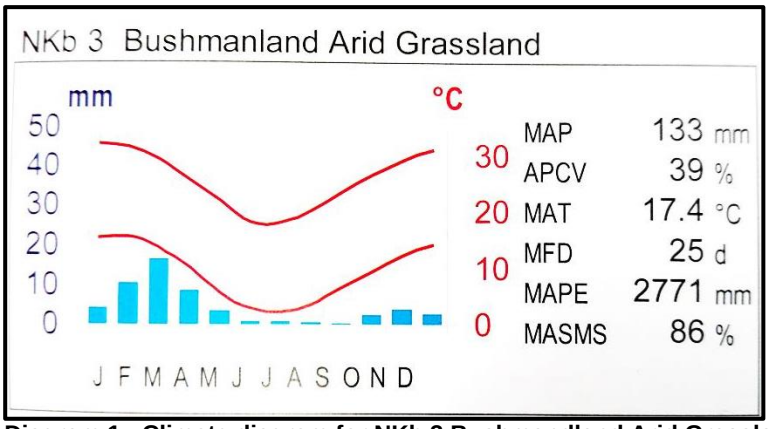


Diagram 1: Climate diagram for NKb 3 Bushmandland Arid Grassland
[The blue bars show the median monthly precipitation. The red lines show the mean daily maximum and minimum temperature. MAP: Mean Annual Temperature. MFD: Mean Frost Days. MAPE: Mean Annual Potential Evaporation. ASMS: Mean Annual Soil Moisture Stress (% of days when evaporation demand was more than double the soil moisture supply).]

8.2.6 Vegetation

Refer to **Figure 2** mapped from the SANBI BIS National Vegetation Map, which shows the location of the project site within Bushmanland Arid Grassland (NKb 3). According to Mucina and Rutherford (2006) this vegetation is associated with extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland dominated by white grasses which gives this vegetation type the character of semi-desert 'steppe", with low shrubs in places, and annual herbs after good rainfalls.

According to Mucina and Rutherford (2006) this vegetation type (Bushmanland Arid Grassland) is Least Threatened, with none conserved in statutory conservation areas and with very little having been transformed, where the alien shrub Prosopis sp. which can be seen as threat.

The vegetation found along the Donkerhoekspruit corridor is characteristic of non-perennial drainage channels in the area, with larger trees located along the banks of the river including such alien invasive trees such as Prosopis sp., and protected tree species such as the Camelthorn tree (*Vachellia erioloba*).

[6] A naturally occurring aggregation of soil particles is termed a ped. Soils high in either clay or organic matter will show a high degree of aggregation or pedality. If no peds are present the soil is termed apedal, if peds are present the soil is classified as pedal. (Sourced from: http://lrrpublic.cli.det.nsw.edu.au/lrrSecure/Sites/Web/5862CF/horticulture/SoilStudies/PhysicalProperties/SoilStructure.htm)

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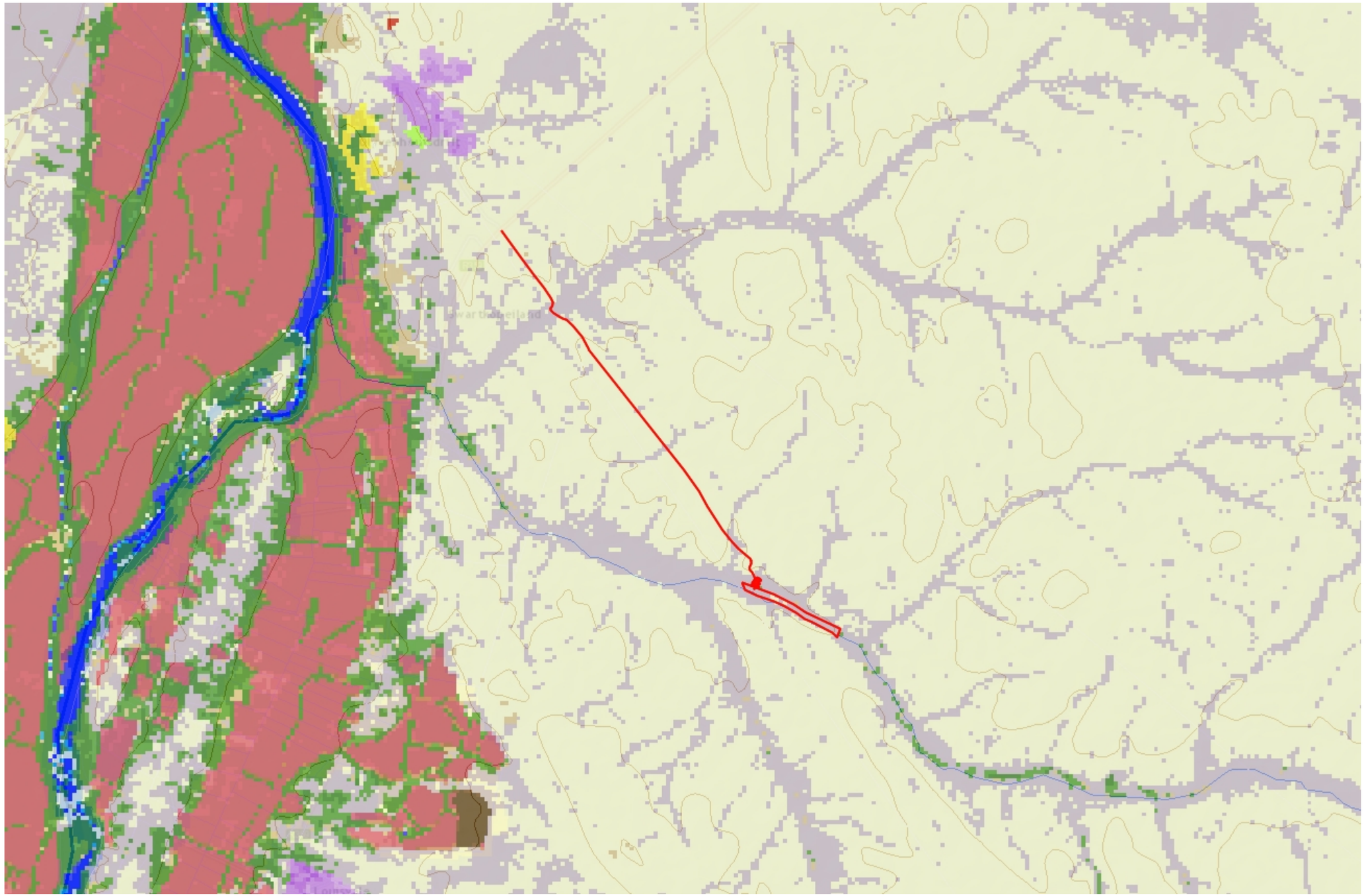

Description

FIGURE 1: SANBI BGIS 20m CONTOURS & LAND USE

Legend

National Landcover 2014

- Water seasonal
- Water permanent
- Wetlands
- Indigenous Forest
- Thicket /Dense bush
- Woodlan/Open bush
- Grassland
- Shrubland fynbos
- Low shrubland
- Cultivated comm fields (high)
- Cultivated comm fields (med)
- Cultivated comm fields (low)
- Cultivated comm pivots (high)
- Cultivated comm pivots (med)
- Cultivated comm pivots (low)
- Cultivated orchards (high)
- Cultivated orchards (med)
- Cultivated orchards (low)
- Cultivated vines (high)
- Cultivated vines (med)
- Cultivated vines (low)
- Cultivated permanent pineapple
- Cultivated subsistence (high)
- Cultivated subsistence (med)

1: 36 112

1,8 0 0,92 1,8 Kilometers

WGS_1984_Web_Mercator_Auxiliary_Sphere

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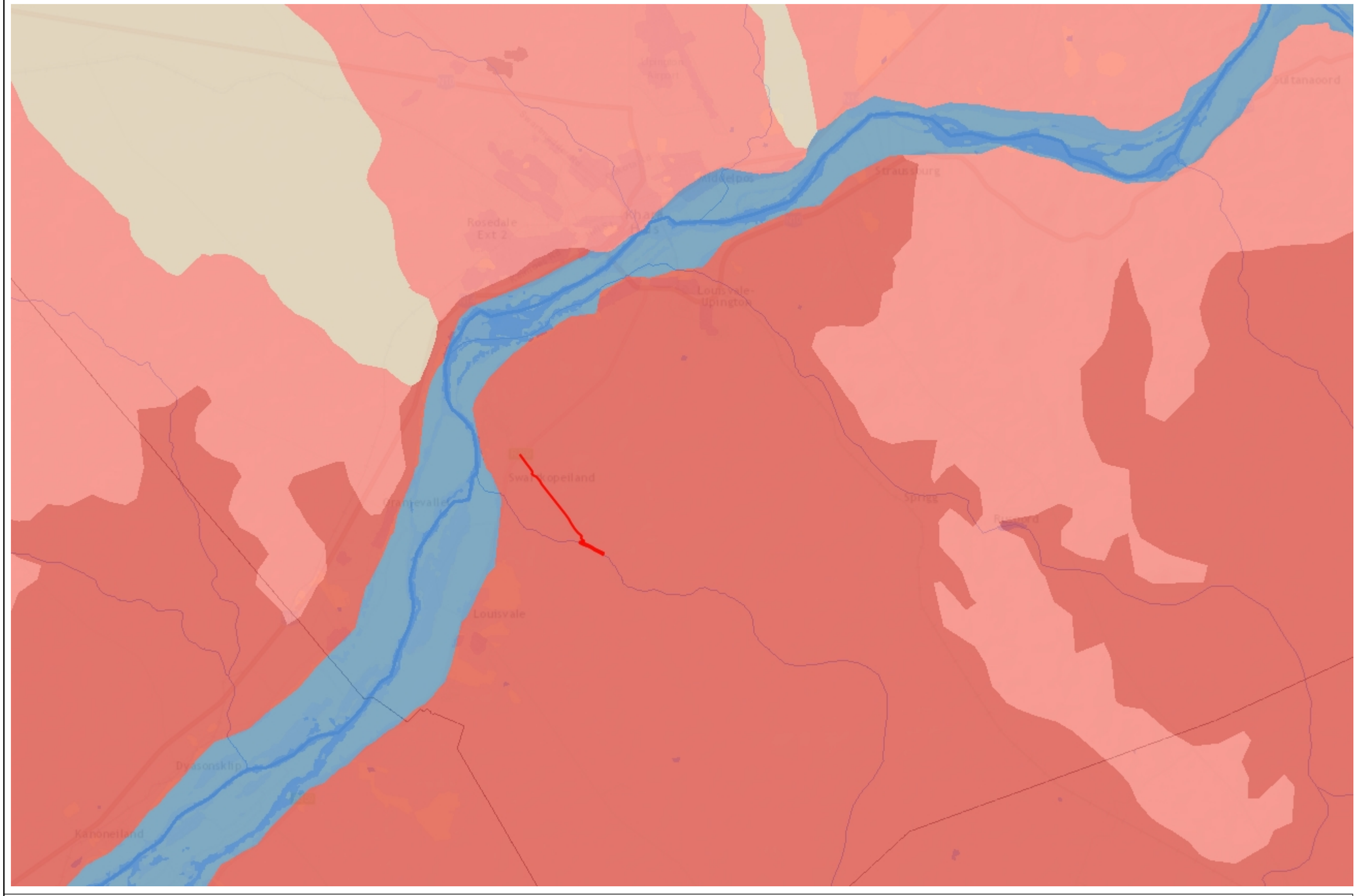

Description

FIGURE 2: SANBI BGIS VEGETATION TYPE

Legend

National Vegetation Map 2012 beta 2

- FFs 1 Bokkeveld Sandstone Fynbos
- FFs 2 Graafwater Sandstone Fynbos
- FFs 3 Olifants Sandstone Fynbos
- FFs 4 Cederberg Sandstone Fynbos
- FFs 5 Winterhoek Sandstone Fynbos
- FFs 6 Piketberg Sandstone Fynbos
- FFs 7 North Hex Sandstone Fynbos
- FFs 8 South Hex Sandstone Fynbos
- FFs 9 Peninsula Sandstone Fynbos
- FFs 10 Hawequas Sandstone Fynbos
- FFs 11 Kogelberg Sandstone Fynbos
- FFs 12 Overberg Sandstone Fynbos
- FFs 13 North Sonderend Sandstone Fynbos
- FFs 14 South Sonderend Sandstone Fynbos
- FFs 15 North Langeberg Sandstone Fynbos
- FFs 16 South Langeberg Sandstone Fynbos
- FFs 17 Potberg Sandstone Fynbos
- FFs 18 North Outeniqua Sandstone Fynbos
- FFs 19 South Outeniqua Sandstone Fynbos
- FFs 20 Tsitsikamma Sandstone Fynbos
- FFs 21 North Rooiberg Sandstone Fynbos
- FFs 22 South Rooiberg Sandstone Fynbos
- FFs 23 North Swartberg Sandstone Fynbos
- FFs 24 South Swartberg Sandstone Fynbos
- FFs 25 North Kammanassie Sandstone Fynbos

1: 144 448

7,3 0 3,67 7,3 Kilometers

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Photograph 1: Donkerhoekspruit river bed showing typical vegetation found in the river bed and on the banks

8.2.7 Water Resources

The three main rivers in the ZF Mgcawu District Municipality (ZFM) are the Orange, Hartbees and Molopo Rivers. The Orange River is under severe pressure from agriculture and the encroachment of alien vegetation. All rivers in the ZFM, except the Orange River, are non-perennial rivers.

The proposed site is located with the D73F Quaternary Catchment area which falls under the Department of Water & Sanitation's Lower Orange Water Management Area.

Refer to **Figure 3** that shows the location of the project site on a section of the Donkerhoekspruit, which is a tributary to the Orange River. It is not a Freshwater Ecosystem Priority Area (FEPA)[7], and is classed as Category C: Moderately Modified as referenced from the SANBI BGIS NFEPA Database Map Viewer.

River FEPAs achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species, and were identified in rivers that are currently in a good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources. This does not mean that FEPAs need to be fenced off from human use, but rather that they should be supported by good planning, decision-making and management to ensure that human use does not impact on the condition of the ecosystem[8]. It is important to note that river FEPAs currently in an A or B ecological category may still require some rehabilitation effort, e.g. clearing of invasive alien plants and/or rehabilitation of river banks.

There are no wetlands near the proposed project site as shown in **Figure 3**.

[7] FEPAs are strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources. FEPAs were determined through a process of systematic biodiversity planning and were identified using a range of criteria for conserving ecosystems and associated biodiversity of rivers, wetlands and estuaries. FEPA maps are suitable to use at a desktop level for planning and decision-making processes at the national or water management area level. In general, confidence in the FEPA maps at a national level is high but decreases at more local levels of planning.

[8] "Implementation Manual for Freshwater Ecosystem Priority Areas Report to the Water Research Commission" (WRC Report No. 1801/1/11; AUGUST 2011)

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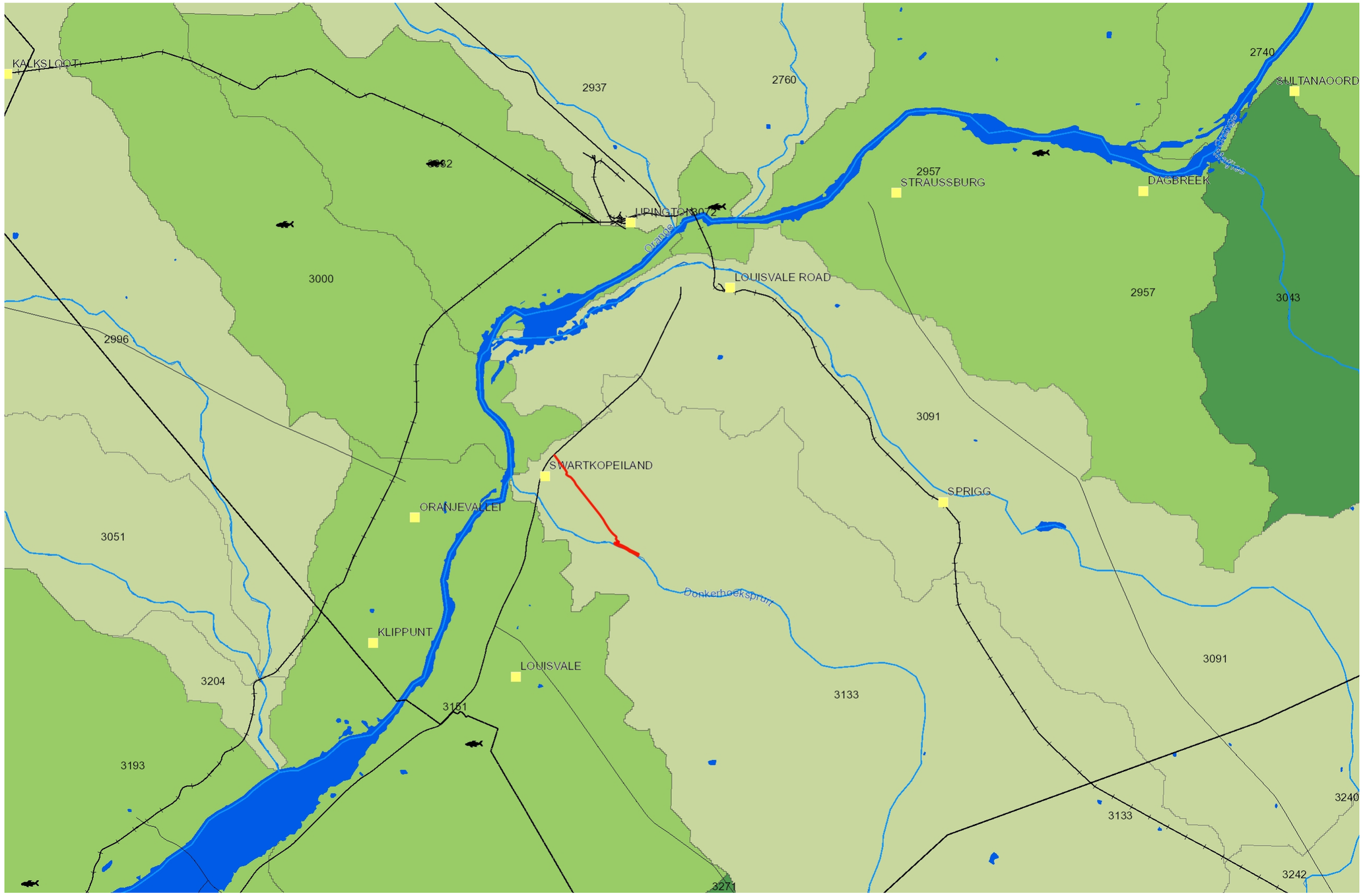
BGIS Land Use Decision Support (LUDS) Tool

DONKERHOEKSPRUIT



Description

FIGURE 3: BGIS NFEPA MAP VIEWER

Legend

- Towns
- District municiipality
- Local municipalities
- Secondary roads
  - ARTERIAL ROUTE
  - MAIN ROAD
  - SECONDARY ROAD
- Railways
- Rivers
- Water management areas
- Sub water management areas
- Fish points
  - Fish sanctuary: CR/EN fish
  - Fish sanctuary: other fish
- Wetland cluster
- NFEPA rivers
  - 1
  - 5
  - 10
- Formal land-based (NBA 2011)
- Informal land-based (NPAES)
- Marine - MPA (NBA 2011)
- National wetlands map 4 (NFEPA wetland m
- National wetlands map 4 (NFEPA wetland m - Estuaries
  - Wetland NFEPA wetlands map
  - Wetland and estuary FEPA

1: 144 448

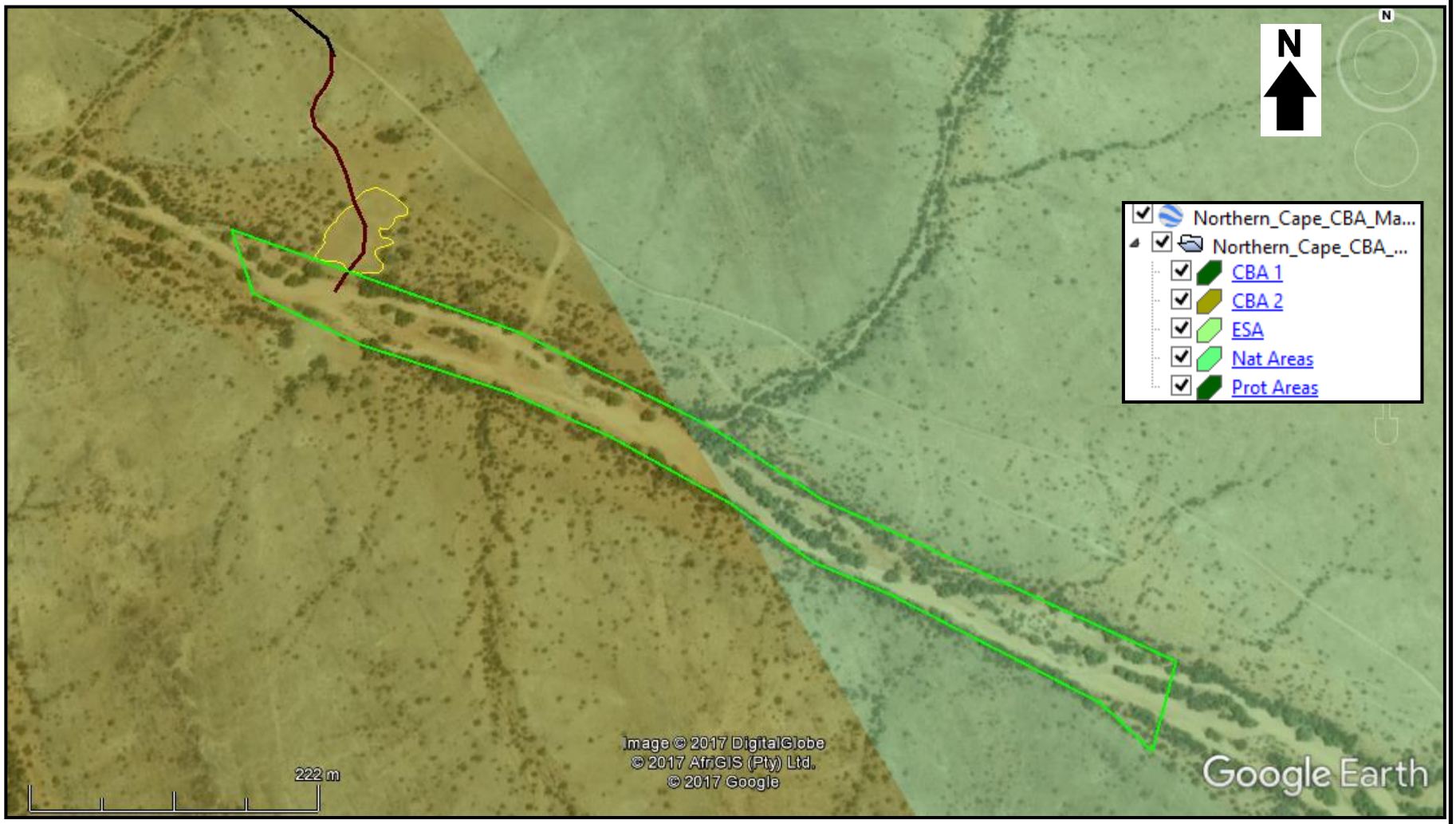
7,3 0 3,67 7,3 Kilometers

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Figure 4: Location of Project Site within a CBA2 & ESA

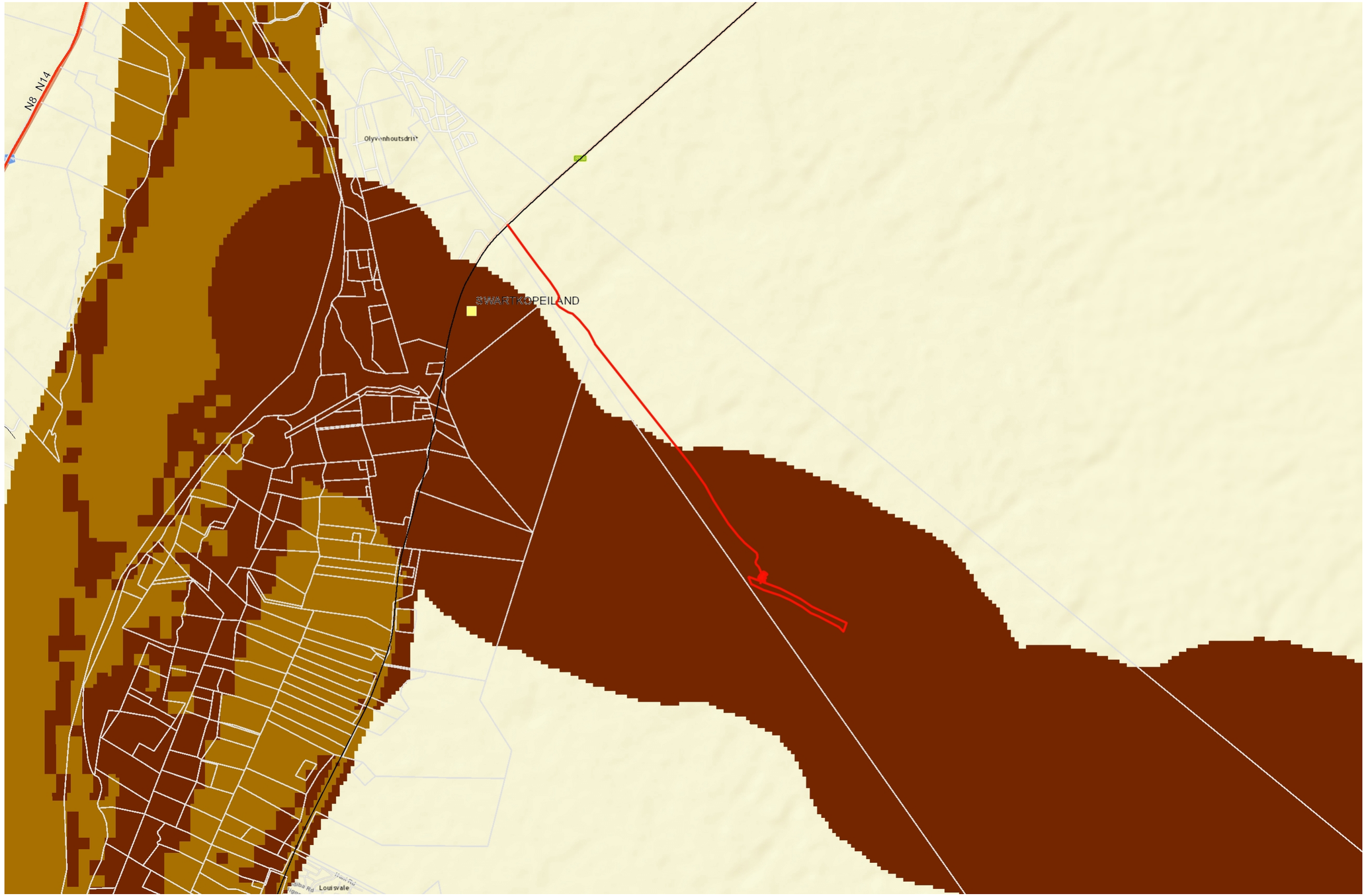


Donkerhoekspruit Sand Mining Basic Assessment	**Source: Database overlay of Conservation Areas from DENC (Nov. 2017)** **Scale on Map**	green direction sustainability consulting

SANBI
Biodiversity for Life

BGIS Land Use Decision Support (LUDS) Tool

DONKERHOEKSPRUIT



Description

FIGURE 5: SANBI BGIS MINING & BIODIVERSITY

Legend

- National roads
- Secondary roads
  - ARTERIAL ROUTE
  - MAIN ROAD
  - SECONDARY ROAD
- Minor roads
- Railways
- Towns
- International borders
- Provincial borders
- District municiipality
- Local municipalities
- Farm boundaries
- Active and abandoned mines 2012
  - Deposit, Exploited (DXP)
  - Mine, Continuously Producing (CPR)
  - Mine, Dormant (DRM)
  - Deposit, Exploited (DXP)
  - Mine, Intermittently Producing (IPR)
- Mpumalanga Highveld Wetlands
- Mining and biodiversity guidelines
  - A. Legallly protected - mining prohibited
  - B. Highest biodiversity importance - highest risk for mir
  - C. High biodiversity importance - high risk to mining
  - D. Moderate biodiversity importance - moderate risk fo mining
- World Street Map

1: 36 112

1,8 0 0,92 1,8 Kilometers

WGS_1984_Web_Mercator_Auxiliary_Sphere

As described in section 5.1 above, the "Mining and Biodiversity Guidelines (2013)" document identifies four categories of biodiversity priority areas in relation to their biodiversity importance and implications for mining. The category of relevance to this proposed sand mining project is "Category B: Highest Biodiversity Importance" as the site is located in a CBA2, which requires (in summary), an environmental impact assessment process to address the issues of sustainability. According to the 2017 conservation status (not yet gazetted) the eastern portion of the site would then be zoned as "C: High biodiversity importance – high risk to mining" based on an updated database for mining and biodiversity.
Refer to **Figure 4** (see section 2.8.2 below) and **Figure 5** which shows the Mining and Biodiversity Guidelines as per the SANBI BGIS map viewer.

The proposed activities trigger the National Water Act (Act 36 of 1998) Water Use Activities of Section 21(c) related to impeding or diverting the flow of water in a watercourse, and Section 21(i) related to altering the bed, banks, course or characteristics of a watercourse. An application for a General Authorisation in terms of GN 509 of 2016 for Section 21(c) and (i) has been submitted to DWS.

8.2.8 Critical Biodiversity Areas and Ecological Support Areas

Refer to **Figure 4** which shows that the western portion of the proposed sand mining operation is located within a Critical Biodiversity Area 2 (CBA2) and the eastern portion within an Ecological Support Area (ESA).

Critical Biodiversity Areas (CBAs)[9] are areas that are required to meet biodiversity targets for species, ecosystems or ecological processes and infrastructure. These include:

- All areas required to meet biodiversity pattern (e.g. species, ecosystems) targets;
- Critically Endangered ecosystems (terrestrial, wetland and river types);
- All areas required to meet ecological infrastructure targets, which are aimed at ensuring the continued existence and functioning of ecosystems and delivery of essential ecosystem services; and,
- Critical corridors to maintain landscape connectivity.

CBAs are areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loss of habitat or species. Degraded areas should be rehabilitated to natural or near-natural condition. Only low-impact, biodiversity-sensitive land uses are appropriate. In the maps, a distinction is made between CBAs that are likely to be in a natural condition (CBA 1) and those that are potentially degraded or represent secondary vegetation (CBA 2). This distinction is based on best available land cover data, but may not be an accurate or current reflection of condition.

An ESA[10] is described as an area that is not essential for meeting biodiversity targets, but that plays an important role in supporting the functioning of Protected Areas or Critical Biodiversity Areas, and are required for delivering ecosystem services. They support landscape connectivity, encompass the ecological infrastructure from which ecosystem goods and services flow, and strengthen resilience to climate change. They include features such as regional climate adaptation corridors, water source and recharge areas, riparian habitat surrounding rivers or wetlands, and endangered vegetation. ESAs need to be maintained in at least a functional state, in order to support the purpose for which they were identified, but some limited habitat loss may be acceptable. A greater range of land uses over wider areas is appropriate, subject to an authorization process that ensures the underlying biodiversity objectives and ecological functioning are not compromised. Cumulative impacts should also be considered.

8.2.9 Socio-economic

Local economy[11]
Key constraints/problems/issues in terms of the development of Dawid Kruiper Municipality include a shortage of job opportunities and job creation in the area. The natural resource base and economy does not have the capacity to support the total population, forcing the labour force to seek employment opportunities outside of the Municipality (e.g. Kimberley), etc. Furthermore low levels of income obtained in the area imply low levels of buying power and, therefore, few opportunities for related activities such as trade. This in turn also supports the "leakage" of buying power.
With regards to the socio-economic characteristics of the local population, the employment rate for the Municipality is relatively high, with as much as 75% of people of working age who are actively seeking

[9] Pool-Stanvliet,R.,Duffell-Canham, A., Pence, G. & Smart, R. 2017. The Western Cape Biodiversity Spatial Plan Handbook. Stellenbosch: CapeNature.
[10] Referenced from the Western Cape Biodiversity Spatial Plan Handbook (2017)
[11] Referenced from Dawid Kruiper Draft IDP (2017-2022)

employment being able to secure a job. However, the majority of the employed population is found in elementary occupations, which require little or no skills. This is also reflected in the low education levels of the local population, with as much as 12% of the population aged 20 years and older having no form of education whatsoever. This, to some extent, constrains the development potential of the Municipality in the development of more advanced industries. The level of employment and type of occupations taken up by the population of the Municipality also directly affects their income levels.

The Municipality's economy is rather centred on the trade and retail sector, due to its strong tourism sector, leaving the local economy fairly vulnerable for any significant changes in this industry. It is, therefore, important that the Municipality seeks to further diversify its economy into other sectors. Furthermore, the manufacturing sector of the municipality is one of the lowest performing sectors of the local economy. This sector has the potential to generate significant growth for the region, and Dawid Kruiper Municipality is experiencing a lack of manufacturing activities. As a result much in the municipality has to be sourced from outside of the municipal boundaries, resulting in money flowing out of the local economy.

Due to the unique spatial manifestation of the municipality, both the first and second economy is mostly located around the CBD and farms. Upington has a well-defined business centre with numerous residential areas. Secondary activities in the study area are mainly light industrial, warehousing, and light engineering works.

New economic opportunities arose for the Dawid Kruiper municipal area with the generation of sustainable solar energy developments, including the need for new power line construction in the area, creating employment opportunities, and economic spin-offs such as an increase in the demand for the supply of locally sourced building materials.

Social Profile[12]

According to the Stats SA Census 2011 data the population of Dawid Kruiper Municipality's was 107 162 in 2016. This reflects an overall population growth of 1.82% between 2011 up to 2016. The unemployment rate decreases significantly from 34% in 2001 to 22.1% in 2011, and there was a huge decline in the youth unemployment rate from 42.3% in 2001 to 29% in 2011 but the youth unemployment rate is still very high in comparison with the overall unemployment rate of the municipality. Although about 44.7% of the Dawid Kruiper population is between 14 and 35 years old, youths remains relatively marginalised. All municipal services except sewerage increased since 2001 with electricity for lighting increased from 91.1% in 2011 to 94% in 2016 within the Khara Hais area and 69 % within the Mier Area, respectively.

8.2.10 Heritage and Palaeontological Resources

Heritage

Reference is made to the Heritage Impact Assessment (**Appendix E1**), where it states that the river sand between the banks of the spruit yielded a few artefacts but that these were all in secondary context. A few isolated artefacts were noted at various places on the sand sediments alongside the spruit bed. "A ridge rising to the south of the spruit, with rocky outcrop at its crest, was found to provide sheltering rocks and a relatively constrained flat surface that had been a place of concerted artefact production and use in Later Stone Age times. It corroborates other observations (e.g. alongside a sand mining site on Kakamas South – Morris 2017b) that suggest Latter Stone Age hunter gatherer use of higher ground alongside rivers/spruits or leegtes in this environment."

The Report concluded that: "Precolonial/Stone Age material noted at the portion of Jannelsepan investigated in this study was found to be generally of low significance, where present at all. Minimal isolated archaeological finds found in the sand source area within the dry bed of the spruit are in secondary context. Criteria used here for impact significance assessment for archaeological traces rate the impacts as not worthy of further mitigation. Mining should however be limited to the intended zone within the bed of the spruit so as not to disturb possible materials in in situ sediments alongside the spruit."

Palaeontology

Reference is made to the Palaeontological Impact Assessment (attached at **Appendix E2**) which summaries the findings: "The proposed mining area lies on Kalahari sands and ancient volcanic and plutonic rocks of the Namaqua-Natal Province and in particular the Jannelsepan Formation migmatitic amphibolites and calc-silicates and the amphibolites of the Dagbreek Formation. These rocks are too old for body fossils and of the

[12] Referenced from Dawid Kruiper Draft IDP (2017-2022)

wrong type, being igneous. The sand to be mined is alluvial and would not contain fossils either. As far as the palaeontological heritage is concerned the project can continue and no further assessment is required."

8.2.11 Description of the current land uses

There is intensive irrigation farming associated with the Orange River, and extensive livestock farming in the more arid areas of the region.

Refer to **Figure 1**. The 2009 National mosaic landcover sourced from the SANBI BGIS database shows that Farm Jannelsepan No. 39 is classified as natural with low shrubland.

The proposed project site for sand mining is the river bed of the non-perennial Donkerhoekspruit. The banks of the river are lined with vegetation characterised by alien invasive plant species, which are also located within the dry river bed in some areas. There are existing tracks on the farm, which provide access to the river bed. Refer to **Diagram 3** (Site Plan).

8.2.12 Description of specific environmental features and infrastructure on the site

Refer to **Diagram 3** and **Figures 1 to 5** which provides an overview of the position of the propose project site in the Donkerhoekspruit, the existing access tracks, and the extent of the vegetation on the river banks and in the river itself.

8.2.13 Environmental and current land use map

Refer to **Figures 1 to 5** provided as part of the specific attributes of the proposed project site.

8.3 Impacts and risks identified for each alternative

8.3.1 Overview

As described in Section 3.1 of this report (and elsewhere), the mining activities are restricted to the removal of river bed sand up to an average depth of 1.5 metres from the Donkerhoekspruit.

The risks associated with safety:

- The risk of deep and unstable excavations that can be detrimental to the safety and health of humans and animals can be regarded as insignificant given the extremely low rainfall in the area and small size of the excavations. The drainage channel is only in flood on average once a year and during flood events any excavations are filled naturally with sand washed in from upstream.
- Due to the simple mining process that only includes loading and hauling, there will be no unsafe areas like steep slopes that would require demarcation to prevent access by humans and animals.
- No infrastructure, sub-surface voids, fine residue dams or evaporation ponds will be developed that can lead to potentially unsafe post-mining areas; therefore no post mining access control would be required.

The risks associated with the removal of vegetation on the banks:

- This will lead to scouring, and will be mitigated by shaping of the bank of the drainage channel;
- Preventing destruction of vegetation on the banks to prevent scouring; and,
- Restricting the depth of the excavations to an average depth of 1.5m.

The potential risks arising after mine closure are changes in the quantity of surface water compared to pre-mining quantities that may negatively affect the area:

- To prevent significant negative effects the post-mining topography must be adjusted where possible to minimise the effect on water flow and increase potential for re-vegetation.

The risk of erosion and scouring:

- Ensure stability of the bank of the drainage channel by re-shaping and backfilling of the access point with suitable material where required.

The risk of waste:

- No industrial or mine waste is generated during the mining process and all material consisting mainly of river sand will be removed from the site and sold as a FoT product. No processing will take place so no mining waste or overburden and fine residue dumps will be created and there will be only limited product stockpiles present on site.
- The potential risk is related to waste management practices that will require implementing of mitigation and management actions to limit the residual impact after mine closure.

8.3.2 Potential impacts and risks associated with the Preferred Alternative

Refer to **Appendix C** for the full Impact Assessment Tables for the Preferred and Only Alternative (Sand Mining Activity) compared to the No-Go Alternative.

Table 4: Preferred Alternative: Potential Impacts and Risks per Phase per Activity

Phase	Activities	Potential Impacts
CONSTRUCTION PHASE	Site access	Disturbance to river bank at access point
		Disturbance of vegetation and fauna
		Soil compaction from repeated use of access track
	Site Establishment Activities (including: topsoil stripping and stockpiling for lay down areas, waste generation and management)	Noise Generation
		Visual intrusion
		Dust fall and nuisance from activities, dust emission from top soil stripping.
		Wildlife and vegetation disturbance from site preparation
		Removal of alien invasive plant species such as Prosopis sp. (positive impact)
		Soil and sand contamination from hydrocarbons
		Contamination and disturbance of soil from compaction and soil disturbance due to topsoil stockpiling
		Socio-economic impact on job security, employment creation and economic spin-offs (positive impact)
		No impact on heritage artefacts, heritage sites or grave yards
OPERATIONAL PHASE	Removal of sand to a depth of 1.5 metres in the river bed; movement of trucks on site to collect sand for removal; waste generation and management	Noise caused by the machinery and vehicles on site, and by vehicles going to and from the sand mining site
		Visibility of the sand mining operations
		Dust emissions from general site activities (vehicle entrained dust)
		Removal of sand from river bed impacting on river ecosystem
		Wildlife and vegetation disturbance from front end loader and trucks
		Ongoing removal of alien invasive plant species such as Prosopis sp. (positive impact)
		Soil and sand contamination from hydrocarbon spills
		Compaction of soil on access tracks and in river bed due to sand mining activities
		Socio-economic impact on job security, employment creation and economic spin-offs (positive impact)
		No impact on heritage artefacts, heritage sites and grave yards
DECOMMISSIONING PHASE	Rehabilitation of the sand mining area, scarifying compacted areas and vehicle tracks	Shaping of river profile and replacing topsoil
		Ongoing removal of alien invasive plant species such as Prosopis sp. (positive impact)
		Socio-economic impact on job security, employment creation and economic spin-offs (positive impact)

8.3.3 Potential Impacts and Risks associated with the No-Go Alternative

There would be no change to the biophysical environment with the No-Go Alternative. The landowner and Applicant would forgo an opportunity to create employment and generate an income from this project.

8.4 Methodology used in determining significance of potential impacts

Refer to Table 5 below, which provides the impact assessment criteria applied in the rating of the impacts associated with each phase of the proposed mining activity for the Preferred and Only Alternative. Each impact is assessed in terms of: nature (character status); extent (spatial scale); duration (time scale); probability (likelihood) of occurring; reversibility of the impact; the degree to which the impact may cause

irreplaceable loss of resources; the significance (size or magnitude scale) prior to mitigation; the degree to which the impact can be mitigated; and, the significance (size or magnitude scale) after mitigation.

Table 5: Impact Assessment Criteria

ASSESSMENT CRITERIA	
NATURE	
Positive	Beneficial to the receiving environment
Negative	Harmful to the receiving environment
Neutral	Neither beneficial or harmful
EXTENT (GEOGRAPHICAL)	
Site	The impact will only affect the site
Local/ district	Will affect the local area or district
Province/region	Will affect the entire province or region
International and National	Will affect the entire country
CONSEQUENCE	
Loss/gain	The impact will result in loss or gain of resource
No loss/gain	The impact will result in no loss or no gain of resource
DURATION	
Construction period / Short term	Up to 3 years
Medium term	Up to 6 years after construction
Long term	More than 6 years after construction
PROBABILITY	
Definite	Impact will certainly occur (>75% probability of occurring)
Probable	Impact likely to occur (50 – 75% probability of occurring)
Possible	Impact may occur (25 – 50% probability of occurring)
Unlikely	Impact unlikely to occur (0 – 25% probability of occurring)
REVERSIBILITY	
Reversible	Impacts can be reversed though the implementation of mitigation measures
Irreversible	Impacts are permanent and can't be reversed by the implementation of mitigation measures
IRREPLACEABLE LOSS OF RESOURCES	
High	The impact is result in a complete loss of all resources
Medium	The impact will result in significant loss of resources
Low	The impact will result in marginal loss of resources
No Loss	The impact will not result in the loss of any resources
CUMULATIVE EFFECTS	
High	The impact would result in significant cumulative effects
Medium	The impact would result in moderate cumulative effects
Low	The impact would result in minor cumulative effects
SIGNIFICANCE RATINGS	
Very High	Major to permanent environmental change with extreme social importance.
High	Long term environmental change with great social importance.
Medium	Medium to long term environmental change with fair social importance.
Low	Short to medium term environmental change with little social importance.
Very low	Short-term environmental change with no social importance
None	No environmental change
Unknown	Due to lack of information
DEGREE TO WHICH IMPACT COULD BE AVOIDED/MANAGED/MITIGATED	
High	The impact could be significantly avoided/managed/mitigated.
Medium	The impact could be fairly avoided/managed/mitigated.
Low	The impact could be avoided/managed/mitigated to a limited degree.
Very Low	The impact could not be avoided/managed/mitigated; there are no mitigation measures that would prevent the impact from occurring.

8.5 The positive and negative impacts that the proposed activity and alternatives will have

Refer to **Appendix C** for the full Impact Assessment Tables for the Preferred and Only Alternative (Sand Mining Activity) compared to the No-Go Alternative.

Positive impacts

- Creation of employment and job security and economic spin-offs (positive impact)
- Provision of materials for construction industry to support local and regional economic growth related to the renewable energy industry.
- Removal of alien invasive plant species, such as *Prosopis sp*.

Negative impacts

The key potential negative impacts associated with the sand mining activity include the following:

- Site access:
  - Disturbance of onsite fauna and flora
  - Soil compaction from repeated use of access tack

- Site Establishment Activities (including: topsoil stripping and stockpiling, erection of temporary equipment laydown area, waste generation and management)
  - Noise Generation
  - Visual intrusion
  - Dust fall and nuisance from activities, dust emission from top soil stripping
  - Wildlife and vegetation disturbance from site preparation
  - River bed contamination from hydrocarbons
  - Contamination and disturbance of river sand from compaction and soil disturbance due to topsoil stockpiling

- Removal of sand to an average depth of 1.5 metres in the river bed; movement of trucks on site to collect sand for removal; waste generation and management:
  - Noise caused by the machinery and vehicles on site, and by vehicles going to and from the mining site
  - Visibility of the sand mining operations
  - Dust emissions from general site activities (vehicle entrained dust)
  - Removal of sand from river bed impacting on river ecosystem
  - Wildlife and vegetation disturbance from front end loader and trucks
  - Impact of stormwater run-off during infrequent rainfall events
  - River sand contamination from hydrocarbon spills
  - Compaction of soil on access tracks and in river bed due to sand mining activities

- Rehabilitation of the sand mining area, scarifying compacted areas and vehicle tracks
  - Dust emission from decommissioning activities (vehicle entrained dust)
  - Soil erosion of topsoil
  - Ongoing removal of alien invasive plant species such as Prosopis sp. (positive impact)
  - Socio-economic impact on job security, employment creation and economic spin-offs (positive impact)

8.6 The possible mitigation measures that could be applied

Refer to **Appendix C** for the Impact Assessment Tables, as the mitigation measures are included under each impact.

8.7 Motivation where no alternative sites were considered

Alternatives were considered, as described in Section 8.1 and 8.3 above and subjected to the impact rating methodology in Table 5 above as detailed in **Appendix C**.

8.8 Concluding Statement on Alternatives development

The site was selected as it contains good quality building sand located in a convenient position in close proximity to transport routes to the Applicant's business premises where the concrete is manufactured. The layout and technology of this sand mining project has been determined by the shape, position and orientation of the mineral resource which is the sand in the Donkerhoekspruit.

Refer to the Site Plan attached as **Diagram 3.**

The operational approach is practical and based on best practice to ensure a phased approach of mining followed by rehabilitation in sequential stages.

There are therefore no other reasonable or feasible sites, layouts, activities, technologies, or operational alternatives for further consideration in the impact assessment component, other than the mandatory "no-go" alternative that must be assessed for comparison purposes against the baseline.

9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (In respect of the final site layout plan) through the life of the activity

Refer to **Diagram 3** for the Site Plan of the Preferred and Only Alternative.

Refer to Section 8.3 above where the risks have been described.

Refer to Section 8.4 above where the methodology has been described, and refer to **Appendix C** for the full Impact Assessment Tables for the Preferred and Only Alternative (Sand Mining Activity) compared to the "No-Go" Alternative.

This BAR and EMPr were compiled through a detailed desktop investigation and site assessment in order to determine the environmental setting in which the project is located.

Input from stakeholders during the public participation process will also assist the EAP in the identification of any additional impacts associated with the proposed sand mining activities.

The methodology described above was used to assess the significance of the potential impacts of the sand mining activities. The assessment of impacts is based on the experience of the EAP.

The mitigation measures proposed are considered to be reasonable and based on the location of the mining area and must be implemented in order for the outcome of the assessment to be accurate.

9.2 Assessment of each identified potentially significant impact and risk

Table 6: Significance of Impacts per Activity per Phase

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	SIGNIFICANCE if not mitigated	MITIGATION TYPE	SIGNIFICANCE if mitigated
Site Access	Disturbance to river bank at access points	Water Resources functionality (flow regime; water quality and quantity; aquatic biota). The Donkerhoekspruit is non-perennial and impacts will have little effect on water resource functionality as a whole.	Construction	MEDIUM	• Topsoil at access point to be removed prior during construction phase, and replaced during rehabilitation. • After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Reasonable measures must be undertaken to ensure that any exposed areas are adequately protected against the wind and stormwater run-off. • Top soil shall be removed separately and stockpiled separately from other soil base layers. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Topsoil storage areas must be convex and should not exceed 2m in height. • Topsoil must be treated with care, must not be buried or in any other way be rendered unsuitable for further use (e.g. by mixing with spoil) and precautions must be taken to prevent unnecessary handling and compaction. • In particular, topsoil must not be subject to compaction greater than 1 500 kg/m² and must not be pushed by a bulldozer for more than 50 metres. Trucks may not be driven over the stockpiles.	LOW

					• Temporarily halt material handling in windy conditions. • Compacted areas that are not required for access shall be scarified after use during decommissioning and rehabilitation. • Rehabilitation of the river banks at each access point as soon as that section of the river has been mined. • Shaping of river bank to be returned to original profile.	
	Disturbance of vegetation and fauna	Effect on biodiversity in a CBA2 area and an Ecological Support Area (ESA). There is only 1 laydown area identified as the existing disturbed area where clearing would be minimal, resulting in little impact on ecological functioning at a local level during the construction process. The clearing of alien invasive vegetation is a positive impact, and will benefit and improve the ecological functioning of the river bed and adjacent areas.	Construction	MEDIUM	• Identify existing disturbed patches for laydown areas, and demarcate areas for clearing. Refer to **Diagram 3**, which indicates that existing tracks will be used. • Demarcate areas for clearing. • Remove alien invasive vegetation, • No indigenous plants outside of the demarcated work areas may be damaged. • Identify protected tree species, and leave these intact, such as Camelthorn trees. • Ensure ongoing alien vegetation clearing in the area. • The noise and vibration caused by the earthmoving equipment will disturb smaller animals. These will move away whilst operations are in progress. Should any animals be encountered these should be moved away by a suitably trained nature conservation officer, if necessary.	VERY LOW
	Soil compaction from repeated use of access track.	Loss of soil resource	Construction	MEDIUM	• After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly.	LOW

	Soil disturbance due to topsoil removal & stockpiling				• Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Reasonable measures must be undertaken to ensure that any exposed areas are adequately protected against the wind and stormwater run-off. • Top soil shall be removed separately and stockpiled separately from other soil base layers. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Topsoil storage areas must be convex and should not exceed 2m in height. • Topsoil must be treated with care, must not be buried or in any other way be rendered unsuitable for further use (e.g. by mixing with spoil) and precautions must be taken to prevent unnecessary handling and compaction. • In particular, topsoil must not be subject to compaction greater than 1 500 kg/m² and must not be pushed by a bulldozer for more than 50 metres. Trucks may not be driven over the stockpiles. • Reduce drop height of material to a minimum. • Temporarily halt material handling in windy conditions. • A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers using the access road and entering the site will be informed of the speed limit. • Compacted areas that are not required for access shall be scarified after use during decommissioning and rehabilitation.	
Site establishment	Visibility	Visual intrusion	Construction	LOW	• The laydown areas shall be kept neat and tidy at all times. Equipment must be kept in designated areas and storing/stockpiling shall be kept orderly. • Restrict working hours to normal work day hours with no work over weekends when holidays occur to minimize hauling trucks along access roads.	VERY LOW

	Noise, Dust and Vehicle (carbon) emissions	Dust and noise nuisance and greenhouse emissions	Construction	LOW	• The Contractor shall adhere to the local by-laws and regulations regarding the noise and associated hours of operations. • The Contractor shall limit noise levels (e.g. install and maintain silencers on machinery). The provisions of SANS 1200A Sub clause 4.1 regarding "built-up" area shall apply to all areas within audible distance of residents whether in urban, peri-urban or rural areas. • Construction and demolition activities generating output of 85dB or more, shall be limited to normal working hours and not allowed during weekends to limit the impact of noise of neighbours. Should the Contractor need to work outside normal working hours, the surrounding neighbours shall be informed prior to the work taking place. • No amplified music shall be allowed on site. • On public roads adjacent to the site vehicles shall adhere to municipal and provincial traffic regulations including speed limits. • Vehicles used on site for the construction related activities shall be maintained and in a good working condition so as to reduce emissions. • Stockpiles must be maintained (covered where necessary) to avoid wind erosion of the material. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Trucks shall have tarpaulins to prevent sand from blowing off in transit.	VERY LOW

	Disturbance of vegetation and fauna	Disturbance to biodiversity	Construction	MEDIUM	• Identify existing disturbed patches for laydown areas, and demarcate areas for clearing. Refer to **Diagram 3**, which indicates that existing disturbed areas have been earmarked for laydown areas. • Demarcate areas for clearing. • Remove alien invasive vegetation and ensure ongoing alien vegetation clearing in the area • No indigenous plants outside of the demarcated work areas may be damaged. • Identify protected tree species, and leave these intact, such as Camelthorn trees. • The noise and vibration caused by the earthmoving equipment will disturb smaller animals. These will move away whilst operations are in progress. Should any animals be encountered these should be moved away by a suitably trained nature conservation officer, if necessary.	VERY LOW
	Soil and sand contamination from hydrocarbons	Loss of soil resource through pollution	Construction	MEDIUM	• Oils and lubricants must be stored within sealed containment structures if kept on site. • Any mechanical equipment maintenance must be undertaken on drip trays or UPVC sheets to prevent spills/ leaks onto the soil. • When not in use, a drip tray must be placed beneath mechanical equipment and vehicles. • Machinery must be kept in good working order and regularly inspected for leaks. • A spill kit will be available on each site where mining activities are in progress. • Any spillages will be cleaned up immediately. • Waste materials generated on site must be stored in suitable lidded containers and removed off site to a suitable disposal facility. • Waste separation must be undertaken if practical for recycling • Provide all workers with environmental awareness training. • Provide a bin at the site. • Regularly dispose of any solid waste at a municipal waste disposal site. • Ensure all workers comply with the requirements of the EMPr. • Provide a mobile ablution facility.	LOW
	Contamination	Loss of soil	Construction	MEDIUM	• After clearing, the affected area shall be	LOW

	and disturbance of soil from compaction and soil disturbance due to topsoil stockpiling	resource			stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Reasonable measures must be undertaken to ensure that any exposed areas are adequately protected against the wind and stormwater run-off. • Top soil shall be removed separately and stockpiled separately from other soil base layers. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Topsoil storage areas must be convex and should not exceed 2m in height. • Topsoil must be treated with care, must not be buried or in any other way be rendered unsuitable for further use (e.g. by mixing with spoil) and precautions must be taken to prevent unnecessary handling and compaction. • In particular, topsoil must not be subject to compaction greater than 1 500 kg/m² and must not be pushed by a bulldozer for more than 50 metres. Trucks may not be driven over the stockpiles. • Reduce drop height of material to a minimum. • Temporarily halt material handling in windy conditions. • A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers using the access road and entering the site will be informed of the speed limit. • Compacted areas that are not required for access shall be scarified after use during decommissioning and rehabilitation.	
	Socio-economic impact on job security, employment creation and	Improvement in people's living standards, and support to local economy through	Construction	MEDIUM (-)	• Employment of local previously disadvantaged labour wherever possible, with provision of training (upskilling).	MEDIUM (+)

	economic spin-offs (positive impact)	supply of building materials in response to demand.				
Sand Mining: Removal of sand from river to an average depth of 1.5 metres; movement of trucks on site to collect sand for removal; waste generation and management	Noise caused by the machinery and vehicles on site, and by vehicles going to and from the sand mining site	Noise nuisance	Operation	LOW	• Ensure sand hauling is during normal working hours and not on weekends • No amplified music shall be allowed on site. • On public roads the vehicles shall adhere to municipal and provincial traffic regulations including speed limits. • Vehicles used on site for the construction related activities shall be maintained and in a good working condition so as to reduce emissions.	VERY LOW
	Visibility of the sand mining operations	Visual intrusion	Operation	LOW	• The laydown areas shall be kept neat and tidy at all times. Equipment must be kept in designated areas and storing/stockpiling shall be kept orderly. • Restrict working hours to normal work day hours with no work over weekends when holidays occur to minimize hauling trucks along access roads.	VERY LOW
	Noise, Dust (vehicle entrained dust) and Vehicle emissions	Dust and noise nuisance and greenhouse emissions	Operation	LOW	• After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of vegetation in river bed should take place to avoid unnecessary exposed surfaces. • Reasonable measures must be undertaken to ensure that any exposed areas are adequately protected against the wind and stormwater run-off. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Reduce drop height of material to a minimum. • Temporarily halt material handling in windy conditions. • A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers using the access road and entering the site will be informed of the speed limit. • Trucks shall have tarpaulins to prevent sand	VERY LOW

					from blowing off in transit.	
	Removal of sand from river bed impacting on river ecosystem	Water Resources functionality (flow regime; water quality and quantity; aquatic biota). The Donkerhoekspruit is a non-perennial river and impacts will have little effect on water resource functionality as a whole. Sand will be washed from upstream to the affected area.	Operation	MEDIUM	• No stockpiling to take place within the drainage channel. • Shaping of river bed to avoid diversion of stormwater towards banks to prevent erosion of river banks, and to prevent channelling of water that would increase erosive capacity of stormwater. • Sand will be washed from upstream to the mining site over time.	LOW
	Wildlife and vegetation disturbance from front end loader and trucks transporting materials.	Effect on biodiversity in a CBA2 area and Ecological Support Area (ESA). Transport of materials will be along existing access tracks resulting in little impact on ecological functioning at a local level during the operation phase. The clearing of alien invasive vegetation is a positive impact, and will benefit and improve the ecological functioning of the	Operation	MEDIUM	• The mining area and stockpile areas must be demarcated and the footprint contained within the demarcated area. • Mining areas to be limited to blocks of 500m at a time with rehabilitation of the bank and access areas required before moving upstream to the next block. • The annual rehabilitation plan must be implemented. • Remove alien invasive vegetation and ensure ongoing alien vegetation clearing in the area. • No indigenous plants outside of the demarcated work areas may be damaged. • Identify protected tree species, and leave these intact, such as Camelthorn trees. • The noise and vibration caused by the earthmoving equipment will disturb smaller animals (e.g. snakes). These will move away whilst operations are in progress. • Should any animals be encountered these should be moved away by a suitably trained nature conservation officer, if necessary.	LOW

		river bed and adjacent areas.				
	River sand contamination from hydrocarbon spills	Loss of soil resource through pollution	Operation	MEDIUM	• Oils and lubricants must be stored within sealed containment structures if kept on site. • Any mechanical equipment maintenance must be undertaken on drip trays or UPVC sheets to prevent spills/ leaks onto the soil. • When not in use, a drip tray must be placed beneath mechanical equipment and vehicles. • Machinery must be kept in good working order and regularly inspected for leaks. • A spill kit will be available on each site where mining activities are in progress. • Any spillages will be cleaned up immediately. • Waste materials generated on site must be stored in suitable lidded containers and removed off site to a suitable disposal facility. • Waste separation must be undertaken if practical for recycling • Provide all workers with environmental awareness training. • Provide a bin at the site. • Regularly dispose of any solid waste at a municipal waste disposal site. • Ensure all workers comply with the requirements of the EMPr. • Provide a mobile ablution facility.	LOW
	Compaction of soil on access tracks and in river bed due to sand mining activities	Loss of soil resource	Operation	MEDIUM	• Compacted areas that are not required for access shall be scarified after use during decommissioning and rehabilitation.	LOW
	Socio-economic impact on job security, employment creation and economic spin-offs (positive impact)	Improvement in people's living standards, and support to local economy through supply of building materials in response to demand.	Operation	MEDIUM (-)	• Employment of local previously disadvantaged labour wherever possible, with provision of training (upskilling).	MEDIUM (+)

Rehabilitation of the sand mining area, scarifying compacted areas and vehicle tracks	Ongoing removal of alien invasive plant species such as *Prosopis sp.*	Rehabilitation	Decommissioning	MEDIUM	• Ongoing removal of alien invasive vegetation	VERY LOW
	Shaping of river profile		Decommissioning	MEDIUM	• Compacted areas shall be scarified after use during decommissioning and rehabilitation. • Any stored topsoil shall be spread over the scarified surface. • Shaping of river bed to avoid steep profiles and hollows.	VERY LOW
	Socio-economic impact on job security, employment creation and economic spin-offs (positive impact)	Rehabilitation	Decommissioning	MEDIUM (-)	• Employment of local previously disadvantaged labour wherever possible, with provision of training (upskilling)	MEDUIM (+)

The supporting impact assessment conducted by the EAP is attached as **Appendix C.**

9.3 Summary of specialist reports

Table 7: Summary of Specialist Reports

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Heritage Impact Assessment attached at Appendix E1	Precolonial/Stone Age material noted at the portion of Jannelsepan investigated in this study was found to be generally of low significance, where present at all. Minimal isolated archaeological finds found in the sand source area within the dry bed of the spruit are in secondary context. Criteria used here for impact significance assessment for archaeological traces rate the impacts as not worthy of further mitigation. Mining should however be limited to the intended zone within the bed of the spruit so as not to disturb possible	**X**	**Section 8.2.10** **EMPr: Table 11**

	materials in in situ sediments alongside the spruit. **Mitigation measures:** Action 1: Provision for on-going heritage monitoring in an environmental management plan which also provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of mining. Responsibility 1: Environmental management provider with on-going monitoring role set up by the mining company for the mining phase and for any instance of periodic or on-going land surface modification thereafter. Timeframe 1: Environmental management plan to be in place before commencement of mining. Action 2: Should unexpected finds be made (e.g. precolonial burials; ostrich eggshell container cache; or localised Stone Age sites with stone tools, pottery; military remains), the relevant Heritage Authority should be contacted. Responsibility 2: Environmental Control Officer should become acquainted at a basic level with the kinds of heritage resources potentially occurring in the area and should report to the Heritage Authority as needed Timeframe 2: In the event of finding any of the features mentioned (Action 2) reporting by the developer to relevant heritage authority should be immediate. Contact: SAHRA Ms N. Higgins 021-4624502 or NC Heritage Resources Authority Mr Andrew Timothy 053-8312537/8074700. Performance Indicator: Inclusion of further heritage impact		

	consideration in any future extension of mining or any infrastructural elements. Monitoring: Officials from relevant heritage authorities (National, Provincial or Local) to be permitted to inspect the site at any time in relation to the heritage component of the management plan.		
Palaeontological Impact Assessment attached at Appendix E2.	The proposed mining area lies on Kalahari sands and ancient volcanic and plutonic rocks of the Namaqua-Natal Province and in particular the Jannelsepan Formation migmatitic amphibolites and calc-silicates and the amphibolites of the Dagbreek Formation. These rocks are too old for body fossils and of the wrong type, being igneous. The sand to be mined is alluvial and would not contain fossils either. As far as the palaeontological heritage is concerned the project can continue and no further assessment is required.	**X**	**Section 8.2.10**

10 ENVIRONMENTAL IMPACT STATEMENT

10.1 Summary of the key findings of the environmental impact assessment

The significance ratings of impacts after mitigation on the key aspects of the "preferred alternative" and the "no go" alternative are shown per Phase in the following tables.

Table 8: Significance Ratings of Impacts after Mitigation during Construction Phase (Site Access and Site Establishment)

IMPACTS AND ASPECTS	PREFERRED AND ONLY ALTERNATIVE (SAND MINING ON 5HA PORTION OF DONKERHOEKSPRUIT ON FARM JANNLESEPAN NO. 39)	NO-GO ALTERNATIVE
1. SOIL EROSION AND COMPACTION: The clearing of laydown areas for site establishment and clearing of existing vegetation will disturb the soil increasing the potential for soil erosion by wind and loss of soil in the event of rainfall. Soil compaction will result from repeated use of access tracks.	**Low / Insignificant Risk**	**N/A**
2. WATER RESOURCE FUNCTIONALITY IN NON-PERENNIAL RIVER: The removal of sand from the river bank at the access points could impact on flow regime, water quality and quantity, and aquatic biota. The Donkerhoekspruit is however, non-perennial and impacts will have little effect on water resource functionality as a whole.	**Low / Insignificant Risk**	**N/A**
3. LOSS OF NATURAL VEGETATION AND ECOLOGICAL FUNCTIONING IMPACTING ON LOCAL BIODIVERSITY IN A CBA2 AND ESA: The existing disturbed area has been identified for **the** laydown area for site establishment. Clearing of existing vegetation in the river bed will result in the loss of vegetation and localized ecological functioning, however this vegetation consists of mostly alien invasive species.	**Very Low / Insignificant Risk**	**N/A**
4. POTENTIAL FOR SOIL AND RIVER SAND CONTAMINATION AND SOLID WASTE POLLUTION	**Low / Insignificant Risk**	**N/A**
5. VISUAL INTRUSION: Caused by the front end loader, topsoil stockpiles, cleared areas, and movement of trucks on site. The site is however, remote and rural in nature with no receptors (people) as it is located on private property.	**Very Low / Insignificant Risk**	**N/A**
6. EMMISSIONS (DUST, VEHICLES & NOISE): Noise and dust will be created by mining equipment (e.g. front end loaders) and vehicles, which will emit Greenhouse Gases.	**Very low / Insignificant Risk**	**N/A**
7. HERITAGE, PALAEONTOLOGICAL AND CULTURAL IMPACTS	**Very Low / Insignificant Risk**	**N/A**
8. CREATION OF EMPLOYMENT & JOB SECURITY WITH LOCAL AND REGIONAL ECONOMIC SPIN-OFFS	**Medium (+)**	**Medium (-)**

Table 9: Significance Ratings of Impacts after Mitigation during Operational Phase (Sand mining and transporting of materials)

IMPACTS AND ASPECTS	PREFERRED AND ONLY ALTERNATIVE (SAND MINING ON 5HA PORTION OF DONKERHOEKSPRUIT ON FARM JANNELSEPAN NO. 39)	NO-GO ALTERNATIVE
1. SOIL EROSION & SOIL COMPACTION: The sand mining process will disturb the river sand increasing the potential for fine particle suspension by wind. Soil compaction will result from repeated use of access tracks.	**Low / Insignificant Risk**	**N/A**
2. WATER RESOURCE FUNCTIONALITY IN A NON-PERENNIAL RIVER: The removal of sand from the river channel could impact on flow regime, water quality and quantity, and aquatic biota. The Donkerhoekspruit is however, non-perennial and impacts will have little effect on water resource functionality as a whole, as there is no permanent surface water, and storm water run-off events are very seldom in the arid climate. Sand will be transported downstream into the mined area over time.	**Low / Insignificant Risk**	**N/A**
3. LIMITED LOSS OF NATURAL VEGETATION AND DISTURBANCE OF ECOLOGICAL FUNCTIONING IN A CBA2 & ESA: The clearing of existing vegetation in the river bed will result in the loss of vegetation and localised ecological functioning. However, the existing vegetation is mostly alien invasive species and biodiversity will improve as a result. Transport of materials will be along existing access tracks resulting in little impact on ecological functioning at a local level during the operation phase. The Front End Loader will disturb local fauna.	**Low / Insignificant Risk**	**N/A**
4. POTENTIAL FOR SOIL AND RIVER SAND CONTAMINATION AND SOLID WASTE POLLUTION	**Low / Insignificant Risk**	**N/A**
5. VISUAL INTRUSION: Caused by the front end loader, topsoil stockpiles, cleared areas, and movement of trucks on site. The site is however, remote and rural in nature with no receptors (people) as it is located on private property.	**Very Low / Insignificant Risk**	**N/A**
6. EMMISSIONS (DUST, VEHICLES & NOISE): Noise and dust will be created by mining equipment (e.g. front end loaders) and vehicles, which will emit Greenhouse Gases.	**Very Low / Insignificant Risk**	**N/A**
7. HERITAGE, PALAEONTOLOGICAL AND CULTURAL IMPACTS	**Very Low / Insignificant Risk**	**N/A**
8. CREATION OF EMPLOYMENT & JOB SECURITY WITH LOCAL AND REGIONAL ECONOMIC SPIN-OFFS	**Medium (+)**	**Medium (-)**

All of the negative identified impacts will occur for a limited period and the extent of the negative impacts will be localised. All of the identified impacts can be suitably mitigated. There is a correlation between cumulative impacts post mitigation, and significance rating of impacts after mitigation as indicated in **Appendix C**.

10.2 Final Site Map

Refer to the proposed site plan attached as **Diagram 3**.

10.3 Summary of the positive and negative impacts and risks of the proposed activity and identified alternatives

Refer to Section 10.1 above.

10.4 Proposed impact management objectives and the impact management outcomes for inclusion in the EMPr

10.4.1 Management Objectives

The proposed impact management objectives are listed below:

- Objective 1 - To create a safe and rehabilitated post-mining environment.
  - Ensure safe mining area with no potentially dangerous areas like deep excavations.
  - The site in the river bed is to be shaped and levelled at each stage of closure and rehabilitation.
  - Topsoil to be stockpiled and replaced during decommissioning and closure, and rehabilitation.

- Objective 2 - To minimise pollution or degradation of the environment
  - Provide sufficient information and guidance to plan the sand mining activities in a manner that would reduce impacts as far as practically possible.
  - Limit residual environmental impact with no surface water or soil contamination by ensuring that no fuel or oil spills occur in the mining area.
  - Ensure that no solid waste or rubble is dumped on the site.
  - Ensure that portable toilets are used.

- Objective 3 – To minimise impacts on the community and to provide optimal post-mining social opportunities
  - Ensure that workers remain within the mining permit area.
  - Operate during normal working hours only.
  - Minimise the generation of noise and dust.
  - Respond rapidly to any complaints received.
  - Minimal negative aesthetic impact
  - Optimised benefits for the social environment

10.4.2 Outcomes

- By providing sufficient information to strategically plan the sand mining activities, unnecessary social and environmental impacts be avoided.
- Ensure an approach that will provide the necessary confidence in terms of environmental compliance.
- Provide a management plan that is effective and practical for implementation.
- Through the implementation of the proposed mitigation measures it is anticipated that the identified social and environmental impacts can be managed and mitigated effectively.
- Noise generation can be managed through consultation and restriction of operating hours and by maintaining equipment and applying noise abatement equipment if necessary.
- Visual intrusion can be managed through natural vegetation or shade cloth, etc.
- Dust fall can be managed by reducing driving speeds when driving on unpaved roads.
- Wildlife disturbance and clearance of vegetation will be limited to the absolute minimum required and disturbed areas will be re-vegetated with locally indigenous species as soon as possible.
- Surface water and groundwater contamination by hydrocarbons can be managed by conducting proper vehicle maintenance, refueling with care to minimise the chance of spillages and by having a spill kit available on each site where sand mining activities are in progress.

10.5 Aspects for inclusion as conditions of Authorisation

- All mining and rehabilitation to be conducted as per the approved EMPr, and Rehabilitation, Decommissioning and Closure Plan (**Appendix D**).
- Concurrent mining and rehabilitation must be done in the designated mining blocks.
- The proposed mining area must be clearly demarcated with semi-permanent markers.
- The upper 50cm of soil must be removed and stockpiled to be returned after mining by spreading evenly over the mined area.
- Eradicate all alien vegetation in the area during and regularly after mining.
- The sand mining operator must appoint a suitably qualified ECO who will be responsible for ensuring compliance with the requirements of the EMPr during the mine operation and decommissioning.
    - The ECO must:
        - Inspect the site and record compliance with the EMPr;
        - Inform key, on-site staff of their roles and responsibilities in terms of the EMPr;
        - Ensure that all activities on site are undertaken in accordance with the EMPr;
        - Immediately notify the mine operator of any non-compliance with the EMPr, or any other issues of environmental concern.
- Should any burials or other historical material be encountered during construction, work must cease immediately and SAHRA must be contacted.
- The mine operation must follow an Integrated Waste Management approach. Control measures must be implemented to prevent pollution of any water resource or soil surface by oil, grease, fuel or chemicals. Appropriate pollution prevention measures must be implemented to prevent dust.
- A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers will be informed of the speed limit applicable to the length of the access road off the N14 where after the national speed limits will be applicable for hauling trucks. The access road will be maintained during operational activities.

10.6 Description of any assumptions, uncertainties and gaps in knowledge

- The desk-top research included reference to the SANBI BGIS database map viewer for the various baseline environmental attributes, and any assumptions or gaps in knowledge expressed by SANBI in the provision of this information would be applicable to this information as referenced.
- It is assumed that the proposed mitigation measures as listed in this report and included in the EMPr will be implemented and adhered to. Mitigation measures are proposed which are considered to be reasonable and must be implemented in order for the outcome of the assessment to be accurate.

10.7 Reasoned opinion as to whether the proposed activity should or should not be authorised

10.7.1 Reasons why the activity should be authorized or not

It is the opinion of the EAP that the proposed sand mining activity should be authorised. In reaching this conclusion the EAP has considered that:

- The “preferred alternative” takes into account location alternatives, activity alternatives, layout alternatives, technology alternatives and operational alternatives.
- The approach taken is that it is preferable to avoid significant negative environmental impacts, wherever possible. There are no significant environmental impacts associated with the proposed activity.
- The site is located in a Critical Biodiversity 2 Area and Ecological Support Area (ESA). The river classification of the Donkerhoekspruit is a Category C (Moderately Modified). It is the opinion of the EAP that the underlying biodiversity objectives and ecological functioning will not be compromised, subject to the strict adherence to the EMPr and Rehabilitation, Decommissioning and Closure Plan (**Appendix D**).
- No negative impacts have been identified that are so severe as to prevent the proposed mining activity from taking place. The activity has been assessed to have a positive socio-economic impact, especially in terms of the creation of employment and the provision of building sand at a local and district level for the renewable energy sector.
- Provided the recommended mitigation measures are implemented and mining activities are managed in accordance with the stipulations of the EMPr, and Rehabilitation, Decommissioning and Closure Plan

(**Appendix D**), in an environmentally sound manner, the potential negative impacts associated with the implementation of the preferred alternative can be reduced to acceptable levels.

10.7.2 Conditions that must be included in the authorisation

As per section 10.5 above:

- All mining and rehabilitation to be conducted as per the approved EMPr, and Rehabilitation, Decommissioning and Closure Plan (**Appendix D**).
- Concurrent mining and rehabilitation must be done in the designated mining blocks.
- The proposed mining area must be clearly demarcated with semi-permanent markers.
- The upper 50cm of soil must be removed and stockpiled to be returned after mining by spreading evenly over the mined area.
- Eradicate all alien vegetation in the area during and regularly after mining.
- The sand mining operator must appoint a suitably qualified ECO who will be responsible for ensuring compliance with the requirements of the EMPr during the mine operation and decommissioning.
    - The ECO must:
        - Inspect the site and record compliance with the EMPr;
        - Inform key, on-site staff of their roles and responsibilities in terms of the EMPr;
        - Ensure that all activities on site are undertaken in accordance with the EMPr;
        - Immediately notify the mine operator of any non-compliance with the EMPr, or any other issues of environmental concern.
- Should any burials or other historical material be encountered during construction, work must cease immediately and SAHRA must be contacted.
- The mine operation must follow an Integrated Waste Management approach. Control measures must be implemented to prevent pollution of any water resource or soil surface by oil, grease, fuel or chemicals. Appropriate pollution prevention measures must be implemented to prevent dust.
- A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers will be informed of the speed limit applicable to the length of the access road off the N14 where after the national speed limits will be applicable for hauling trucks. The access road will be maintained during operational activities.

10.7.3 Period for which the Environmental Authorisation is required

The authorisation is required for the duration of the sand mining permit which is an initial 2 years plus a potential to extend the permit by an additional 3 years. Normally there is also a time delay in the granting of applications for renewal therefore a total period of 10 years may be required.

10.7.4 Undertaking

It is confirmed that the undertaking required to meet the requirements of this section is provided at the end of the EMPr and is applicable to both the Basic Assessment Report (BAR) and the Environmental Management Programme report (EMPr).

11 FINANCIAL PROVISION

11.1 Legal Framework

With the repeal of Section 41 of the MPRDA (Act 28 of 2002) that requires that the owner of a mine must make financial provision for the remediation of environmental damage, regulations pertaining to the financial provision for prospecting, exploration, mining or production operations under section 44, read with sections 24 of the National Environmental Management Act, 1998 (Act No.107 of 1998) were issued in 2015.

According to regulation 7 the applicant or holder of a right or permit must ensure that the financial provision is, at any given time, equal to the sum of the actual costs of implementing the plans and report contemplated in regulation 6 and regulation 11(1). In terms of regulation 11(1) the holder of a right or permit must ensure that a review is undertaken of the requirements for:
(a) annual rehabilitation, as reflected in an annual rehabilitation plan;
(b) rehabilitation, decommissioning and closure of the prospecting, exploration, mining or production operations at the end of the life of operations as reflected in a final rehabilitation, decommissioning and mine closure plan; and,
(c) remediation of latent or residual environmental impacts which may become known in the future, including the pumping and treatment of polluted or extraneous water, as reflected in an environmental risk assessment report.

11.2 Calculation

Financial provision in terms of reg. 6(c) are covered by the requirements for the actual costs of implementation of the measures required for rehabilitation, decommissioning and closure of the mining operations at the end of the life of operations as reflected in the Rehabilitation, Decommissioning and Mine closure plan in terms of regulation 6(b) and attached as **Appendix F**.

Table 10: Table of Costs for Final Rehabilitation, Decommissioning and Closure of the Mining Operations

Closure Element Mitigating measures	Unit	No Units	Unit Cost	Cost per Element
Remove all stockpiles	Ha	2.5	R2,053.54	R5,133.85
Compacted area - Stockpile and hauling area (ripping & levelling)	Ha	2.5	R1,000.00	R2,500.00
Area covered by normal surface disturbance roads (ripping & levelling)	Ha	5	R1,000.00	R5,000.00
Spread topsoil dumps over ripped areas	Ha	5	R2,053.54	R10,267.70
Reinstate original profile of the riverbank by back filling of access points with the original material excavated	Ha	1	R2,053.54	R2,053.54
Promote re-vegetation of bank with natural riparian vegetation (ripping & levelling)	Ha	2	R1,000.00	R2,000.00
Prompt rehabilitation and maintenance of erosion events	Refer annual rehab plan			
Preventing attenuating or diverting any of the natural flow	Refer annual rehab plan			
Prevent canalisation of the flow	Refer annual rehab plan			
Levelling of the river bed to prevent impeding and damming upstream	Refer annual rehab plan			
Final clean-up	Ha	5	R76.04	R380.20
Annual rehabilitation plan	Year 1			R14,750.00
Total financial provision required to fully decommission and rehabilitate the mining operation				**R42,085.29**

11.3 Explain how the aforesaid amount was derived

According to regulation 6 an applicant must determine the financial provision through a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required for:
(a) annual rehabilitation, as reflected in an annual rehabilitation plan;
(b) rehabilitation, decommissioning and closure of the prospecting, exploration, mining or production operations at the end of the life of operations, as reflected in a final rehabilitation, decommissioning and mine closure plan; and,
(c) remediation of latent or residual environmental impacts which may become known in the future, including the pumping and treatment of polluted or extraneous water, as reflected in an environmental risk assessment report.

11.4 Confirm that this amount can be provided for from operating expenditure

The amount needed for the implementation of the rehabilitation, decommissioning and closure plan will be provided to DMR in the form of a bank guarantee and the plan will be revised on an annual basis in terms of regulation 11(1) of the NEMA Financial Regulations 2015.

Provision for implementation of the annual rehabilitation plan is to be provided as part of the environmental audit report in terms of Regulation 34 (1)(b) of the NEMA EIA Regulations (2014) will be provided as part of the operational budget. Proof of access to the necessary fund will be provided as part of the Mine Works Plan (MWP) together with proof of access to the necessary financial resources.

12 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

12.1 Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998)

The EIA report must include the:-

(1) Impact on the socio-economic conditions of any directly affected person
A full consultation process is being implemented during the environmental authorisation process. The purpose of the consultation is to provide affected persons the opportunity to raise any potential concerns. Concerns raised will be captured and addressed within the public participation section of this report (attached as **Appendix B**) to inform the decision-making process.

2) Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act
Refer to the Heritage Impact Assessment attached at **Appendix E1** and the Palaeontological Impact Assessment attached at **Appendix E2**.
Comments from SAHRA will be included in the Final Scoping Report.

12.2 Other matters required in terms of sections 24(4)(a) and (b) of the Act

A motivation for investigating the reasonable and feasible alternatives is provided in Section 8 above.

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

13 DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

13.1 Details of the EAP

This is addressed in Section 1.1 above.

13.2 Description of the Aspects of the Activity

This is addressed in Part A, Sections 9 and 10 above.

13.3 Composite Map

This is addressed in Section 8 above, and the Site Plan is attached as **Diagram 3**.

13.4 Description of Impact management objectives including management statements

This is addressed in Section 10.4 above.

13.5 Determination of closure objectives

This is addressed in Section 10.4 above.

13.6 Volumes and rate of water use required for the operation

The proposed sand mining activity does not require water for operation.

13.7 Has a water use license has been applied for?

An application for a General Authorisation in terms of GN 509 of 2016 for Section 21(c) and (i) has been submitted to DWS.

13.8 Impacts to be mitigated in their respective phases

Table 11: Measures to rehabilitate the environment affected by the undertaking of any listed activity

ACTIVITIES	PHASE	SIZE AND SCALE of disturbance	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
SITE ACCESS (use of existing farm tracks; access points to river bed) & SITE ESTABLISHMENT	CONSTRUCTION	Total footprint is 5ha	**Impact 1: Soil erosion & soil compaction** • After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Reasonable measures must be undertaken to ensure that any exposed areas are adequately protected against the wind and stormwater run-off. • Top soil shall be removed separately and stockpiled separately from other soil base layers. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Topsoil storage areas must be convex and should not exceed 2m in height. • Topsoil must be treated with care, must not be buried or in any other way be rendered unsuitable for further use (e.g. by mixing with spoil) and precautions must be taken to prevent unnecessary handling and compaction. • In particular, topsoil must not be subject to compaction greater than 1 500 kg/m² and must not be pushed by a bulldozer for more than 50 metres. Trucks may not be driven over the stockpiles. • Reduce drop height of material to a minimum. • Temporarily halt material handling in windy conditions. • A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers using the access road and entering the site will be informed of the speed limit. • Compacted areas that are not required for access shall be scarified after use during decommissioning and rehabilitation. **Impact 2: Water resource functionality** • Topsoil at access point to be removed prior during construction phase, and replaced	NEMA Section 2 Principles Environmental Authorisation	Start of activity and continuous as mining progresses over the site during construction period (site access and site establishment activities) Upon cessation of each activity where applicable. Immediately in the event of spills

			during rehabilitation. • After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Top soil shall be removed separately and stockpiled separately from other soil base layers. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Topsoil storage areas must be convex and should not exceed 2m in height. • Topsoil must be treated with care, must not be buried or in any other way be rendered unsuitable for further use (e.g. by mixing with spoil) and precautions must be taken to prevent unnecessary handling and compaction. • In particular, topsoil must not be subject to compaction greater than 1 500 kg/m² and must not be pushed by a bulldozer for more than 50 metres. Trucks may not be driven over the stockpiles. • Temporarily halt material handling in windy conditions. • Rehabilitation of the river banks at each access point as soon as that section of the river has been mined. • Compacted areas are to be scarified. • Shaping of river bank to be returned to original profile.		
			Impact 3: Impact on biodiversity • Identify existing disturbed patches for laydown areas, and demarcate areas for clearing. Refer to **Diagram 3** which indicates that existing farm tracks will be used, and disturbed areas have been earmarked for laydown areas. • Remove alien invasive vegetation and ensure ongoing alien vegetation clearing in the area. • No indigenous plants outside of the demarcated work areas may be damaged. • Identify protected tree species, and leave these intact, such as Camelthorn trees. • The noise and vibration caused by the earthmoving equipment will disturb smaller animals. These will move away whilst operations are in progress. Should any animals be encountered these should be moved away by a suitably trained nature conservation officer, if necessary.		
			Impact 4: Contamination & Pollution • Oils and lubricants must be stored within sealed containment structures if kept on site. • Any mechanical equipment maintenance must be undertaken on drip trays or UPVC sheets to prevent spills/ leaks onto the soil. • When not in use, a drip tray must be placed beneath mechanical equipment and vehicles. • Machinery must be kept in good working order and regularly inspected for leaks. • A spill kit will be available on each site where mining activities are in progress. • Any spillages will be cleaned up immediately. • Waste materials generated on site must be stored in suitable lidded containers and removed off site to a suitable disposal facility. • Waste separation must be undertaken if practical for recycling • Provide all workers with environmental awareness training. • Provide a bin at the site. • Regularly dispose of any solid waste at a municipal waste disposal site. • Ensure all workers comply with the requirements of the EMPr.		

			Provide a mobile ablution facility. **Impact 5: Visual landscape** • The laydown areas shall be kept neat and tidy at all times. Equipment must be kept in designated areas and storing/stockpiling shall be kept orderly. • Restrict working hours to normal work day hours with no work over weekends when holidays occur to minimize hauling trucks along access roads. **Impact 6: Emissions** • The Contractor shall adhere to the local by-laws and regulations regarding the noise and associated hours of operations. • The Contractor shall limit noise levels (e.g. install and maintain silencers on machinery). The provisions of SANS 1200A Sub clause 4.1 regarding "built-up" area shall apply to all areas within audible distance of residents whether in urban, peri-urban or rural areas. • Construction and demolition activities generating output of 85dB or more, shall be limited to normal working hours and not allowed during weekends to limit the impact of noise of neighbours. Should the Contractor need to work outside normal working hours, the surrounding neighbours shall be informed prior to the work taking place. • No amplified music shall be allowed on site. • On public roads adjacent to the site vehicles shall adhere to municipal and provincial traffic regulations including speed limits. • Vehicles used on site for the construction related activities shall be maintained and in a good working condition so as to reduce emissions. • Stockpiles must be maintained (covered where necessary) to avoid wind erosion of the material. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. **Impact 7: Heritage resources** • **Action 1**: Provision for on-going heritage monitoring in an environmental management plan which also provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of mining. • Responsibility 1: Environmental management provider with on-going monitoring role set up by the mining company for the mining phase and for any instance of periodic or on-going land surface modification thereafter. • Timeframe 1: Environmental management plan to be in place before commencement of mining. • **Action 2:** Should unexpected finds be made (e.g. precolonial burials; ostrich eggshell container cache; or localised Stone Age sites with stone tools, pottery; military remains), the relevant Heritage Authority should be contacted. • Responsibility 2: Environmental Control Officer should become acquainted at a basic level with the kinds of heritage resources potentially occurring in the area and should report to the Heritage Authority as needed • Timeframe 2: In the event of finding any of the features mentioned (in Action 2), reporting by the developer to relevant heritage authority should be immediate. Contact: SAHRA Ms N. Higgins 021-4624502 or NC Heritage Resources Authority Mr		

			Andrew Timothy 053-8312537/8074700. • Performance Indicator: Inclusion of further heritage impact consideration in any future extension of mining or any infrastructural elements. • Monitoring: Officials from relevant heritage authorities (National, Provincial or Local) to be permitted to inspect the site at any time in relation to the heritage component of the management plan. **Impact 8: Socio-economic** • Employment of local previously disadvantaged labour wherever possible, with provision of training (upskilling)		
Mining of sand material (extraction, loading and hauling)	OPERATION	Total footprint is 5ha: average depth of 1.5 metres	**Impact 1: Soil erosion & soil compaction** • After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of vegetation in river bed should take place to avoid unnecessary exposed surfaces. • Reasonable measures must be undertaken to ensure that any exposed areas are adequately protected against the wind and stormwater run-off. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Reduce drop height of material to a minimum. • Temporarily halt material handling in windy conditions. • A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers using the access road and entering the site will be informed of the speed limit. • Compacted areas that are not required for access shall be scarified after use during decommissioning and rehabilitation. • Planting of indigenous vegetation in areas under rehabilitation. **Impact 2: Water resource functionality** • No equipment may be parked within the drainage channel when not in use. • No stockpiling to take place within the drainage channel. • Shaping of river bed to avoid diversion of stormwater towards banks to prevent erosion of river banks, and to prevent channelling of water that would increase erosive capacity of stormwater. • Sand will be washed from upstream to the mining site over time. **Impact 3: Impact on biodiversity** • Identify existing access tracks. Refer to **Diagram 3**, which indicates that existing farm tracks will be used. • Demarcate areas for clearing in the river bed. • The mining area and stockpile areas must be demarcated and the footprint contained within the demarcated area. • Mining areas to be limited to blocks of 500m at a time with rehabilitation of the bank and access areas required before moving upstream to the next block. • The annual rehabilitation plan must be implemented. • Remove alien invasive vegetation, and ensure ongoing alien vegetation clearing in the area. • No indigenous plants outside of the demarcated work areas may be damaged. • Identify protected tree species, and leave these intact, such as Camelthorn trees.	NEMA Section 2 Principles Environmental Authorisation	During the estimated 5 year lifespan of the mine. Start of activity and continuous as mining progresses over the site during operational period. Upon cessation of each activity where applicable. Immediately in the event of spills.

			• The noise and vibration caused by the earthmoving equipment will disturb smaller animals (e.g. snakes). These will move away whilst operations are in progress. Should any animals be encountered these should be moved away by a suitably trained nature conservation officer, if necessary. **Impact 4: Contamination & Pollution** • Oils and lubricants must be stored within sealed containment structures if kept on site. • Any mechanical equipment maintenance must be undertaken on drip trays or UPVC sheets to prevent spills/ leaks onto the soil. • When not in use, a drip tray must be placed beneath mechanical equipment and vehicles. • Machinery must be kept in good working order and regularly inspected for leaks. • A spill kit will be available on each site where mining activities are in progress. • Any spillages will be cleaned up immediately. • Waste materials generated on site must be stored in suitable lidded containers and removed off site to a suitable disposal facility. • Waste separation must be undertaken if practical for recycling • Provide all workers with environmental awareness training. • Provide a bin at the site. • Regularly dispose of any solid waste at a municipal waste disposal site. • Ensure all workers comply with the requirements of the EMPr. • Provide a mobile ablution facility. **Impact 5: Visual landscape** • The laydown areas shall be kept neat and tidy at all times. Equipment must be kept in designated areas and storing/stockpiling shall be kept orderly. • Restrict working hours to normal work day hours with no work over weekends when holidays occur to minimize hauling trucks along access roads. **Impact 6: Emissions** • Ensure sand hauling is during normal working hours and not on weekends • No amplified music shall be allowed on site. • On public roads the vehicles shall adhere to municipal and provincial traffic regulations including speed limits. • Vehicles used on site for the construction related activities shall be maintained and in a good working condition so as to reduce emissions. **Impact 7: Heritage resources** • **Action 1**: Provision for on-going heritage monitoring in an environmental management plan which also provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of mining. • Responsibility 1: Environmental management provider with on-going monitoring role set up by the mining company for the mining phase and for any instance of periodic or on-going land surface modification thereafter. • Timeframe 1: Environmental management plan to be in place before commencement of mining. • **Action 2:** Should unexpected finds be made (e.g. precolonial burials; ostrich eggshell container cache; or localised Stone Age sites with stone tools, pottery; military remains), the relevant Heritage Authority should be contacted.		

			• Responsibility 2: Environmental Control Officer should become acquainted at a basic level with the kinds of heritage resources potentially occurring in the area and should report to the Heritage Authority as needed • Timeframe 2: In the event of finding any of the features mentioned (in Action 2), reporting by the developer to relevant heritage authority should be immediate. Contact: SAHRA Ms N. Higgins 021-4624502 or NC Heritage Resources Authority Mr Andrew Timothy 053-8312537/8074700. • Performance Indicator: Inclusion of further heritage impact consideration in any future extension of mining or any infrastructural elements. • Monitoring: Officials from relevant heritage authorities (National, Provincial or Local) to be permitted to inspect the site at any time in relation to the heritage component of the management plan. **Impact 8: Socio-economic** • Employment of local previously disadvantaged labour wherever possible, with provision of training (upskilling)		
Final Rehabilitation and removal of temporary infrastructure	DECOMMISSIONING	Less than 5ha	• Implementation of Final Rehabilitation, Decommissioning and Mine Closure Plan. • Compacted areas shall be scarified after use during decommissioning and rehabilitation. • Any stored topsoil shall be spread over the scarified surface. • Shaping of river bed to avoid steep profiles and hollows. • Ongoing removal of alien invasive vegetation. • Planting of indigenous vegetation.	NEMA Section 2 Principles Environmental Authorisation	

13.9 Impact Management Outcomes

Table 12: Impact Management Outcomes

ACTIVITY (whether listed or not listed).	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	MITIGATION TYPE	STANDARD TO BE ACHIEVED
Site access	Disturbance of river bank at access points	Water resources functionality in a non-perennial river	Construction	Remedy through restriction and rehabilitation	Impacts minimised and mitigated. End use objectives achieved through rehabilitation.
	Disturbance of fauna and flora	Biodiversity in an CBA2 & ESA		Remedy through restriction and rehabilitation	
	Soil compaction and erosion	Soil resource		Control through monitoring and management	
Site establishment, including waste generation and management	Visibility	Visual intrusion	Construction	Control through monitoring and management	Impacts minimised and mitigated. End use objectives achieved through rehabilitation.
	Emissions (dust, noise & vehicles)	Noise & Air quality		Control through monitoring and management	
	Disturbance of fauna and flora	Biodiversity in an CBA2 & ESA		Remedy through restriction and rehabilitation	
	Soil and sand contamination, soil compaction and disturbance	Soil resource		Remedy through restriction and rehabilitation & control through monitoring and management	
	Destruction or loss of Heritage resources	Cultural and Heritage		Avoidance by relocation of activity if required	Impact avoided
Removal of sand, loading and hauling, waste generation ad management	Visibility	Visual	Operation	Control through monitoring and management	Impacts minimised and mitigated. End use objectives achieved through rehabilitation.
	Emissions (dust, noise & vehicles)	Noise & Air quality		Control through monitoring and management	
	Disturbance of fauna and flora	Biodiversity in an CBA2 & ESA		Remedy through restriction and rehabilitation	
	Soil and sand contamination, soil compaction and disturbance	Soil resource		Remedy through restriction and rehabilitation & control through monitoring and management	
	Disturbance of river bed; sand extraction	Water resources functionality in a non-perennial			

		river			
	Destruction or loss of Heritage resources	Cultural and Heritage		Avoidance by removing sand only in river bed and not banks.	Impact avoided
Removal of temporary infrastructure and site rehabilitation	Dust emissions (vehicle entrained dust)	Soil resource	Decommissioning	Control through monitoring and management	Impacts minimised and mitigated.
	Soil erosion due to slow recovery of vegetation	Soil resource & biodiversity		Remedy through restriction and rehabilitation & control through monitoring and management	End use objectives achieved through rehabilitation.
	River bed profile	Water resources functionality in a non-perennial river.			

13.10 Impact Management Actions

Table 13: Impact Management Actions

ACTIVITY whether listed or not listed.	**POTENTIAL IMPACT**	**MITIGATION TYPE**	**TIME PERIOD FOR IMPLEMENTATION**	**COMPLIANCE WITH STANDARDS**
Site access	Disturbance of river bank at access points	Remedy through restriction and rehabilitation Control through monitoring and management	Concurrently with site access activities Upon cessation of activity	Remain within the ambit of the Mining Permit Programme and Environmental Authorisation
	Disturbance of fauna and flora			
	Soil compaction and erosion			
Site establishment, including waste generation and management	Visibility	Control through monitoring and management		
	Emissions (dust, noise & vehicles)			
	Disturbance of fauna and flora	Remedy through restriction and rehabilitation		
	Soil and sand contamination, soil compaction and disturbance	Remedy through restriction and rehabilitation & control through monitoring and management		
	Destruction or loss of Heritage resources	Avoidance		
Removal of sand, loading and hauling, waste generation ad management	Visibility	Control through monitoring and management	Concurrently with site access activities Upon cessation of activity	Remain within the ambit of the Mining Permit Programme and Environmental Authorisation
	Emissions (dust, noise & vehicles)	Control through monitoring and management		

	Disturbance of fauna and flora	Remedy through restriction and rehabilitation		
	Soil and sand contamination, soil compaction and disturbance	Remedy through restriction and rehabilitation & control through monitoring and management		
	Disturbance of river bed; sand extraction			
	Destruction or loss of Heritage resources	Avoidance		
Removal of temporary infrastructure and site rehabilitation	Dust emissions (vehicle entrained dust)	Control through monitoring and management	Upon cessation of activity	Remain within the ambit of the Mining Permit Programme and Environmental Authorisation
	Soil erosion due to slow recovery of vegetation	Remedy through restriction and rehabilitation & control through monitoring and management		
	River bed profile			

14 FINANCIAL PROVISION

14.1 Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under the Regulation

- Objective 1 - To create a safe and rehabilitated post-mining environment:
  - Ensure safe mining area with no potentially dangerous areas like deep excavations.
  - The site in the river bed is to be shaped and levelled at each stage of closure and rehabilitation.
  - Topsoil to be stockpiled and replaced during decommissioning and closure, and rehabilitation.
- Objective 2 - To minimise pollution or degradation of the environment:
  - Provide sufficient information and guidance to plan the sand mining activities in a manner that would reduce impacts as far as practically possible.
  - Limit residual environmental impact with no surface water or soil contamination by ensuring that no fuel or oil spills occur in the mining area.
  - Ensure that no solid waste or rubble is dumped on the site.
  - Ensure that portable toilets are used.
- Objective 3 – To minimise impacts on the community and to provide optimal post-mining social opportunities:
  - Ensure that workers remain within the mining permit area.
  - Operate during normal working hours only.
  - Minimise the generation of noise and dust.
  - Respond rapidly to any complaints received.
  - Minimal negative aesthetic impact
  - Optimised benefits for the social environment

14.2 Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties

The closure objectives are included in this Draft BAR and in the Rehabilitation, Decommissioning and Mine Closure Plan (**Appendix D**), which is being made available to all registered Interested and Affected parties.

14.3 Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure

Refer to the Rehabilitation, Decommissioning and Mine Closure Plan, which includes the Environmental Risk Assessment in **Appendix D**.

14.4 Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives

The closure objectives are to return the land disturbed by sand mining activities back to its original condition. The rehabilitation plan provides the detail on how this will be achieved as detailed in **Appendix D**.

14.5 Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

Refer to Part A, Section 11.2 of this report.

14.6 Confirm that the financial provision will be provided as determined

Refer to Part A, Section 11.4 of this report.

14.7 Mechanisms for monitoring compliance with and performance assessment against the Environmental Management Programme and reporting

Table 14: Mechanisms for Monitoring Compliance

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
All mining activities	All commitments contained in the BA Report and accompanying EMPr.	Ensure commitments made within the approved BAR and EMPr are being adhered to.	Site Manager and EAP.	**Annual** Undertake and submit an environmental performance audit to DMR
Site access and site establishment	Visual inspection of soil erosion and/or compaction	All exposed areas, access roads and soil stockpiles must be monitored for erosion on a regular basis, specifically after rainfall events.	Site Manager and Independent EAP	**Weekly, and after rain-fall events** Weekly monitoring reports to be signed-off by the Site Manager Corrective action to be confirmed and signed-off by the Site Manager. Consolidated monthly monitoring reports (including confirmation of corrective action taken, with photographic evidence) to be submitted to the Site Manager.
Sand Mining	Visual inspection of biodiversity impacts Visual inspection of water resource functionality Visual inspection of waste management, housekeeping and maintenance.	Visual inspection of sand mining activities and other possible secondary impacts • Control and prevent the development of new access tracks. • Control and prevent growth of alien vegetation in cleared areas and on stockpiles. • Standard waste management practices must be implemented to prevent contamination and littering. • All spill incidents will be reported and corrective action taken in accordance with an established spill response procedure.	Site Manager & Contractor (or sub-contractors)	**Daily** Weekly monitoring reports to be signed-off by the Site Manager. Corrective action to be confirmed and signed-off by the Project Site Manager. Consolidated monthly monitoring reports (including confirmation of corrective action taken, with photographic evidence) to be submitted. Report incidents in terms of the relevant legislation, including the MPRDA, NWA and NEMA.
Closure & Rehabilitation	Revegetation; Stability; River profile; Soil erosion; Alien invasive species	Inspection of all rehabilitated areas to assess whether soil erosion is occurring and to implement corrective action where required.	Site Manager	**Bi-Annual** A final audit report for site closure must be submitted to the DMR for approval.

14.8 Indicate the frequency of the submission of the performance assessment/ environmental audit report.

An external environmental performance audit and the BA & EMPr performance assessment shall be conducted annually interchangeably by an independent environmental assessment practitioner.

15 ENVIRONMENTAL AWARENESS PLAN

15.1 Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

Environmental awareness and training includes:

- Awareness training for contractors and employees.
- Job specific training – training for personnel performing tasks which could cause potentially significant environmental impacts.
- Comprehensive training – on emergency response, spill management, etc.
- Specialised skills.
- Training verification and record keeping.

Before commencement of the sand mining activities all employees and contractors who are involved with such activities should attend relevant induction and training. It is standard practice for employees and the employees of contractors that will be working on a new project or at a new site to attend an induction course where the nature and characteristics of the project and the site are explained.
The training course should include key information abstracted from the EMPr pertaining to the potential environmental impacts, the mitigation measures that will be applied, the monitoring activities that will be undertaken and the roles and responsibilities of contractors' and personnel.
The EMPr document will also be made available to attendees.

15.2 Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

Environmental risks and how to manage them are dealt with in the induction course referred to in Section 15.1 above. Should an incident of environmental pollution or damage occur it will be analysed and appropriate prevention and/or mitigation measures developed. These measures will be added to the EMPr and conveyed to the relevant personnel.
All unplanned incidents with the potential to cause pollution or environmental degradation or conflict with local residents will be reported to the Mineral Resources Manager within 24 hours.

Hydrocarbon Spills
Hydrocarbon spills that are considered to be emergency incidents are large-scale spills (cover a surface area >1m²), resulting from situations such as: a leaking diesel bowser; an oil drum that is knocked over; and, large spillages from equipment.
Activities that are involved in the clean-up of such instances include:

- The containment of the spill;
- The removal of all contaminated material; and,
- The disposal (at a licensed hazardous disposal facility) or bioremediation (at a licensed facility) of this material.

Fire
There is the potential for fire to occur in the following locations of the sand mining site:

- Veld fires across vegetated areas; and
- Vehicles and equipment.

Veld fires: Any person who observes the fire must report it to the fire brigade immediately and then to their supervisor. If possible, additional personnel may be sent to contain the fire, but only if the lives of the personnel will not be endangered.
Vehicles and Equipment: Fire extinguishers will be available at the site where sand mining activities will take place and in the vehicles. All staff members will be trained in the use of fire-fighting equipment.

15.3 Specific information required by the Competent Authority

Not applicable at this stage.

16 UNDERTAKING

The EAP herewith confirms

The correctness of the information provided in the reports;	**X**
The inclusion of comments and inputs from stakeholders and I&APs; **(to be included in Final BAR)**	**N/A**
The inclusion of inputs and recommendations from the specialist reports where relevant; and	**X**
That the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties are correctly reflected herein. **(to be included in Final BAR)**	**N/A**

Signature of the environmental assessment practitioner:

Green Direction Sustainability Consulting (Pty) Ltd

Name of company:

19 March 2018

Date:

-END-

17 APPENDIX A: CV OF EAP

Summary of the Environmental Assessment Practioner's past experience

Jennifer Barnard has been registered with the South African Council for Natural Scientific Professions since 2009, and was awarded certification as an Environmental Assessment Practioner (EAP) by the Interim Certification Board of South Africa in 2010. She has worked on numerous Environmental Impact Assessments, both in South Africa and the United Kingdom and has considerable experience in the preparation and compilation of Environmental Impact Reports, Environmental Management Programmes, Environmental Audits, and Environmental Management Frameworks, including construction monitoring where required. She has been working in the environmental consultancy field for 21 years, and prior to that in the KwaZulu-Natal Provincial Local Government and Development Planning (Environmental Planning and Policy Division) for 5 years.

Specific examples of private consultancy EAP experience include:

- Project Manager and Lead EAP of the Eskom Transnet Coal Link Suite of Projects (in terms of the NEC2 Contract with EIA project value of R6 million), which spanned both Mpumalanga and KwaZulu-Natal;
- Project Manager and Lead EAP of two SANRAL Road Upgrades on the N7, that included Borrow Pits;
- EAP for various Basic Assessments and EIAs in the Northern Cape for agricultural activities, and related Water Use General Authorisation Risk Matrices.
- Water Use General Authorisation for sand mining outside Pella, Northern Cape.
- EAP for Basic Assesment and Water Use General Authorisation for a Sand Mining Application in the Hartbees River, Kakamas, Northern Cape.
- EAP for Basic Assessment for Kaoline Mining outside Garies in the Northern Cape.
- EAP for EIA (in progress) for three granite mines located north-east of Pofadder in the Northern Cape.

18 Appendix B: Public Participation Process Report

18.1 Appendix B1: Background Information Document

BACKGROUND INFORMATION DOCUMENT (BID)

PROPOSED SAND MINING PERMIT APPLICATION:

5HASECTION OF DONKERHOEKSPRUIT ON FARM JANNELSEPAN NO. 39, LOCATED 12KM SOUTH-WEST OF UPINGTON, DAWID KRUIPER LOCAL MUNICIPALITY

19 March 2018 DMR REF.: NCS 30/5/1/1/2/1(10658)MP

INTRODUCTION

The Applicant, van Zyl's Blasting en Grondwerke proposes to mine sand in a section of the Donkerhoekspruit on Farm Jannelsepan No. 39 located 12km south-west of Upington in the Dawid Kruiper Local Municipality, Northern Cape. Refer to the Locality Map at **Figure 1**.

This BID aims to:

- ✓ Provide a description of the project.
- ✓ Briefly describe the potential environmental impacts.
- ✓ Describe what the Basic Assessment process entails.
- ✓ Provide information on how you can participate.

PROJECT DESCRIPTION

The proposed sand mining is in the form of a simple process that only includes loading and hauling of river sand from the Donkerhoekspruit. The depth of the excavations in the river bed will be on average 1.5 metres deep and the total mining footprint 5 hectares. The duration required for the sand mining is an initial 2 years with the potential to extend the permit by an additional 3 years. Normally there is also a time delay in the granting of applications for renewal therefore a total period of 10 years may be required.

Refer to the Proposed Site Plan included as **Figure 2**.

Construction Phase:

- Access and service roads: Access to the mine works will be via the R359 and existing farm tracks, which will be used as haul roads and no new road will be developed.
- Water supply: No process water is used in the mining process.
- Electricity supply: No electricity is used in the mining area.
- Logistics: No infrastructure is present or will be required due to the small scale and simple mining method. Limited waste management facilities will be supplied. A temporary storage area for used lubrication products and other hazardous chemicals needs to be provided for the collection of the small volume of waste before it is removed to the company headquarters.
- Maintenance Oil/grease/diesel management systems will consist of drip trays for stationary equipment to be provided in the parking area outside the drainage channel.

Operational Phase

- The operation phase will only involve the loading and hauling of raw river sand. Only one Front End Loader (FEL) will be used for loading and hauling and no processing will take place. The only surface disturbance except for the mining excavation within the drainage channel will be a small stockpile to be placed in the laydown area as mining progresses.
- The depth of the mining operations will be on average 1.5 metres as only the top layer of sand is mined. The total mining footprint is 5ha. Backfilling is not an option as the sand is completely removed and replaced overtime as it is washed in from upstream.
- No industrial or mine waste is generated during the mining process.
- No processing will take place except for limited stockpiling and no mining waste or overburden or Fine Residue Dumps (FRD) will be created.

Decommissioning and Closure Phase

- Planning for closure and restoration from the beginning of an operation makes the process more efficient, as waste can be removed as it is generated.
- Excavations can be planned so that topography restoration is less complicated, and topsoil can be re-used at shorter intervals.
- The decommissioning and closure phase at the end of the life of the mine will consist of implementing the Rehabilitation, Decommissioning and Closure Plan, included as an Appendix to the DBAR.

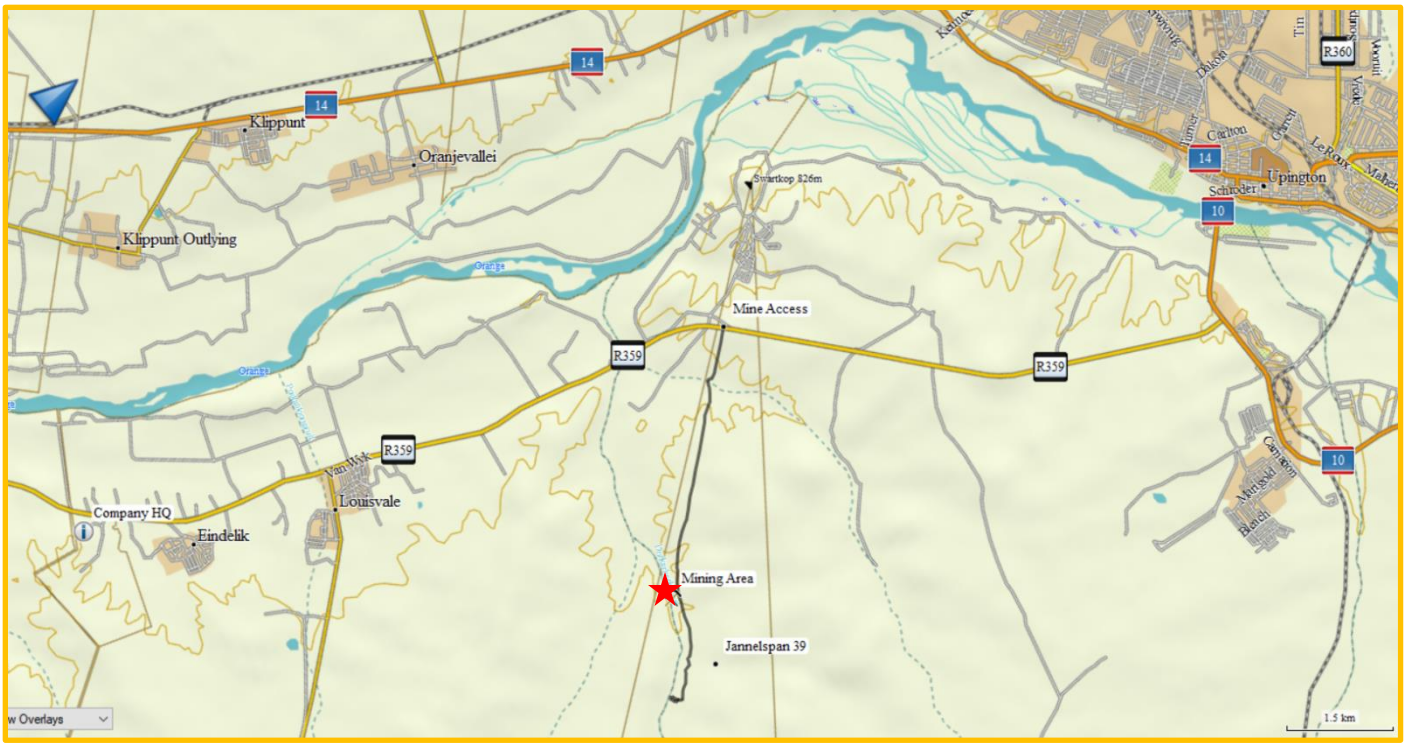


Figure 1: Locality Plan showing location of the Proposed Sand Mining Permit Application

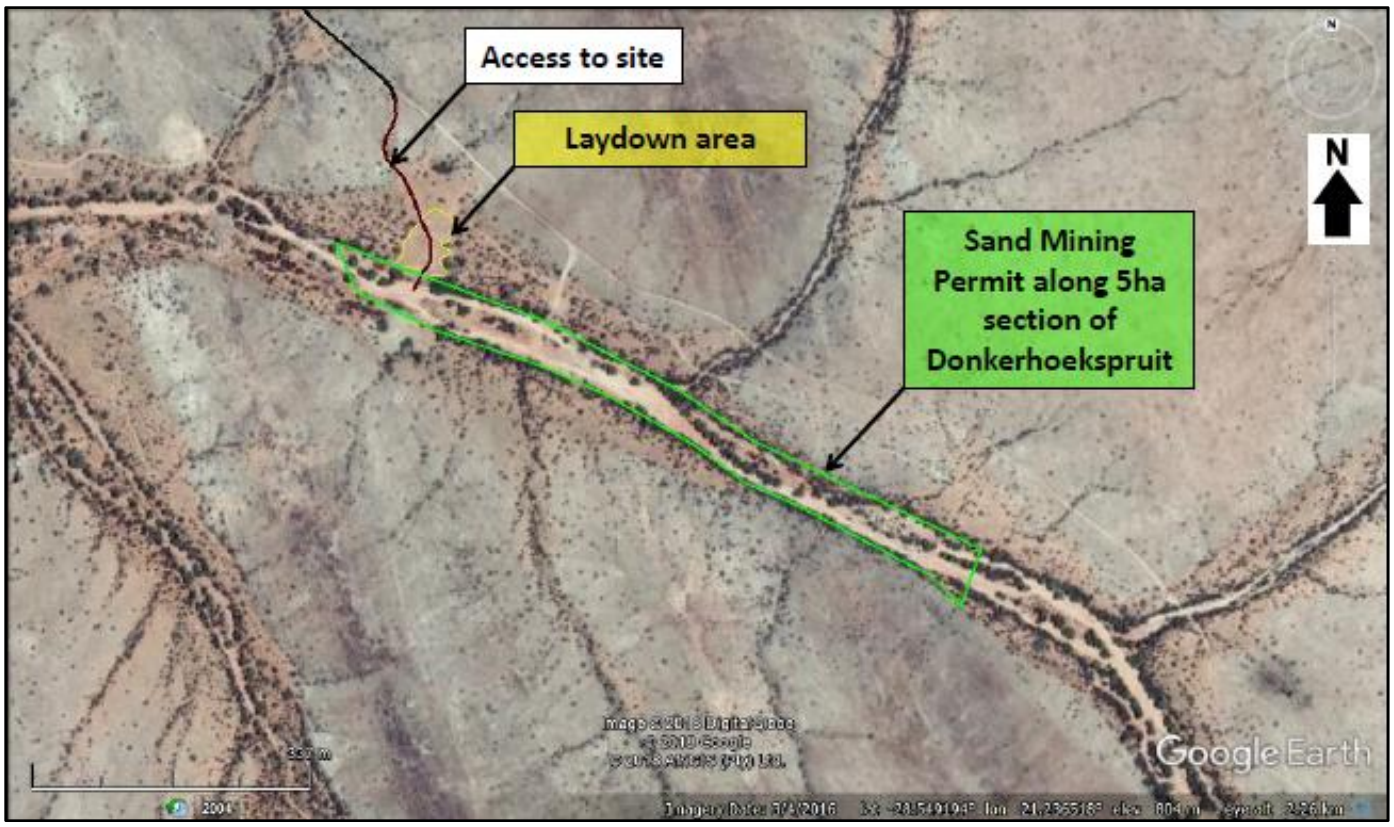


Figure 2: Site Plan for the Proposed Sand Mining site with Access Roads and Laydown Area

ALTERNATIVES

It is a requirement of NEMA that feasible and reasonable alternatives are considered, including the "No Go'" option. The layout and technology of the proposed sand mining project has been determined by the shape, position and orientation of the mineral resource (river sand) to be mined, as shown in Figure 2 above.

There are no reasonable or feasible: location; activity; site layout; technology; or, operational alternatives due to the basic mining methods that are applicable to sand mining.

POTENTIAL ENVIRONMENTAL IMPACTS

The following **potential environmental impacts** have been identified and assessed in the Draft BAR:

- Soil compaction from repeated use of access tracks.
- Noise caused by the machinery and vehicles on site, and by vehicles going to and from the mining site.
- Visibility of the sand mining operations.
- Dust emissions from general site activities.
- Removal of sand from river bed impacting on the Donkerhoekspruit, which is not classified as a Freshwater Ecosystem Priority Area (FEPA). The western portion of the site is classified as a CBA2 (Critical Biodiversity Area) and the eastern side as an Ecological Support Area (ESA). Refer to the relevant Figures in the DBAR.
- Wildlife and vegetation disturbance from front end loader and trucks.
- Impact of stormwater run-off during infrequent rainfall events.
- River sand contamination from hydrocarbon spills.
- Removal of alien invasive plant species such as Prosopis sp. (positive impact).
- Socio-economic impact on job security, employment creation and economic spin-offs (positive impact).

THE BASIC ASSESSMENT PROCESS

Sections 24 and 44 of the National Environmental Management Act (Act No. 107 of 1998) (NEMA) make provision for the promulgation of regulations that identify activities which may not commence without an Environmental Authorisation (EA) issued by the competent authority, in this case, the Department: Mineral Resources (DMR).

The EIA Regulations, 2014 (Government Notice (GN) R982, which came into effect on 8 December 2014), as amended by GNR 327 (dated 7 April 2017), promulgated in terms of NEMA, govern the process, methodologies and requirements for the undertaking of EIAs in support of EA applications. The EIA Regulations are accompanied by Listing Notices (LN) 1-3 that list activities that require EA. The EIA Regulations, 2014 as amended, sets out two alternative authorisation processes. Depending on the type of activity that is proposed, either a Basic Assessment (BA) process or a Scoping and Environmental Impact Reporting (S&EIR - also referred to as an EIA) process is required to obtain EA. LN 1 and LN3 list activities that require a BA process, while LN 2 lists activities that require S&EIR.

The proposed project triggers activities identified in terms of LN1 of the EIA Regulations, 2014 as amended by GNR 327 (dated 7 April 2017), thus requiring a BA process:

- ✓ Activity 21: Any activity including the operation of that activity which requires a mining permit in terms of section 27 of MRPDA, including - associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing.
- ✓ Activity 22: The decommissioning of any activity requiring – a closure certificate in terms of section 43 of the MRPA.
- ✓ Activity 27: The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation.
- ✓ Activity 28: Commercial or industrial developments where such land was used for agriculture on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.

Before commencing with the project, the proponent is required to appoint an independent Environmental Assessment Practitioner (EAP) to undertake a BA process and to obtain authorisation in terms of NEMA from the competent authority (DMR). Green Direction Sustainability Consulting (Pty) Ltd has been appointed as the EAP.

In addition to EA, a **Water Use General Authorisation** is required to be obtained from the Department of Water Affairs and Sanitation (DWS), as the applicable Water Use activities listed in the National Water Act (Act No. 36 of 1998) are:

- **Section 21(c)** related to impeding or diverting the flow of water in a watercourse, and
- **Section 21(i)** related to altering the bed, banks, course or characteristics of a watercourse.

An application for a General Authorisation in terms of GN 509 of 2016 for Section 21(c) and (i) has been submitted to DWS.

The BA Process:

- ✓ Submission of the Application Form to DMR.
- ✓ Preparation of the Background Information Document (BID); registered letters & BID to adjacent landowners; and Project Notice with BID to Organs of State.
- ✓ Preparation of the Draft Basic Assessment Report (DBAR), Environmental Management Programme Report (EMPr), and Closure Report.
- ✓ The availability of these reports will be advertised for the 30 day comment period, with a copy placed in the nearest library. Site notices will be placed, and a copy of the reports will be made available on the EAP's website (www.greendirection.co.za). The public consultation undertaken will be recorded in the Final BAR, which will be submitted to DMR for consideration.

Refer to **Figure 3** for the Basic Assessment process flow diagram.

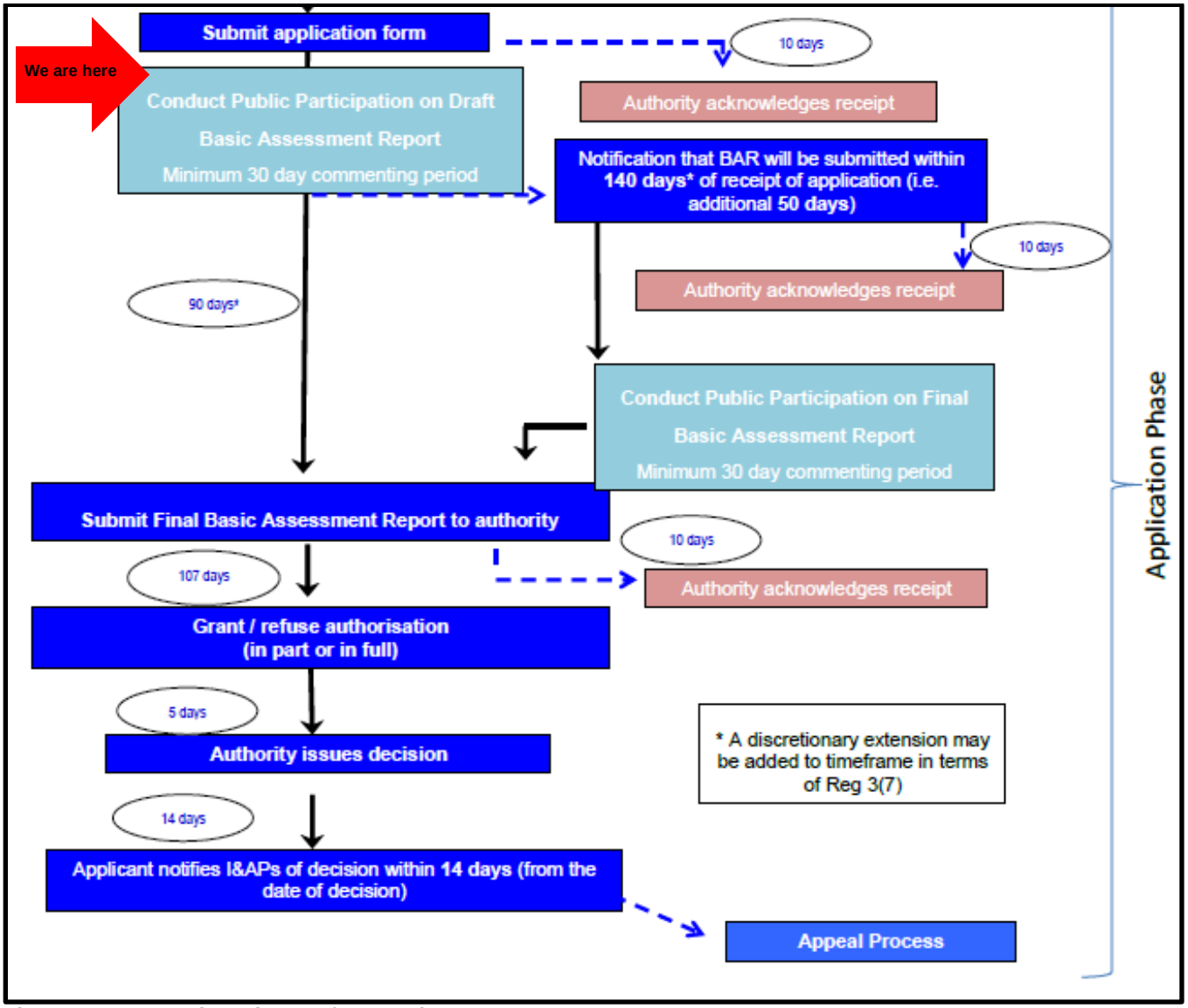


Figure 3: Process Flow Diagram for a Basic Assessment Process

HOW CAN YOU PARTICIPATE?

If you or your organisation would like to be involved in the BA process please submit your contact details for registration as an Interested & Affected Party (I&AP) on our database and submit your written comments on the attached form, by 25th April 2018 as per the details below. Only registered I&APs will continue to be informed about the BA process.

REGISTER OR PROVIDE YOUR WRITTEN COMMENT TO:

Green Direction Sustainability Consulting (Pty) Ltd
Postnet Somerset Mall; Suite 922; Private Bag X15; Somerset West; 7130
Email: jenny@greendirection.co.za

The Reports are available on www.greendirection.co.za/documents

The 30 day comment period is from 23rd March 2018 to 26th April 2018.

Please refer to the above DMR reference number in your submission, and provide your name, contact details (preferred method of notification, e.g. email), and indication of any direct business, financial, personal or other interest, in the application.

REGISTRATION & COMMENT FORM

PROPOSED SAND MINING PERMIT APPLICATION: SECTION OF DONKERHOEKSPRUIT ON FARM JANNELSEPAN NO. 39, DAWID KRUIPER LOCAL MUNICIPALITY

DMR REF.: NCS 30/5/1/1/2/1 (10658) MP

PLEASE REGISTER MY CONTACT DETAILS ON THE DATABASE FOR FURTHER CORRESPONDENCE	
YES	NO

DATE:	
NAME:	
ORGANISATION:	
POSTAL ADDRESS:	
EMAIL:	
TELEPHONE NO.:	
FAX. NO.:	
COMMENTS	
INDICATION OF ANY DIRECT BUSINESS, FINANCIAL, PERSONAL OR OTHER INTEREST IN THE APPLICATION	

SEND YOUR COMMENTS BY VIA EMAIL OR POST – DEADLINE IS 25TH APRIL 2018	
jenny@greendirection.co.za	Postnet Somerset Mall; Melcksloot Village; Suite 922; P/Bag X15; Somerset West; 7130

19 Appendix C: Impact Assessment Tables

APPENDIX C: IMPACT ASSESSMENT TABLES

Table 1: Impact Assessment during Construction Phase

CONSTRUCTION PHASE: SITE ACCESS AND SITE ESTABLISHMENT		
Potential impact and risk: **Loss of topsoil, increased dust levels, and soil compaction**	**IMPACT 1: SOIL EROSION & SOIL COMPACTION: The laydown area is an existing disturbed cleared area and will be used for site establishment. Any clearing of site access points will result in the removal of existing vegetation, which will disturb the soil increasing the potential for soil erosion by wind and loss of soil in the event of rainfall. Soil compaction will result in the laydown area and from repeated use of access tracks.**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	N/A
Extent and duration of impact:	Site and Short term	N/A
Consequence of impact or risk:	Loss	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low	N/A
Degree to which the impact can be reversed:	Reversible	N/A
Indirect impacts:	Dust impacting on adjacent vegetation and causing a nuisance to workers. Compaction of topsoil where vehicles drive outside demarcated areas damages seed bank and habitat for invertebrates.	N/A
Cumulative impact prior to mitigation:	Medium	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium	
Degree to which the impact can be **avoided**:	High	N/A
Degree to which the impact can be **managed:**	High	N/A
Degree to which the impact can be **mitigated**:	High	N/A
Proposed mitigation:	• After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Reasonable measures must be undertaken to ensure that any exposed areas are adequately protected against the wind and stormwater run-off. • Top soil shall be removed separately and stockpiled separately from other soil base layers. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Topsoil storage areas must be convex and should not exceed 2m in height. • Topsoil must be treated with care, must not be buried or in any other way be rendered unsuitable for further use (e.g. by mixing with spoil) and precautions must be taken to prevent unnecessary handling and compaction. • In particular, topsoil must not be subject to compaction greater than 1 500 kg/m² and must not be pushed by a bulldozer for more than 50 metres. Trucks may not be driven over the stockpiles. • Reduce drop height of material to a minimum. • Temporarily halt material handling in windy conditions. • A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers using the access road and entering the site will be informed of the speed limit. • Compacted areas that are not required for access shall be scarified after use during decommissioning and rehabilitation.	N/A
Residual impacts:	Potential loss of invertebrates that live in the top layers of the soil.	N/A
Cumulative impact post mitigation:	Low	N/A
Significance rating of impact after mitigation	Low	N/A

Potential impact and risk: **Potential Impacts on Water Resources (flow regime; water quality and quantity; aquatic biota)**	**IMPACT 2: WATER RESOURCE FUNCTIONALITY IN A NON-PERENNIAL RIVER: The removal of sand from the river bed could impact on flow regime, water quality and quantity, and aquatic biota. The Donkerhoekspruit is however, non-perennial in a dry arid climate and impacts will have little effect on water resource functionality as a whole.**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	N/A
Extent and duration of impact:	Site & Short term	N/A
Consequence of impact or risk:	Loss	N/A
Probability of occurrence:	Unlikely	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low	N/A
Degree to which the impact can be reversed:	Reversible	N/A
Indirect impacts:	Erosion of banks on adjacent sides of access points during storm events, which are very seldom.	N/A
Cumulative impact prior to mitigation:	Medium	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium	
Degree to which the impact can be **avoided**:	Medium	N/A
Degree to which the impact can be **managed:**	High	N/A
Degree to which the impact can be **mitigated**:	High	N/A
Proposed mitigation:	• Topsoil at access point to be removed prior during construction phase, and replaced during rehabilitation. • After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Top soil shall be removed separately and stockpiled separately from other soil base layers. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Topsoil storage areas must be convex and should not exceed 2m in height. • Topsoil must be treated with care, must not be buried or in any other way be rendered unsuitable for further use (e.g. by mixing with spoil) and precautions must be taken to prevent unnecessary handling and compaction. • In particular, topsoil must not be subject to compaction greater than 1 500 kg/m² and must not be pushed by a bulldozer for more than 50 metres. Trucks may not be driven over the stockpiles. • Temporarily halt material handling in windy conditions. • Rehabilitation of the river banks at each access point as soon as that section of the river has been mined. • Compacted areas are to be scarified. • Shaping of river bank to be returned to original profile.	N/A
Residual impacts:	Alien invasive vegetation establishes quickly in disturbed areas.	N/A
Cumulative impact post mitigation:	Low	N/A
Significance rating of impact after mitigation	Low	N/A

Potential impact and risk: **Potential Impacts on Biodiversity**	**IMPACT 3: LIMITED LOSS OF NATURAL VEGETATION AND ECOLOGICAL FUNCTIONING IN AN CBA2 AND ESA: The existing disturbed area has been identified for the laydown area for site establishment. Clearing of existing vegetation in the river bed will result in the loss of vegetation (mostly alien invasive species) with limited impact on localised ecological functioning.**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	N/A
Extent and duration of impact:	Site & Short term	N/A
Consequence of impact or risk:	Loss	N/A
Probability of occurrence:	Definite	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low	N/A
Degree to which the impact can be reversed:	Reversible	N/A
Indirect impacts:	• Soil disturbance caused by vegetation clearing will provide suitable conditions for the establishment and spreading of alien invasive vegetation. • Removal of alien invasive vegetation is a positive impact, and will benefit the ecological functioning. • Protected tree species will not be damaged.	N/A
Cumulative impact prior to mitigation:	Medium	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium	N/A
Degree to which the impact can be **avoided**:	High	N/A
Degree to which the impact can be **managed:**	High	N/A
Degree to which the impact can be **mitigated**:	High	N/A
Proposed mitigation:	• Identify existing disturbed patches for laydown areas, and demarcate areas for clearing. Refer to **Diagram 3** which indicates that existing farm tracks will be used, and disturbed areas have been earmarked for laydown areas. • Remove alien invasive vegetation and ensure ongoing alien vegetation clearing in the area. • No indigenous plants outside of the demarcated work areas may be damaged. • Identify protected tree species, and leave these intact, such as Camelthorn trees. • The noise and vibration caused by the earthmoving equipment will disturb smaller animals (e.g. snakes). These will move away whilst operations are in progress. Should any animals be encountered these should be moved away by a suitably trained nature conservation officer, if necessary.	N/A
Residual impacts:	Laydown areas have been earmarked for existing disturbed areas where clearing would be minimal, resulting in little impact on ecological functioning at a local level during the construction process. The clearing of alien invasive vegetation is a positive impact, and will benefit and improve the ecological functioning of the river bed and adjacent areas.	N/A
Cumulative impact post mitigation:	Very Low	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Very Low	N/A

Potential impact and risk: **Contamination & Pollution**	**IMPACT 4: POTENTIAL FOR SOIL AND RIVER SAND CONTAMINATION AND SOLID WASTE POLLUTION DURING CONSTRUCTION PHASE:**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	N/A
Extent and duration of impact:	Site & Short term	N/A
Consequence of impact or risk:	Loss	N/A
Probability of occurrence:	Possible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low	N/A
Degree to which the impact can be reversed:	Reversible	N/A
Indirect impacts:	Windblown litter will cause visual blight. Hydrocarbons are toxic and will cause vegetation die-back and soil poisoning.	N/A
Cumulative impact prior to mitigation:	Medium	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium	N/A
Degree to which the impact can be **avoided**:	High	N/A
Degree to which the impact can be **managed:**	High	N/A
Degree to which the impact can be **mitigated**:	High	N/A
Proposed mitigation:	• Oils and lubricants must be stored within sealed containment structures if kept on site. • Any mechanical equipment maintenance must be undertaken on drip trays or UPVC sheets to prevent spills/ leaks onto the soil. • When not in use, a drip tray must be placed beneath mechanical equipment and vehicles. • Machinery must be kept in good working order and regularly inspected for leaks. • A spill kit will be available on each site where mining activities are in progress. • Any spillages will be cleaned up immediately. • Waste materials generated on site must be stored in suitable lidded containers and removed off site to a suitable disposal facility. • Waste separation must be undertaken if practical for recycling • Provide all workers with environmental awareness training. • Provide a bin at the site. • Regularly dispose of any solid waste at a municipal waste disposal site. • Ensure all workers comply with the requirements of the EMPr. • Provide a mobile ablution facility.	N/A
Residual impacts:	A lack of waste food management encourages vermin.	N/A
Cumulative impact post mitigation:	Low	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	N/A

Potential impact and risk: **Potential Impacts on Visual Landscape**	**IMPACT 5: VISUAL INTRUSION: Caused by the front end loader, topsoil stockpiles, cleared areas, and movement of trucks on site during preparation of site access and site establishment. The site is however, remote and rural in nature with no receptors (people) as it is located on private property.**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	N/A
Extent and duration of impact:	Site & Short term	N/A
Consequence of impact or risk:	Loss	N/A
Probability of occurrence:	Definite	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low	N/A
Degree to which the impact can be reversed:	Reversible	N/A
Indirect impacts:	There are few indirect impacts as the area is remote and rural, with no people (receptors) living near the site.	N/A
Cumulative impact prior to mitigation:	Low	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	N/A
Degree to which the impact can be **avoided**:	Medium	N/A
Degree to which the impact can be **managed:**	Medium	N/A
Degree to which the impact can be **mitigated**:	Medium	N/A
Proposed mitigation:	• The laydown areas shall be kept neat and tidy at all times. Equipment must be kept in designated areas and storing/stockpiling shall be kept orderly. • Restrict working hours to normal work day hours with no work over weekends when holidays occur to minimize hauling trucks along access roads.	N/A
Residual impacts:	Good housekeeping will ensure a neat and well maintained construction area reducing visual impact.	N/A
Cumulative impact post mitigation:	Very Low	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Very Low	N/A

Potential impact and risk: **Potential Impacts on Social, and Biophysical Environments**	**IMPACT 6: EMMISSIONS (DUST, VEHICLES & NOISE): Noise and dust will be created by mining equipment (e.g. front-end loaders) and vehicles, which will emit Greenhouse Gases.**	
	PREFERRED AND ONLY ALTERNATIVE	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	N/A
Extent and duration of impact:	Local & Short Term	N/A
Consequence of impact or risk:	Loss	N/A
Probability of occurrence:	Definite	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low	N/A
Degree to which the impact can be reversed:	Reversible	N/A
Indirect impacts:	• Carbon emissions from vehicle exhausts have a negative impact on the ozone layer. • Local residents along the access tracks and roads would be impacted on by noise, dust and vehicle emissions during the construction activities. • Increase in Greenhouse Gas Emissions from vehicles.	N/A
Cumulative impact prior to mitigation:	Low	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	N/A
Degree to which the impact can be **avoided**:	Medium	N/A
Degree to which the impact can be **managed:**	Medium	N/A
Degree to which the impact can be **mitigated**:	Medium	N/A
Proposed mitigation:	• The Contractor shall adhere to the local by-laws and regulations regarding the noise and associated hours of operations. • The Contractor shall limit noise levels (e.g. install and maintain silencers on machinery). The provisions of SANS 1200A Sub clause 4.1 regarding “built-up” area shall apply to all areas within audible distance of residents whether in urban, peri-urban or rural areas. • Construction and demolition activities generating output of 85dB or more, shall be limited to normal working hours and not allowed during weekends to limit the impact of noise of neighbours. Should the Contractor need to work outside normal working hours, the surrounding neighbours shall be informed prior to the work taking place. • No amplified music shall be allowed on site. • On public roads adjacent to the site vehicles shall adhere to municipal and provincial traffic regulations including speed limits. • Vehicles used on site for the construction related activities shall be maintained and in a good working condition so as to reduce emissions. • Stockpiles must be maintained (covered where necessary) to avoid wind erosion of the material. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Trucks shall have tarpaulins to prevent sand from blowing off in transit.	N/A
Residual impacts:	Carbon emissions have impact on climate change.	N/A
Cumulative impact post mitigation:	Very Low	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Very Low	N/A

Potential impact and risk: **Potential Impacts on Heritage, Paleontological and Cultural landscape**	**IMPACT 7: LIMITED POTENTIAL FOR HERITAGE, PALAEONTOLOGICAL AND CULTURAL IMPACTS:** **Refer to HIA (Appendix E1) & PIA (Appendix E2)**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Loss	N/A
Extent and duration of impact:	Site & Short term	N/A
Consequence of impact or risk:	No loss	N/A
Probability of occurrence:	Unlikely	N/A
Degree to which the impact may cause irreplaceable loss of resources:	No Loss	N/A
Degree to which the impact can be reversed:	Irreversible	N/A
Indirect impacts:	None	N/A
Cumulative impact prior to mitigation:	None	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Very low	N/A
Degree to which the impact can be **avoided**:	High	N/A
Degree to which the impact can be **managed:**	High	N/A
Degree to which the impact can be **mitigated**:	High	N/A
Proposed mitigation:	Refer to Appendix E1 (page 19): Provision for on-going heritage monitoring in an environmental management plan which also provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of mining. Should unexpected finds be made (e.g. precolonial burials; ostrich eggshell container cache; or localised Stone Age sites with stone tools, pottery; military remains), the relevant Heritage Authority should be contacted. Environmental Control Officer should become acquainted at a basic level with the kinds of heritage resources potentially occurring in the area and should report to the Heritage Authority as needed. Refer to Appendix E2 – none required	N/A
Residual impacts:	None	N/A
Cumulative impact post mitigation:	Very low As referenced from Appendix E1: where any archaeological contexts occur, direct impacts are once-off permanent destructive events. Secondary cumulative impacts may occur with the increase in development and operational activity associated with the life of the proposed sand mining. As referenced from Appendix E2: None	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Very low	N/A

Potential impact and risk: **Potential Impacts on Socio-Economic Environment**	**IMPACT 8: CREATION OF EMPLOYMENT & JOB SECURITY DURING CONSTRUCTION PHASE WITH LOCAL AND REGIONAL ECONOMIC SPIN-OFFS**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Positive	Negative
Extent and duration of impact:	Local, District and Short term	Local, District & Short Term
Consequence of impact or risk:	Gain	Loss
Probability of occurrence:	Definite	Definite
Degree to which the impact may cause irreplaceable loss of resources:	No Loss	Medium
Degree to which the impact can be reversed:	Irreversible (employment can be lost by an individual due to non-performance but the job provision is irreversible)	Reversible
Indirect impacts:	• Upskilling • Local economic spin-offs through increased income earned, and through purchasing of local materials	• No upskilling • No local economic spin-offs due to lack of income earned, and limited supply of building materials with possible demand exceeding supply.
Cumulative impact prior to mitigation:	Medium (-)	Medium (-)
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	Medium (-)
Degree to which the impact can be **avoided**:	Very low	Medium
Degree to which the impact can be **managed:**	High	Medium
Degree to which the impact can be **mitigated**:	High	Medium
Proposed mitigation:	• Employment of local previously disadvantaged labour wherever possible, with provision of training (upskilling)	No mitigation possible with No-Go alternative.
Residual impacts:	The upliftment of unemployed people, with positive impact on standard of living for their families. Increase in local building materials, which reduce economies of scale for building projects in the region, such as for the renewable energy sector.	No job creation or potential for upskilling of previously disadvantaged labour, and no supply or purchasing of local materials.
Cumulative impact post mitigation:	Medium (+)	Medium (-)
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium (+)	Medium (-)

Table 2: Impact Assessment during Operational Phase

OPERATIONAL PHASE		
Potential impact and risk: **Loss of soil, increased dust levels, and soil compaction**	**IMPACT 1: SOIL EROSION & SOIL COMPACTION: The sand mining process will disturb the river sand increasing the potential for fine particle suspension by wind. Soil compaction will result from repeated use of access tracks.**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	N/A
Extent and duration of impact:	Site & Long term	N/A
Consequence of impact or risk:	Loss	N/A
Probability of occurrence:	Possible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low	N/A
Degree to which the impact can be reversed:	Reversible	N/A
Indirect impacts:	• Dust impacting on adjacent vegetation and causing a nuisance to workers. • Compaction of topsoil damages seed bank and habitat for invertebrates.	N/A
Cumulative impact prior to mitigation:	Medium	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium	N/A
Degree to which the impact can be **avoided**:	Medium	N/A
Degree to which the impact can be **managed:**	Medium	N/A
Degree to which the impact can be **mitigated**:	Medium	N/A
Proposed mitigation:	• After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of vegetation in river bed should take place to avoid unnecessary exposed surfaces. • Reasonable measures must be undertaken to ensure that any exposed areas are adequately protected against the wind and stormwater run-off. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Reduce drop height of material to a minimum. • Temporarily halt material handling in windy conditions. • A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers using the access road and entering the site will be informed of the speed limit. • Compacted areas that are not required for access shall be scarified after use during decommissioning and rehabilitation. • Planting of indigenous vegetation in areas under rehabilitation.	N/A
Residual impacts:	• Unmanaged soil erosion will result in loss of topsoil. • Unmanaged dust will cause a nuisance and impact on the health of the workers.	N/A
Cumulative impact post mitigation:	Low	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	N/A

Potential impact and risk: **Potential Impacts on Water Resources (flow regime; water quality and quantity; aquatic biota)**	**IMPACT 2: WATER RESOURCE FUNCTIONALITY IN A NON-PERENNIAL RIVER: The removal of sand from the river channel could impact on flow regime, water quality and quantity, and aquatic biota.** **The Donkerhoekspruit is a non-perennial river in a dry arid climate and impacts will have little effect on water resource functionality as a whole. There is no permanent surface water, and storm water run-off events are very seldom in the arid climate. Sand will be transported downstream into the mined area over time.**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	N/A
Extent and duration of impact:	Site	N/A
Consequence of impact or risk:	Loss	N/A
Probability of occurrence:	Unlikely	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low	N/A
Degree to which the impact can be reversed:	Irreversible	N/A
Indirect impacts:	• Water diversion around sand piles in the river, and water accumulation in excavated areas • Erosion of banks on adjacent sides of access points during storm events, which are very seldom.	N/A
Cumulative impact prior to mitigation:	Medium	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium	N/A
Degree to which the impact can be **avoided**:	Medium	N/A
Degree to which the impact can be **managed:**	Medium	N/A
Degree to which the impact can be **mitigated**:	Medium	N/A
Proposed mitigation:	• No equipment may be parked within the drainage channel when not in use. • No stockpiling to take place within the drainage channel. • Shaping of river bed to avoid diversion of stormwater towards banks to prevent erosion of river banks, and to prevent channeling of water that would increase erosive capacity of stormwater. • Sand will be washed from upstream to the mining site over time.	N/A
Residual impacts:	Alien invasive vegetation establishes quickly in disturbed areas.	N/A
Cumulative impact post mitigation:	Low	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	N/A

Potential impact and risk: **Potential Impacts on Biodiversity**	**IMPACT 3: LIMITED LOSS OF NATURAL VEGETATION AND DISTURBANCE OF ECOLOGICAL FUNCTIONING IN A CBA2 & ESA: The clearing of existing vegetation in the river bed will result in the loss of vegetation and localized ecological functioning. However, the existing vegetation is mostly alien invasive species and biodiversity will improve as a result. Transport of materials will be along existing access tracks resulting in little impact on ecological functioning at a local level during the operation phase.** **Vehicles will disturb local fauna.**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	N/A
Extent and duration of impact:	Site & Short term	N/A
Consequence of impact or risk:	Loss	N/A
Probability of occurrence:	Definite	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low	N/A
Degree to which the impact can be reversed:	Irreversible	N/A
Indirect impacts:	• Soil disturbance caused by vegetation clearing will provide suitable conditions for the establishment and spreading of alien invasive vegetation. • Removal of alien invasive vegetation is a positive impact, and will benefit the ecological functioning. • Protected tree species will not be damaged.	N/A
Cumulative impact prior to mitigation:	Medium	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium	N/A
Degree to which the impact can be **avoided**:	Low	N/A
Degree to which the impact can be **managed:**	High	N/A
Degree to which the impact can be **mitigated**:	High	N/A
Proposed mitigation:	• Identify existing access tracks. Refer to **Diagram 3**, which indicates that existing farm tracks will be used. • Demarcate areas for clearing in the river bed. • The mining area and stockpile areas must be demarcated and the footprint contained within the demarcated area. • Mining areas to be limited to blocks of 500m at a time with rehabilitation of the bank and access areas required before moving upstream to the next block. • The annual rehabilitation plan must be implemented. • Remove alien invasive vegetation, and ensure ongoing alien vegetation clearing in the area. • No indigenous plants outside of the demarcated work areas may be damaged. • Identify protected tree species, and leave these intact, such as Camelthorn trees. • The noise and vibration caused by the earthmoving equipment will disturb smaller animals (e.g. snakes). These will move away whilst operations are in progress. Should any animals be encountered these should be moved away by a suitably trained nature conservation officer, if necessary.	N/A
Residual impacts:	The laydown area is an existing disturbed area, and sand mining activities here are unlikely to affect ecological functioning at a local level during the operation process. The clearing of alien invasive vegetation is a positive impact, and will benefit the ecological functioning.	N/A
Cumulative impact post mitigation:	Low	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	N/A

Potential impact and risk: **Contamination & Pollution**	**IMPACT 4: POTENTIAL FOR SOIL AND RIVER SAND CONTAMINATION AND SOLID WASTE POLLUTION DURING OPERATIONAL PHASE**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	
Extent and duration of impact:	Site & Short term	
Consequence of impact or risk:	Loss	
Probability of occurrence:	Possible	
Degree to which the impact may cause irreplaceable loss of resources:	Low	
Degree to which the impact can be reversed:	Reversible	
Indirect impacts:	Windblown litter will cause visual blight. Hydrocarbons are toxic and will cause vegetation die-back and soil poisoning.	
Cumulative impact prior to mitigation:	Medium	
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium	
Degree to which the impact can be **avoided**:	High	
Degree to which the impact can be **managed:**	High	
Degree to which the impact can be **mitigated**:	High	
Proposed mitigation:	• Oils and lubricants must be stored within sealed containment structures if kept on site. • Any mechanical equipment maintenance must be undertaken on drip trays or UPVC sheets to prevent spills/ leaks onto the soil. • When not in use, a drip tray must be placed beneath mechanical equipment and vehicles. • Machinery must be kept in good working order and regularly inspected for leaks. • A spill kit will be available on each site where mining activities are in progress. • Any spillages will be cleaned up immediately. • Waste materials generated on site must be stored in suitable lidded containers and removed off site to a suitable disposal facility. • Waste separation must be undertaken if practical for recycling • Provide all workers with environmental awareness training. • Provide a bin at the site. • Regularly dispose of any solid waste at a municipal waste disposal site. • Ensure all workers comply with the requirements of the EMPr. • Provide a mobile ablution facility.	
Residual impacts:	A lack of waste food management encourages vermin.	
Cumulative impact post mitigation:	Low	
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	

Potential impact and risk: **Potential Impacts on Visual Landscape**	**IMPACT 5: VISUAL INTRUSION: Caused by the front-end loader, topsoil stockpiles, cleared areas, and movement of trucks on site. The site is however, remote and rural in nature with no receptors (people) as it is located on private property.**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	
Extent and duration of impact:	Site & Short term	
Consequence of impact or risk:	Loss	
Probability of occurrence:	Definite	
Degree to which the impact may cause irreplaceable loss of resources:	Low	
Degree to which the impact can be reversed:	Reversible	
Indirect impacts:	There are few indirect impacts as the area is remote and rural, with no people (receptors) living near the site.	
Cumulative impact prior to mitigation:	Low	
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	
Degree to which the impact can be **avoided**:	Medium	
Degree to which the impact can be **managed:**	Medium	
Degree to which the impact can be **mitigated**:	Medium	
Proposed mitigation:	• The laydown areas shall be kept neat and tidy at all times. Equipment must be kept in designated areas and storing/stockpiling shall be kept orderly. • Restrict working hours to normal work day hours with no work over weekends when holidays occur to minimize hauling trucks along access roads.	
Residual impacts:	Good housekeeping will ensure a neat and well maintained construction area reducing visual impact.	
Cumulative impact post mitigation:	Very Low	
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Very low	

Potential impact and risk: **Potential Impacts on Social, and Biophysical Environments**	**IMPACT 6: EMMISSIONS (DUST, VEHICLES & NOISE): Noise and dust will be created by mining equipment (e.g. front-end loaders) and vehicles, which will emit Greenhouse Gases.**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Negative	N/A
Extent and duration of impact:	Site and short term	N/A
Consequence of impact or risk:	Loss	N/A
Probability of occurrence:	Definite	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low	N/A
Degree to which the impact can be reversed:	Low	N/A
Indirect impacts:	• Carbon emissions from vehicle exhausts have a negative impact on the ozone layer. • Residents and occupants of work places along the access tracks and roads would be impacted on by noise, dust and vehicle emissions.	N/A
Cumulative impact prior to mitigation:	Low	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	N/A
Degree to which the impact can be **avoided**:	Medium	N/A
Degree to which the impact can be **managed:**	Medium	N/A
Degree to which the impact can be **mitigated**:	Medium	N/A
Proposed mitigation:	• Ensure sand hauling is during normal working hours and not on weekends • No amplified music shall be allowed on site. • On public roads the vehicles shall adhere to municipal and provincial traffic regulations including speed limits. • Vehicles used on site for the construction related activities shall be maintained and in a good working condition so as to reduce emissions. • Trucks shall have tarpaulins to prevent sand from blowing off in transit.	N/A
Residual impacts:	Dust settling on adjacent vegetation can impact on vegetative growth, which is a short-term impact until the rainfall season.	N/A
Cumulative impact post mitigation:	Very Low	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Very Low	

Potential impact and risk: **Potential Impacts on Heritage, Paleontological and Cultural landscape**	**IMPACT 7: LIMITED POTENTIAL FOR HERITAGE, PALAEONTOLOGICAL AND CULTURAL IMPACTS:** **Refer to HIA (Appendix E1) & PIA (Appendix E2).**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Loss	N/A
Extent and duration of impact:	Site & Short term	N/A
Consequence of impact or risk:	No loss	N/A
Probability of occurrence:	Unlikely	N/A
Degree to which the impact may cause irreplaceable loss of resources:	No Loss	N/A
Degree to which the impact can be reversed:	Irreversible	N/A
Indirect impacts:	None	N/A
Cumulative impact prior to mitigation:	None	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Very low	N/A
Degree to which the impact can be **avoided**:	High	N/A
Degree to which the impact can be **managed:**	High	N/A
Degree to which the impact can be **mitigated**:	High	N/A
Proposed mitigation:	Refer to Appendix E1 & E2 – none required	N/A
Residual impacts:	None	N/A
Cumulative impact post mitigation:	Very low Refer to Appendix E1 (page 19): Provision for on-going heritage monitoring in an environmental management plan which also provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of mining. Should unexpected finds be made (e.g. precolonial burials; ostrich eggshell container cache; or localised Stone Age sites with stone tools, pottery; military remains), the relevant Heritage Authority should be contacted. Environmental Control Officer should become acquainted at a basic level with the kinds of heritage resources potentially occurring in the area and should report to the Heritage Authority as needed. Refer to Appendix E2 – none required.	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Very low As referenced from Appendix E1: where any archaeological contexts occur, direct impacts are once-off permanent destructive events. Secondary cumulative impacts may occur with the increase in development and operational activity associated with the life of the proposed sand mining. As referenced from Appendix E2: None	N/A

Potential impact and risk: **Potential Impacts on Socio-Economic Environment**	**IMPACT 8: CREATION OF EMPLOYMENT & JOB SECURITY DURING OPERATIONAL PHASE WITH LOCAL AND REGIONAL ECONOMIC SPIN-OFFS**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Positive	Negative
Extent and duration of impact:	Local, district and Short term	Local, District & Short Term
Consequence of impact or risk:	Gain	Loss
Probability of occurrence:	Definite	Definite
Degree to which the impact may cause irreplaceable loss of resources:	No loss	Medium
Degree to which the impact can be reversed:	Irreversible (employment can be lost by an individual due to non-performance but the job provision is irreversible)	Reversible
Indirect impacts:	• Upskilling • Local economic spin-offs through increased income earned, and through purchasing of local materials	• No upskilling • No local economic spin-offs due to lack of income earned, and limited supply of building materials with possible demand exceeding supply.
Cumulative impact prior to mitigation:	Medium (-)	Medium (-)
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium (-)	Medium (-)
Degree to which the impact can be **avoided**:	Very low	Medium
Degree to which the impact can be **managed:**	High	Medium
Degree to which the impact can be **mitigated**:	High	Medium
Proposed mitigation:	• Employment of local previously disadvantaged labour wherever possible, with provision of training (upskilling)	No mitigation possible with No-Go alternative.
Residual impacts:	The upliftment of unemployed people, with positive impact on standard of living for their families. Increase in local building materials, which reduce economies of scale for building projects in the region, such as for the renewable energy sector.	No job creation or potential for upskilling of previously disadvantaged labour, and no supply or purchasing of local materials.
Cumulative impact post mitigation:	Medium (+)	Medium (-)
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium (+)	Medium (-)

Table 3: Impact Assessment during Decommissioning and Closure Phase

DECOMMISSIONING & CLOSURE PHASE		
Potential impact and risk: **Potential Impacts on Biophysical Environment**	**IMPACT 1: REHABILITATION OF MINED AND CLEARED AREAS: Ongoing removal of alien invasive plant species; shaping of river profile and replacing topsoil.**	
ALTERNATIVE	**ALTERNATIVE 1 (PREFERRED)**	**NO-GO ALTERNATIVE**
Nature of impact:	Positive	N/A
Extent and duration of impact:	• Local & short term	N/A
Consequence of impact or risk:	Gain	N/A
Probability of occurrence:	Definitely	N/A
Degree to which the impact may cause irreplaceable loss of resources:	No loss	N/A
Degree to which the impact can be reversed:	Reversible	N/A
Indirect impacts:	• Biodiversity of area will improve due to removal of alien invasive vegetation. • Fauna will return to the disturbed areas. • Sand will move into the mined areas from upstream areas over time.	N/A
Cumulative impact prior to mitigation:	Medium	N/A
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium	N/A
Degree to which the impact can be **avoided**:	Very low (rehabilitation is mandatory)	N/A
Degree to which the impact can be **managed:**	High	N/A
Degree to which the impact can be **mitigated**:	High	N/A
Proposed mitigation:	• Implementation of Final Rehabilitation, Decommissioning and Mine Closure Plan (**Appendix D**). • Compacted areas shall be scarified after use during decommissioning and rehabilitation. • Any stored topsoil shall be spread over the scarified surface. • Shaping of river bed to avoid steep profiles and hollows. • Ongoing removal of alien invasive vegetation. • Planting of indigenous vegetation.	N/A
Residual impacts:	Net loss of river sand in the mined area, until sand from upstream is brought downstream by storm events over time.	Storm events cause sand to move downstream.
Cumulative impact post mitigation:	Very Low	N/A
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Very Low	N/A

Potential impact and risk: **Potential Impacts on Socio-Economic Environment**	**IMPACT 2: CREATION OF EMPLOYMENT, JOB SECURITY WITH LOCAL AND REGIONAL ECONOMIC SPIN-OFFS DURING DECOMMISSIONING & CLOSURE PHASE**	
ALTERNATIVE	**PREFERRED AND ONLY ALTERNATIVE**	**NO-GO ALTERNATIVE**
Nature of impact:	Positive	Negative
Extent and duration of impact:	Local, district and Short term	Local, District & Short Term
Consequence of impact or risk:	Gain	Loss
Probability of occurrence:	Definite	Definite
Degree to which the impact may cause irreplaceable loss of resources:	No loss	Medium
Degree to which the impact can be reversed:	Irreversible (employment can be lost by an individual due to non-performance but the job provision is irreversible)	Reversible
Indirect impacts:	• Upskilling • Local economic spin-offs through increased income earned, and through purchasing of local materials	• No upskilling • No local economic spin-offs due to lack of income earned, and limited supply of building materials with possible demand exceeding supply.
Cumulative impact prior to mitigation:	Medium (-)	Medium (-)
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Low	Medium (-)
Degree to which the impact can be **avoided**:	Very low	Medium
Degree to which the impact can be **managed:**	High	Medium
Degree to which the impact can be **mitigated**:	High	Medium
Proposed mitigation:	• Employment of local previously disadvantaged labour wherever possible, with provision of training (upskilling)	No mitigation possible with No-Go alternative.
Residual impacts:	The upliftment of unemployed people, with positive impact on standard of living for their families.	No job creation or potential for upskilling of previously disadvantaged labour, and no supply or purchasing of local materials.
Cumulative impact post mitigation:	Medium (+)	Medium (-)
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	Medium (+)	Medium (-)

20 Appendix D: Rehabilitation, Decommissioning and Closure Plan

Rehabilitation, Decommissioning and Mine Closure Plan Including Environmental Risk Assessment

Van Zyl's Blasting en Grondwerke CC
Farm Jannelsepan No. 39, near Upington

ReferenceNo.: NCS 30/5/1/1/2/1 (10658) MP

Contents

1 INTRODUCTION

1.1 Background

This document serves to comply with regulation 11(1) of the NEMA Financial Regulations that states that the holder of a right or permit must ensure that a review is undertaken of the requirements for final rehabilitation, decommissioning and closure of the prospecting, exploration, mining or production operations at the end of the life of operations as reflected in a final rehabilitation, decommissioning and mine closure plan; and remediation of latent or residual environmental impacts which may become known in the future, including the pumping and treatment of polluted or extraneous water, as reflected in an environmental risk assessment report.

The objectives of this final rehabilitation, decommissioning and mine closure plan is to to identify a post-mining land use that is feasible through-

- providing the vision (goals), objectives, targets and criteria for final rehabilitation, decommissioning and closure of the project;
- outlining the design principles for closure;
- explaining the risk assessment approach and outcomes and link closure activities to risk rehabilitation;
- detailing the closure actions that clearly indicate the measures that will be taken to mitigate and/or manage identified risks and describes the nature of residual risks that will need to be monitored and managed post closure;
- committing to a schedule, budget, roles and responsibilities for final rehabilitation, decommissioning and closure of each relevant activity or item of infrastructure;
- identifying knowledge gaps and how these will be addressed and filled;
- detailing the full closure costs for the life of project at increasing levels of accuracy as the project develops and approaches closure in line with the final land use proposed; and
- outlining monitoring, auditing and reporting requirements.

1.2 Issues that have guided the development of the plan

The company identified three key closure goals for the final decommissioning and closure of the mining operation that are listed below.

- To create a safe and healthy post-mining environment with no residual environmental impact.
- To create a stable, free draining post mining landform, which is compatible with the surrounding landscape and which is capable of a productive land use that achieves a land capability equal to that of pre-mining conditions
- To provide optimal post-mining social opportunities

Each goal is supported by a suite of key objectives and activities which are elaborated on in section 3 of this review. Section 3 also describes how these objectives are planned to be met and elaborate on the implementation of certain risk mitigation actions, with risk assessment and mitigation being integral to the planning and executing of the rehabilitation and closure of the mine. Aftercare and maintenance of rehabilitated sites is often the difference between the ultimate successes or failure of rehabilitation and monitoring of rehabilitation will determine whether rehabilitation objectives and requirements are being achieved.

1.3 Context of the Mining operation

1.3.1 Mining Permit

The mining area is situated over a section of the Donkerhoekspruit on Farm Jannelsepan No. 39. The operation is to be carried out under cover of Mining Permit to be issued to van Zyl's Blasting en Grondwerke CC (Reg. 2008/260901/23) with file reference NCS30/5/1/1/2/1(10658)MP.
The operation is situated in the Dawid Kruiper Local Authority of the Kenhardt administrative district of the Northern Cape.

Farm Jannelsepan No. 39 in the Division Kenhardt, Province Northern Cape is registered in the name of Louisvale Irrigation Board by virtue of Title Deed KEF1-14/1923. The area is situated off the R359 road approximately 12km south-west of Upington with an approximate locality of S28.54890° E21.23626° (Refer to Co-ordinate no. 3 on Diagram 2).

1.3.2 Project Description

Mining will be in the form of a simple process that only include loading and hauling of river sand from a sand quarry. No processing will take place as the raw sand will be sold as a FoT product and only limited stockpiling will take place.

Construction phase
Due to the small scale of operations no permanent infrastructure will be developed and only existing farm tracks will be used. Upgrading of the existing tracks will be done as part of the construction phase. No buildings and infrastructure will be required as the operation will be run from the company headquarters were all logistics will be available.

Operational phase
During operations mining will only consist of loading and hauling or river sand. Only temporary product stockpiles will be developed as sand will be transported to the company headquarters for stockpiling and distribution as it is loaded.
One excavator or FEL will be used in the mining process for loading of sand onto the haul trucks.
As part of this phase training of personnel in the implementation of the EMPr will be undertaken and the implementation of the environmental awareness plan as part of the EMP will be an ongoing process.

Decommissioning phase
The decommissioning phase at the end of the life of the mine will consist of implementing this final rehabilitation, decommissioning and closure plan

1.3.3 Mine design map

The area is situated off the R359 public road south-west of Upington, which provides good access to the mining operation. The turn-off from the R359 to the mine is approximately 12km to the south-west of Upington. Refer to Diagram 1.

No water or electricity is used in the mining operation and no permanent infrastructure is present or will be required due to the small scale and simple mining method. Existing farm tracks will be used as haul roads and no new roads will be developed.

The only infrastructure and or services are stockpile and waste management or laydown areas created.

Refer to section 6 for mine layout and quantification of closure elements.

Diagram 1: Position of proposed site on a section of the Donkerhoekspruit

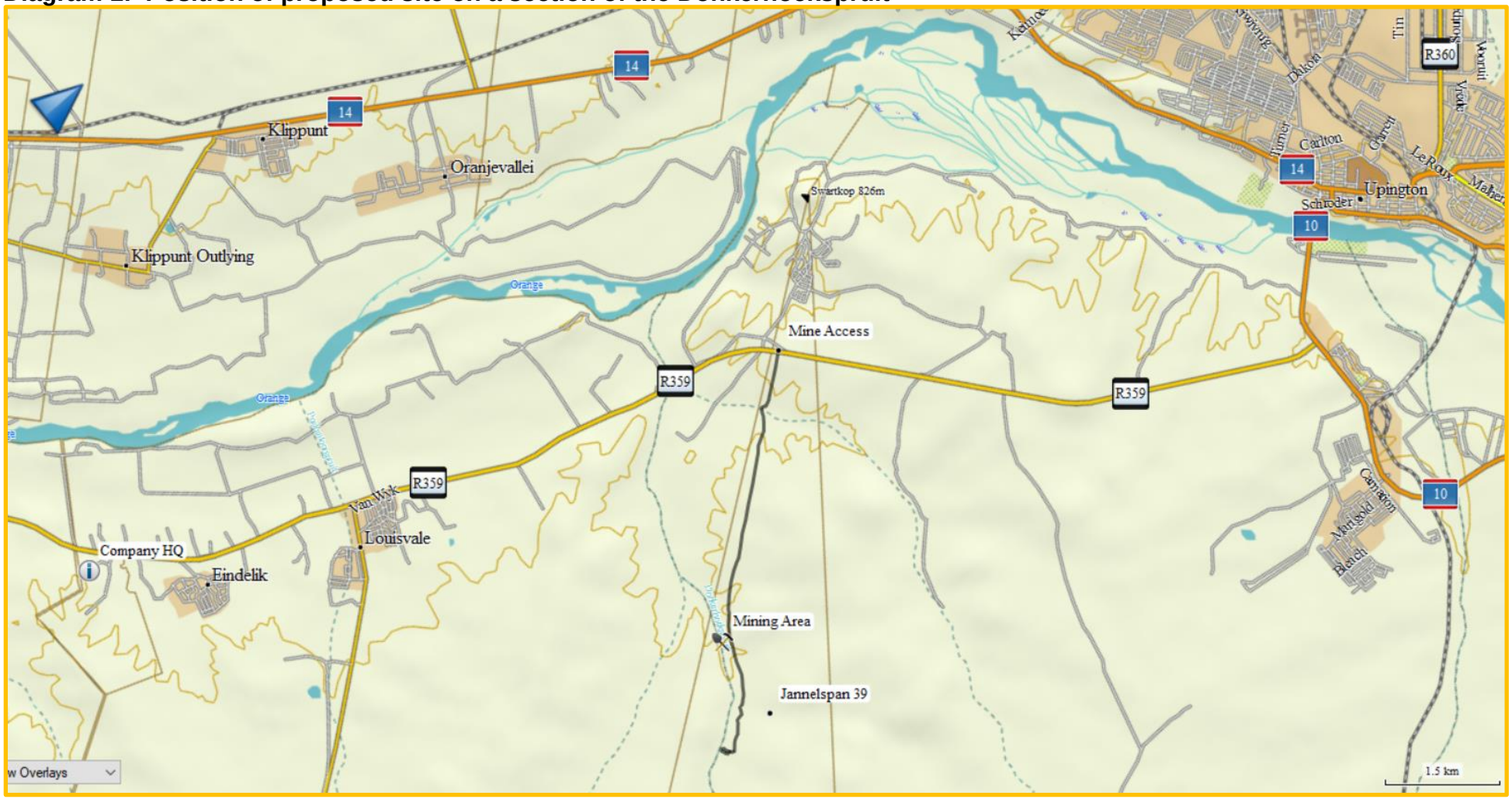


Diagram 2: Site Layout

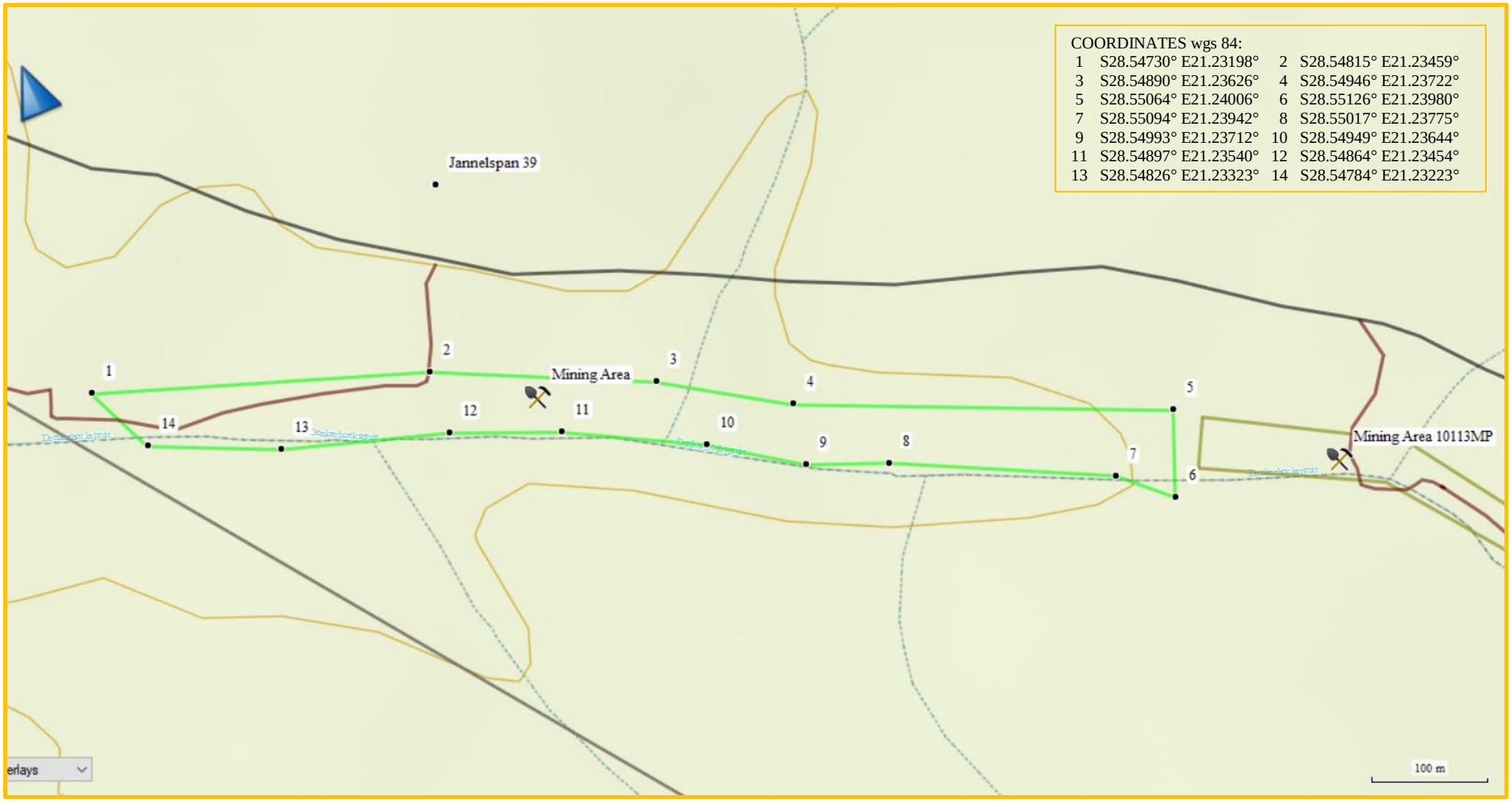
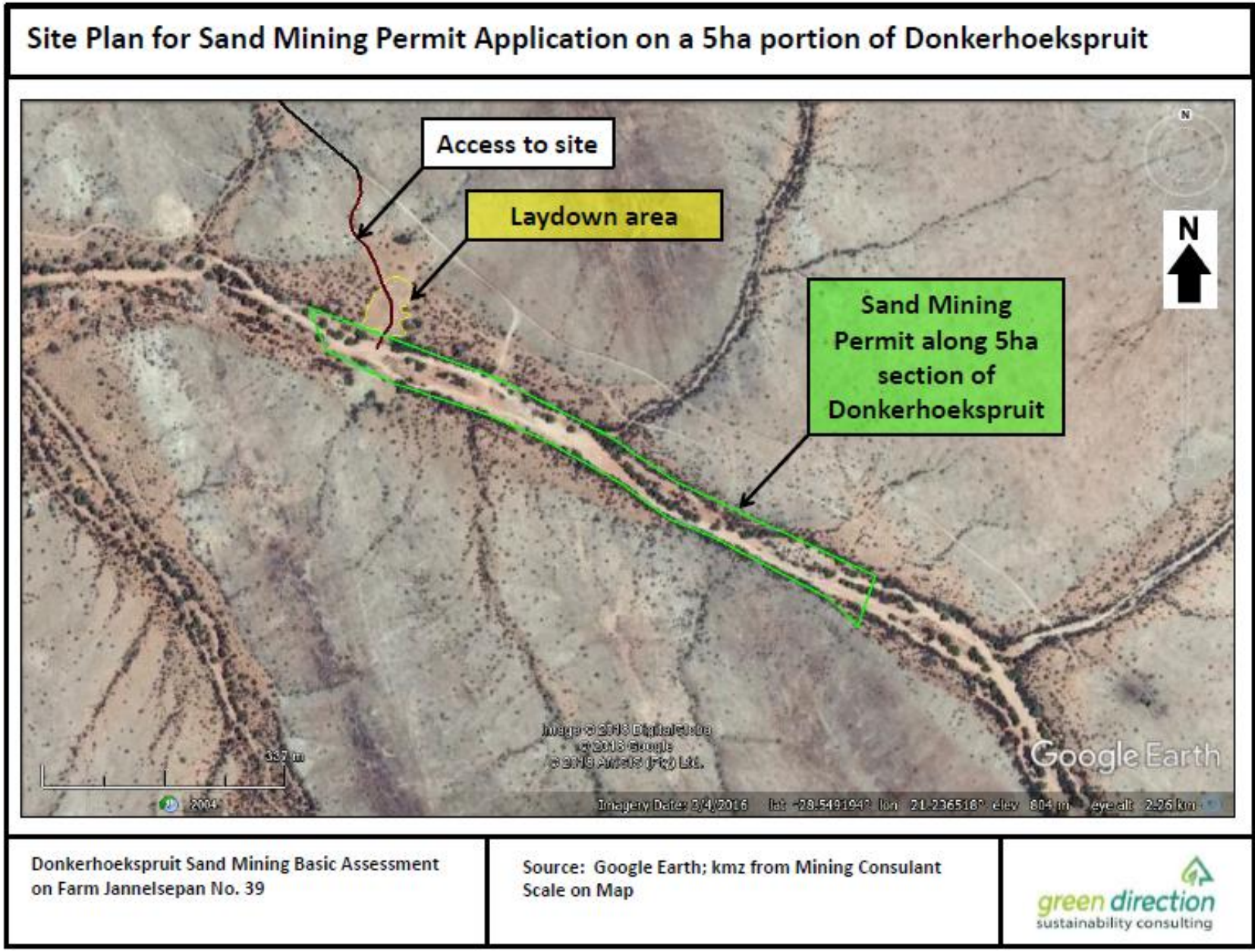


Diagram 3: Site Plan showing access to site and laydown areas



1.3.4 Project description

1.3.4.1 Construction Phase

Development of infrastructure and logistics

- Access and service roads
  Access to the mine workings is via the R359 main road and existing farm tracks (Diagram 2 and 3). The existing farm tracks will be used as haul roads and will only be upgraded to facilitate haul trucks.
- Water supply
  No process water is used in the mining process.
- Electrical supply
  No electricity is used on the mining area.
- Logistics
  No infrastructure will be required due to the simple mining method and only limited waste management facilities will be supplied consisting of the following:
  - Domestic waste is collected in plastic containers and transported daily to the company headquarters.
  - A temporary storage area for used lubrication products and other hazardous chemicals needs to be provided for the collection of the small volume of waste before it is removed to the company headquarters.
  - Only one 200-litre container is needed for the small amount of waste.
- Maintenance Oil/grease/diesel management systems will consist of the following:
  - Parking area with drip trays for stationary equipment to be provided outside the drainage channel.

1.3.4.2 Operational Phase

This operation will only involve the loading and hauling of raw river sand. Only one frond end loader will be used for loading and hauling and no processing will take place. The only surface disturbance except for the mining excavation within the drainage channel will be a small stockpile area and parking for equipment outside the drainage channel.

The depth of the mining operations will be less than 2m as only the top layer of sand is mined. The total area under excavation will approximately be 4 Ha and sand will be removed over the total area. Backfilling is not an option as the sand is completely removed as it is washed in from upstream.

No industrial or mine waste is generated during the mining process. All material consisting mainly of river sand is removed from the seasonal drainage channel to a depth of 2m and sold as a FoT product. No processing is taking place except for limited stockpiling so no mining waste or overburden and FRD will be created.

Domestic or any other waste generated during the mining operation will be stored in a temporary storage area provided as part of the parking area from where it will be removed to the company HQ.

Only minor repairs are done on site. A PVC lining and drip trays are used during maintenance and accidental spills are cleaned up immediately by removing of the contaminated sand. The small volume of contaminated sand is sold with the rest of the sand to be used in the building industry. Only one FEL is used in the mining process that is transported to the company headquarters for major repairs.

1.3.4.3 Decommissioning and closure phase

Planning for closure and restoration from the beginning of an operation makes the process easier; waste can be removed as it is created, excavation can be planned so that topography restoration is less complicated, and topsoil can be re-use at shorter interval. Site rehabilitation can make the land more valuable and attractive for resale. Additionally, establishing a closure strategy (and communicating that activity to the public) can help enhance the company's reputation as a socially-responsible operation. The decommissioning and closure phase at the end of the life of the mine will consist of implementing this final rehabilitation, decommissioning and closure plan.

2 REGULATORY REQUIREMENTS

2.1 Legal requirements

In terms of the transitional arrangements of the Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations (NEMA Financial Regulation) that took effect on 20 November 2015 any actions undertaken in terms of regulations 53 and 54 relating to financial provision in the MPRDA Regulations, 2004 which can be undertaken in terms of a provision of the NEMA Financial Regulations must be regarded as having been undertaken in terms of the provision of these Regulations (Reg. 17(1)).
A financial provision approved in terms of the MPRDA Regulations, 2004 must also be regarded to be the financial provision approved in terms of the NEMA Financial Regulations (Reg. 17(4)).
One of the conditions in terms of Regulation 17 (4) is that a holder that operates in terms of a financial provision approved in terms of the Mineral and Petroleum Resources Development Act, 2002 at the time of the coming into operation of the NEMA Financial Regulations, must review and align such approved financial provision with the provisions of the NEMA Financial Regulations on an annual basis as set out in regulations 9 and 11, read with the necessary changes.
This review fulfils the requirements of the Final Rehabilitation, Decommissioning and Mine Closure Plan and the Environmental Risk Assessment Report required in terms of the NEMA (Act 107 of 1998) regulations.

Several pieces of legislation are applicable to mine closure. Importantly, public participation is an integral part of mine closure and the process followed needs to fulfil the requirements of all relevant legislation. The following government departments have been identified amongst others as playing a key role in the closure process:

- Department of Minerals Resources (DMR). Lead agent, facilitator of closure inspections and issues the closure certificate,
- Department of Water and Sanitation (DWAS). Lead agent for potential water related issues and signs off on the mine closure certificate. Cancellation of Water Use license.
- Provincial Department of Environment and Nature Conservation (DENC). Gives input into the closure plan and guides and monitors protection of the natural environment.
- The local municipality and district municipality. Gives input into the mine closure plan and interfacing thereof with their integrated development plan (IDP) of the local area.

2.2 Environmental Authorisation (EMP) requirements

The key closure objective described in the closure plan submitted as part of the EMP is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required to ensure that the rehabilitation measures prove successful. The aim is to ensure a stable environment that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof.
This will be achieved by leaving the drainage channel even, and in a natural state containing no foreign debris or other materials. All scrap and other foreign materials will be removed from the area and disposed of as in the case of other refuse, whether these accrue directly from the mining operation or are brought on to the site. The access points to the drainage channel will be backfilled with the original material removed and profiled to blend in with the topography of the surrounding environment.
This key closure objective is divided in three closure objectives as stated below.

Objective 1 - To create a safe and rehabilitated post-mining environment

- Ensure safe mining area with no potentially dangerous areas like deep excavations.
- The site in the river bed is to be shaped and levelled at each stage of closure and rehabilitation.
- Topsoil to be stockpiled and replaced during decommissioning and closure, and rehabilitation.

Objective 2 - To minimise pollution or degradation of the environment

- Provide sufficient information and guidance to plan the sand mining activities in a manner that would reduce impacts as far as practically possible.
- Limit residual environmental impact with no surface water or soil contamination by ensuring that no fuel or oil spills occur in the mining area.
- Ensure that no solid waste or rubble is dumped on the site.

- Ensure that portable toilets are used.

Objective 3 – To minimise impacts on the community and to provide optimal post-mining social opportunities

- Ensure that workers remain within the mining permit area.
- Operate during normal working hours only.
- Minimise the generation of noise and dust.
- Respond rapidly to any complaints received.
- Minimal negative aesthetic impact
- Optimised benefits for the social environment

3 FINAL DECOMMISSIONING AND CLOSURE OF MINING OPERATION

Concurrent or progressive rehabilitation is good practice and has advantages for the company as it reduces its overall financial exposure. Concurrent rehabilitation and remediation are provided for in the annual rehabilitation plan and contain information that defines activities on an annual basis and how these relate to the final closure vision, as detailed in this final rehabilitation, decommissioning and mine closure plan. Annual reviews in terms of regulations 6(a) and 11(1)(a) of the NEMA Financial Regulations, that form part of the Annual Environmental Audit, assesses what closure objectives and criteria are being achieved through the implementation of the plan.
Areas that are not covered during concurrent rehabilitation as described in the Annual rehabilitation plan that require specific intervention as part of this final rehabilitation, decommissioning and mine closure plan are discussed below.

3.1 Risk sources

The risks sources and associated risks are listed below and the impact rating and mitigation actions of each risk are addressed in the risk assessment.
The risks associated with safety are deep and unstable excavations that can be detrimental to the safety and health of humans and animals. The risk can be regarded as insignificant given the extremely low rainfall in the area and small size of the excavations. The drainage channel is only in flood on average once a year and during flood events any excavations are filled naturally with sand washed in from upstream.
Due to the simple mining process that only include loading and hauling no unsafe areas like steep slopes that needs demarcation to prevent access by humans and animals will be created on site. No infrastructure, sub-surface voids, fine residue dams or evaporation ponds will be developed that can lead to potentially unsafe post-mining areas therefore no post mining access control would be required.
Another risk is the destruction of vegetation on the banks that will lead to scouring. The risk will be mitigated by shaping of the bank of the drainage channel and preventing destruction of vegetation on the banks to prevent scouring and restricting the depth of the excavations to less than 2m.
Another potential risk arising from the mining area after mine closure are changes in the quantity of surface water compared to pre-mining quantities that may negatively affect the area. To prevent significant negative effects the post-mining topography must be adjusted where possible to minimise the effect on water flow and increase potential for re-vegetation.
Actions to mitigate the risk of erosion and scouring is to ensure stability of the bank of the drainage channel by re-shaping and backfilling of the access point with suitable material where required.
No industrial or mine waste is generated during the mining process and all material consisting mainly of river sand will be removed from the site and sold as a FoT product. No processing will take place so no mining waste or overburden and fine residue dumps will be created with limited product stockpiles present on site.
There will also be a risk with regard to waste management practices leaving legacies and will require implementing of mitigation and management actions to limit the residual impact after mine closure.

3.2 Basic rehabilitation methodology

Objective 1 - To create a safe and healthy post-mining environment:

- Safe mining area (no potentially dangerous areas like deep excavations or securely fenced off)
  - Limit the depth of the excavation to a maximum of 2m deep.
  - Maintaining the affected environment in a stable condition that will not be detrimental to the safety and health of humans and animals.
  - Reinstate original profile of the riverbank by back filling of access point with the original material excavated.
  - Promote re-vegetation of bank with natural riparian vegetation.
  - Minimise risk of erosion from either increased base flow or mining operations followed by prompt rehabilitation and maintenance of erosion events.
- Limited residual environmental impact (No surface and/or groundwater contamination, waste management practices not creating or leaving legacies with a landscape that reduces the requirement for long term monitoring and management)
  - No waste in the form of dumps or structures will remain on surface after mine closure
  - No development of infrastructure and services will take place and facilities at the company headquarters will be used.
  - Unwanted steel, sheet metal and equipment needs to be removed from the mining area on a daily basis and no salvage yard will be established.
  - No temporary storage area for used lubrication products and other hazardous chemicals will be developed and waste must be disposed of at a collection point at the company headquarters on a daily basis.
  - Existing farm roads must be used for mining operations and where not possible the new roads or will be kept to a minimum.
  - Provision must also be made for efficient storm water control to prevent erosion of roadways.
  - Equipment used in the mining process will be adequately maintained in the workshops available at the company headquarters so that during operations it does not spill oil, diesel, fuel, or hydraulic fluid.
  - Accidental petro-chemical spills if any must be cleaned up immediately by removing the spillage together with the polluted soil and by disposing of them at the soil farm of the company HQ.

Objective 2 - To create a stable, free draining post mining landform, which is compatible with the surrounding landscape and which is capable of a productive land use that achieves a land capability equal to that of pre-mining conditions:

- Preventing attenuating or diverting any of the natural flow.
- Remove sand to the demarcated stockpile area with no stockpiling within the drainage channel
- Maintaining river-bank stability to be able to withstand high flow conditions.
- Prevent canalisation of the flow that can lead to scouring or erosion.
- Levelling of the river bed to prevent impeding and damming upstream.
- Topsoil must be removed from virgin areas to be disturbed and vegetation cleared, keeping disturbance to the native vegetation to an absolute minimum.
- Any topsoil removed from roads and stockpile area must be stored separately for later reuse.
- Topsoil borrowing from the virgin areas to cover disturbed areas will not take place.
- All topsoil which is removed prior to any activity will be stockpiled in berms (no higher than 1m) along with its resident seed bank and vegetation cover to an area above the proposed development.
- This berm will then serve a storm water control function in the unlikely event of surface water run-off.
- Movement of vehicles will be restricted to demarcated areas so as to keep the footprint of the mining operation to the absolute minimum.
- Movement of equipment must be restricted to existing roads and no ad hoc driving or turning outside demarcated loading and hauling areas will be allowed.
- All equipment and other items used during the mining operation needs to be removed from the site at final closure.
- All compacted areas due to stockpiling, loading and hauling will be ripped with erosion control measures.
- All stockpiles and leftover product must be removed or used to backfill the excavations

- Minimise the loss of land with agricultural potential: minimize footprint of disturbances to facilitate recovery of degrading patches into active patches through colonization of the patch by dispersing species (patch dynamics)
- Minimising footprint of disturbed areas including stockpile platforms and loading and hauling areas.
- Minimise loss of vegetation within the disturbance footprint: scarifying of all compacted areas as soon as possible for natural plant succession.
- Minimise disturbance of ecology due to loss of habitat and noise/visual/dust

Objective 3 – To minimise impacts on the community and to provide optimal post-mining social opportunities:

- Ensure that workers remain within the mining permit area.
- Operate during normal working hours only.
- Minimise the generation of noise and dust.
- Respond rapidly to any complaints received.
- Minimal negative aesthetic impact
  - Minimise visual disturbance.
  - Waste material of any description, including receptacles, scrap, rubble and tyres, must be removed entirely from the mining area and disposed of at a recognised landfill facility, and will not be buried or burned on the site.
- Optimised benefits for the social environment
  - Maintain positive and transparent relationships with stakeholders and maintaining communication channels.
  - Provide stakeholders including government authorities with relevant information as per legislative requirements.
  - Undertaking environmental management in accordance with the approved EMPr and Closure Plan.
  - Minimise noise disturbance: limiting earth moving to day time.
  - Management of air emissions to minimise nuisance effects or health risk; implementation and maintenance of dust monitoring programs accompanied by dust suppression activities by spraying water and/or dust-allaying agents.
  - Prevent long term changes in land use: revert back to grazing land where possible.

4 AFTERCARE AND MAINTENANCE

Maintenance of rehabilitated sites is often the difference between the ultimate successes or failure of rehabilitation and monitoring of rehabilitation will determine whether rehabilitation objectives and requirements are being achieved.

As the final phase in the project cycle, decommissioning may present positive environmental opportunities associated with the return of the land for alternative use and the cessation of impacts associated with operational activities. However, depending on the nature of the operational activity, the need to manage risks and potential residual impacts may remain well after operations have ceased. Examples of potential residual impacts and risks include erosion, slow recovery of vegetation, stock that has been abandoned (e.g. oil drums, scrap equipment) and old (unserviceable) structures.

The main closure objective is to hand back the rehabilitated properties to the respective landowners in a state that is fit for grazing, as close as possible to the original carrying capacity and to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof. The rehabilitation strategy is based on reinstating the original profile of the landscape and preparing the area for natural re-vegetation. The aim therefore is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. Due to the specific nature of the mining operation no aftercare and maintenance were identified except for monitoring of erosion event over a period of 2 years.

5 RISK ASSESSMENT

5.1 Risk impact rating

ASSESSMENT CRITERIA	
NATURE	
Positive	Beneficial to the receiving environment
Negative	Harmful to the receiving environment
Neutral	Neither beneficial or harmful
EXTENT (GEOGRAPHICAL)	
Site	The impact will only affect the site
Local/ district	Will affect the local area or district
Province/region	Will affect the entire province or region
International and National	Will affect the entire country
CONSEQUENCE	
Loss/gain	The impact will result in loss or gain of resource
No loss/gain	The impact will result in no loss or no gain of resource
DURATION	
Construction period / Short term	Up to 3 years
Medium term	Up to 6 years after construction
Long term	More than 6 years after construction
PROBABILITY	
Definite	Impact will certainly occur (>75% probability of occurring)
Probable	Impact likely to occur (50 – 75% probability of occurring)
Possible	Impact may occur (25 – 50% probability of occurring)
Unlikely	Impact unlikely to occur (0 – 25% probability of occurring)
REVERSIBILITY	
Reversible	Impacts can be reversed though the implementation of mitigation measures
Irreversible	Impacts are permanent and can't be reversed by the implementation of mitigation measures
IRREPLACEABLE LOSS OF RESOURCES	
High	The impact is result in a complete loss of all resources
Medium	The impact will result in significant loss of resources
Low	The impact will result in marginal loss of resources
No Loss	The impact will not result in the loss of any resources
CUMULATIVE EFFECTS	
High	The impact would result in significant cumulative effects
Medium	The impact would result in moderate cumulative effects
Low	The impact would result in minor cumulative effects
SIGNIFICANCE RATINGS	
Very High	Major to permanent environmental change with extreme social importance.
High	Long term environmental change with great social importance.
Medium	Medium to long term environmental change with fair social importance.
Low	Short to medium term environmental change with little social importance.
Very low	Short-term environmental change with no social importance
None	No environmental change
Unknown	Due to lack of information
DEGREE TO WHICH IMPACT COULD BE AVOIDED/MANAGED/MITIGATED	
High	The impact could be significantly avoided/managed/mitigated.
Medium	The impact could be fairly avoided/managed/mitigated.
Low	The impact could be avoided/managed/mitigated to a limited degree.
Very Low	The impact could not be avoided/managed/mitigated; there are no mitigation measures that would prevent the impact from occurring.

At the time of final mine closure an application will be made to DMR for a mine closure certificate only when all risks have been confirmed as insignificant or medium and under control via management actions.

5.2 Risk Mitigation and Closure objectives

In addition to the goals and objectives for final decommissioning and mine closure as documented in section 2, the vision for the post closure land form is to leave the site in as safe and self-sustaining a condition as possible and in a situation where no post-closure intervention is required. The vision is to ensure that the affected environment is maintained in a stable condition that will not be detrimental to the safety and health of humans and animals and that will not pollute the environment or lead to the degradation thereof and that the aesthetic value of the area will be reinstated.
For the vision to be realised the objectives and associated risk management strategies and mitigating measures described in section 3 needs to implemented, monitored and evaluated.

The aim with risk mitigation actions is to over time manage significant and medium risks to become insignificant, or at least medium and under control with management actions. Once achieved, a risk will continue to be monitored to confirm its insignificance rating as part of aftercare and maintenance as discussed in section 4.

The closure process involves a series of actions, executed over a number of years as indicated in the annual closure plans, with continual monitoring, review and remedial actions (if required). Identified and assessed risks feed into mitigation actions (or primary tasks) of which successful implementation result in achievement of the mine closure goals and objectives.

Financial provision is made in section 6 to deal with these mitigating measures in case of temporary closure or sudden closure during the normal operation of the project or at final planned closure.

The identified risks and their levels are listed together with their associated mitigating actions in Table 1.1 and 1.2.

Table 1.1: Risks, risk levels and mitigating actions: Construction Phase

IMPACTS AND ASPECTS	RISK LEVEL AFTER MITIGATION: PREFERRED AND ONLY ALTERNATIVE (SAND MINING ON 5HA PORTION OF DONKERHOEKSPRUIT; FARM JANNELSEPAN NO. 39)	MITIGATING ACTIONS
1. SOIL EROSION AND COMPACTION: The clearing of laydown areas for site establishment and clearing of existing vegetation will disturb the soil increasing the potential for soil erosion by wind and loss of soil in the event of rainfall. Soil compaction will result from repeated use of access tracks.	**Low / Insignificant Risk**	• After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Reasonable measures must be undertaken to ensure that any exposed areas are adequately protected against the wind and stormwater run-off. • Top soil shall be removed separately and stockpiled separately from other soil base layers. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Topsoil storage areas must be convex and should not exceed 2m in height. • Topsoil must be treated with care, must not be buried or in any other way be rendered unsuitable for further use (e.g. by mixing with spoil) and precautions must be taken to prevent unnecessary handling and compaction. • In particular, topsoil must not be subject to compaction greater than 1 500 kg/m² and must not be pushed by a bulldozer for more than 50 metres. Trucks may not be driven over the stockpiles. • Reduce drop height of material to a minimum. • Temporarily halt material handling in windy conditions. • A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers using the access road and entering the site will be informed of the speed limit.

		• Compacted areas that are not required for access shall be scarified after use during decommissioning and rehabilitation.
2. WATER RESOURCE FUNCTIONALITY IN A FEPA RIVER: The removal of sand from the river bank at the access points could impact on flow regime, water quality and quantity, and aquatic biota. The Donkerhoekspruit is however, non-perennial and impacts will have little effect on water resource functionality as a whole.	**Low / Insignificant Risk**	• Topsoil at access point to be removed prior during construction phase, and replaced during rehabilitation. • After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces. • Top soil shall be removed separately and stockpiled separately from other soil base layers. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Topsoil storage areas must be convex and should not exceed 2m in height. • Topsoil must be treated with care, must not be buried or in any other way be rendered unsuitable for further use (e.g. by mixing with spoil) and precautions must be taken to prevent unnecessary handling and compaction. • In particular, topsoil must not be subject to compaction greater than 1 500 kg/m² and must not be pushed by a bulldozer for more than 50 metres. Trucks may not be driven over the stockpiles. • Temporarily halt material handling in windy conditions. • Rehabilitation of the river banks at each access point as soon as that section of the river has been mined. • Compacted areas are to be scarified. • Shaping of river bank to be returned to original profile.
3. LOSS OF NATURAL VEGETATION AND ECOLOGICAL FUNCTIONING IMPACTING ON LOCAL BIODIVERSITY IN AN ECOLOGICAL SUPPORT AREA: Existing disturbed areas have been identified for laydown areas for site establishment. Clearing of existing vegetation in the river bed will result in the loss of vegetation and localized ecological functioning, however this vegetation consists of mostly alien invasive species.	**Very Low / Insignificant Risk**	• Identify existing disturbed patches for laydown areas, and demarcate areas for clearing. Refer to **Diagram 3** which indicates that existing farm tracks will be used, and disturbed areas have been earmarked for laydown areas. • Remove alien invasive vegetation and ensure ongoing alien vegetation clearing in the area. • No indigenous plants outside of the demarcated work areas may be damaged. • Identify protected tree species, and leave these intact, such as Camelthorn trees. • The noise and vibration caused by the earthmoving equipment will disturb smaller animals (e.g. snakes). These will move away whilst operations are in progress. Should any animals be encountered these should be moved away by a suitably trained nature conservation officer, if necessary.
4. POTENTIAL FOR SOIL AND RIVER SAND CONTAMINATION AND SOLID WASTE POLLUTION	**Low / Insignificant Risk**	• Oils and lubricants must be stored within sealed containment structures if kept on site. • Any mechanical equipment maintenance must be undertaken on drip trays or UPVC sheets to prevent spills/ leaks onto the soil. • When not in use, a drip tray must be placed beneath mechanical equipment and vehicles. • Machinery must be kept in good working order and regularly inspected for leaks. • A spill kit will be available on each site where mining activities are in progress. • Any spillages will be cleaned up immediately. • Waste materials generated on site must be stored in suitable lidded containers and removed off site to a suitable disposal facility. • Waste separation must be undertaken if practical for recycling • Provide all workers with environmental awareness training. • Provide a bin at the site. • Regularly dispose of any solid waste at a municipal waste disposal site. • Ensure all workers comply with the requirements of the EMPr. • Provide a mobile ablution facility.

5. VISUAL INTRUSION: Caused by the front end loader, topsoil stockpiles, cleared areas, and movement of trucks on site. The site is however, remote and rural in nature with no receptors (people) as it is located on private property.	**Very Low / Insignificant Risk**	• The laydown areas shall be kept neat and tidy at all times. Equipment must be kept in designated areas and storing/stockpiling shall be kept orderly. • Restrict working hours to normal work day hours with no work over weekends when holidays occur to minimize hauling trucks along access roads.
6. EMMISSIONS (DUST, VEHICLES & NOISE): Noise and dust will be created by mining equipment (e.g. front end loaders) and vehicles, which will emit Greenhouse Gases.	**Very low / Insignificant Risk**	• The Contractor shall adhere to the local by-laws and regulations regarding the noise and associated hours of operations. • The Contractor shall limit noise levels (e.g. install and maintain silencers on machinery). The provisions of SANS 1200A Sub clause 4.1 regarding "built-up" area shall apply to all areas within audible distance of residents whether in urban, peri-urban or rural areas. • Construction and demolition activities generating output of 85dB or more, shall be limited to normal working hours and not allowed during weekends to limit the impact of noise of neighbours. Should the Contractor need to work outside normal working hours, the surrounding neighbours shall be informed prior to the work taking place. • No amplified music shall be allowed on site. • On public roads adjacent to the site vehicles shall adhere to municipal and provincial traffic regulations including speed limits. • Vehicles used on site for the construction related activities shall be maintained and in a good working condition so as to reduce emissions. • Stockpiles must be maintained (covered where necessary) to avoid wind erosion of the material. • Incremental clearing of ground cover should take place to avoid unnecessary exposed surfaces.
7. HERITAGE, PALAEONTOLOGICAL AND CULTURAL IMPACTS	**Low / Insignificant Risk**	No mitigation required – **See Appendix E1 and E2.**
8. CREATION OF EMPLOYMENT & JOB SECURITY WITH LOCAL AND REGIONAL ECONOMIC SPIN-OFFS	**Medium (+) / NO RISK**	Employment of local previously disadvantaged labour wherever possible, with provision of training (upskilling)

Table 1.1: Risks, risk levels and mitigating actions: Operational Phase

IMPACTS AND ASPECTS	RISK LEVEL AFTER MITIGATION: PREFERRED AND ONLY ALTERNATIVE (SAND MINING ON 5HA PORTION OF THE DONKERHOEKSPRUIT ON FARM JANNELSEPAN NO)	MITIGATING ACTIONS
1. SOIL EROSION & SOIL COMPACTION: The sand mining process will disturb the river sand increasing the potential for fine particle suspension by wind. Soil compaction will result from repeated use of access tracks.	**Low/ Insignificant Risk**	• After clearing, the affected area shall be stabilized to prevent any erosion or sediment runoff. Stabilized areas shall be demarcated accordingly. • Incremental clearing of vegetation in river bed should take place to avoid unnecessary exposed surfaces. • Reasonable measures must be undertaken to ensure that any exposed areas are adequately protected against the wind and stormwater run-off. • Stockpiles should ideally be located to create the least visual impact and must be maintained to avoid erosion of the material. • Reduce drop height of material to a minimum. • Temporarily halt material handling in windy conditions. • A speed limit of 30km/hour will be displayed and enforced through a fining system. All vehicle drivers using the access road and entering the site will be informed of the speed limit. • Compacted areas that are not required for access shall be scarified after use during decommissioning and rehabilitation. • Planting of indigenous vegetation in areas under rehabilitation.

2. WATER RESOURCE FUNCTIONALITY IN A FEPA RIVER: The removal of sand from the river channel could impact on flow regime, water quality and quantity, and aquatic biota. The Donkerhoekspruit is however, non-perennial and impacts will have little effect on water resource functionality as a whole, as there is no permanent surface water, and storm water run-off events are very seldom in the arid climate.	**Low/ Insignificant Risk**	• No equipment may be parked within the drainage channel when not in use. • No stockpiling to take place within the drainage channel. • Shaping of river bed to avoid diversion of stormwater towards banks to prevent erosion of river banks, and to prevent channeling of water that would increase erosive capacity of stormwater. • Sand will be washed from upstream to the mining site over time.
3. LIMITED LOSS OF NATURAL VEGETATION AND DISTURBANCE OF CRITICAL BIODIVERSITY 2 AREA & ECOLOGICAL FUNCTIONING IN AN ECOLOGICAL SUPPORT AREA: The clearing of existing vegetation in the river bed will result in the loss of vegetation and localized ecological functioning. However, the existing vegetation is mostly alien invasive species and biodiversity will improve as a result. Transport of materials will be along existing access tracks resulting in little impact on ecological functioning at a local level during the operation phase. The Front End Loader will disturb local fauna.	**Low/ Insignificant Risk**	• Identify existing access tracks. Refer to **Diagram 3**, which indicates that existing farm tracks will be used. • Demarcate areas for clearing in the river bed. • The mining area and stockpile areas must be demarcated and the footprint contained within the demarcated area. • Mining areas to be limited to blocks of 500m at a time with rehabilitation of the bank and access areas required before moving upstream to the next block. • The annual rehabilitation plan must be implemented. • Remove alien invasive vegetation, and ensure ongoing alien vegetation clearing in the area. • No indigenous plants outside of the demarcated work areas may be damaged. • Identify protected tree species, and leave these intact, such as Camelthorn trees. • The noise and vibration caused by the earthmoving equipment will disturb smaller animals (e.g. snakes). These will move away whilst operations are in progress. Should any animals be encountered these should be moved away by a suitably trained nature conservation officer, if necessary.
4. POTENTIAL FOR SOIL AND RIVER SAND CONTAMINATION AND SOLID WASTE POLLUTION	**Low/ Insignificant Risk**	• Oils and lubricants must be stored within sealed containment structures if kept on site. • Any mechanical equipment maintenance must be undertaken on drip trays or UPVC sheets to prevent spills/ leaks onto the soil. • When not in use, a drip tray must be placed beneath mechanical equipment and vehicles. • Machinery must be kept in good working order and regularly inspected for leaks. • A spill kit will be available on each site where mining activities are in progress. • Any spillages will be cleaned up immediately. • Waste materials generated on site must be stored in suitable lidded containers and removed off site to a suitable disposal facility. • Waste separation must be undertaken if practical for recycling • Provide all workers with environmental awareness training. • Provide a bin at the site. • Regularly dispose of any solid waste at a municipal waste disposal site. • Ensure all workers comply with the requirements of the EMPr. • Provide a mobile ablution facility.
5. VISUAL INTRUSION: Caused by the front end loader, topsoil stockpiles, cleared areas, and movement of trucks on site. The site is however, remote and rural in nature with no receptors (people) as it is located on private property.	**Very Low / Insignificant Risk**	• The laydown areas shall be kept neat and tidy at all times. Equipment must be kept in designated areas and storing/stockpiling shall be kept orderly. • Restrict working hours to normal work day hours with no work over weekends when holidays occur to minimize hauling trucks along access roads.
6. EMMISSIONS (DUST, VEHICLES & NOISE): Noise and dust will be created by mining equipment (e.g. front end loaders)	**Very Low / Insignificant Risk**	• Ensure sand hauling is during normal working hours and not on weekends • No amplified music shall be allowed on site.

and vehicles, which will emit Greenhouse Gases.		• On public roads the vehicles shall adhere to municipal and provincial traffic regulations including speed limits. • Vehicles used on site for the construction related activities shall be maintained and in a good working condition so as to reduce emissions.
7. HERITAGE, PALAEONTOLOGICAL AND CULTURAL IMPACTS	**Low / Insignificant Risk**	No mitigation required – **See Appendix E1 and E2.**
8. CREATION OF EMPLOYMENT & JOB SECURITY WITH LOCAL AND REGIONAL ECONOMIC SPIN-OFFS	**Medium (+)** **NO RISK**	Employment of local previously disadvantaged labour wherever possible, with provision of training (upskilling)

Documentation and monitoring results will be provided as objective evidence of achieving the objective as listed in Table 2 below. The criteria with the contents of these documents must comply with are also given in this table.

Table 2: Objective Evidence and Closure Criteria

Closure objective	Document scope	Author	Success criteria to be achieved (standard)
Slope stability	Inspection of the post-mining areas with the objective to identify unstable areas and formation of erosion gulley's	Independent EAP	Post-mining area to be declared stable by DMR mine health and safety
No negative effect on surface water flow and waste management practices do not leave/create legacies	Inspection of the post-mining surface area with the objective to identify erosion and scouring due to flood event and storm water and sheet flow	Independent EAP	Post-mining area to be declared stable by DMR
	Assessment of the completeness of removal of mine waste	Independent EAP	Final performance assessment report to declare 100% removal of waste and equipment
Secured potentially Dangerous post-mining sites	Inspection of the post-mining surface area with the objective to identify unsafe areas	Independent EAP	Post-mining area to be declared safe by DMR
Increase in biodiversity	Report on the monitoring results with regard to succession tempo of total cover in comparison with virgin vegetation adjacent to mining area	Independent EAP	Total cover and species composition will need to be comparable to that of the adjacent virgin area
Soil stability	Monitoring results of erosion on steep slopes (20% gradient) and disturbed areas	Independent EAP	At the time of closure, soil loss will need to be stabilised over the whole previously disturbed area
Limited environmental impacts during demolition activities	Summary of all complaints received during demolition activities and follow up actions	Mine SHE Head, audited by independent EAP	Nuisance levels to be consistently on par with legislative standards after completion of demolition activities. All incidents older than 90 days to be investigated and feedback given to complainant

6 ESTIMATED COST FOR REQUIREMENTS TO FULLY DECOMMISSION THE SITE

With the repeal of Section 41 of the MPRDA (Act 28 of 2002) that requires that the owner of a mine must make financial provision for the remediation of environmental damage, regulations pertaining to the financial provision for prospecting, exploration, mining or production operations under section 44, read with sections 24 of the National Environmental Management Act, 1998 (Act No.107 of 1998) were issued in 2015.

According to regulation 6 an applicant must determine the financial provision through a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required for: (a) annual rehabilitation, as reflected in an annual rehabilitation plan; (b) final rehabilitation,

decommissioning and closure of the prospecting, exploration, mining or production operations at the end of the life of operations, as reflected in a final rehabilitation, decommissioning and mine closure plan; and (c) remediation of latent or residual environmental impacts which may become known in the future as reflected in an environmental risk assessment report.

6.1 Assessment of financial provision

The assessment of the financial provision requirements for annual rehabilitation in terms reg. 6(a) is provided for as part of the annual rehabilitation plan that form part of the annual environmental audit.
No remediation of latent or residual environmental impacts which may become known in the future were identified at this stage and financial provision in terms of reg. 6(c) are covered by the requirements for the actual costs of implementation of the measures required for final rehabilitation, decommissioning and closure of the mining operations at the end of the life of operations as reflected in this final rehabilitation, decommissioning and mine closure plan in terms of reg. 6(b).

The following risk based criteria and assumptions were used to calculate the final rehabilitation, decommissioning and closure cost:

- Return of land to its pre-mining land capability where possible
- All vehicles and equipment will be removed for salvage or resale
- A hazardous disposal site will not be constructed and all hazardous waste will be removed from site and transported to the company headquarters.
- Existing tracks will be used and new tracks must be restricted to the absolute minimum.
- All compacted areas due to hauling and stockpiling must be ripped to 300 mm
- The stockpile areas will not exceed the planned area footprint
- All disturbed and exposed surfaces will be covered with at least 150 mm of topsoil and re-vegetation must be allowed to take place naturally
- It is assumed that levelling of the river bed to prevent impeding and damming upstream will be addressed as part of the operation and necessary remedial actions implemented prior to closure
- The general approach adopted for the drainage channel is to prevent attenuating or diverting any of the natural flow and reinstating the original profile of the access points and ensuring the hydrological integrity of the area.
- Topography to follow the original landform shape.

6.2 Quantified Closure elements

Reinstate original profile of the riverbank by back filling of access point with the original material excavated	**1Ha Cost factor 1**
Promote re-vegetation of bank with natural riparian vegetation (ripping & levelling)	**0.5Ha Cost factor 2**
Maintaining river-bank stability	**part of annual rehab plan**
Prompt rehabilitation and maintenance of erosion events	**part of annual rehab plan**
Preventing attenuating or diverting any of the natural flow	**part of annual rehab plan**
Prevent canalisation of the flow	**part of annual rehab plan**
Levelling of the river bed to prevent impeding and damming upstream	**part of annual rehab plan**
Area covered by normal surface disturbance roads (ripping & levelling)	**1Ha Cost factor 2**
Compacted area - Stockpile and hauling area (ripping & levelling)	2**.5Ha Cost factor 2**
Final clean-up	**5Ha Cost factor 3**

6.3 Calculation of Closure cost

For each closure element, various possible combinations of required rehabilitation work were identified and costs were calculated for each of these, based on quotations obtained from independent third party suppliers for earthmoving equipment rental and various other consumables. Rates used are industry related.

Equipment

Excavator Cat 336D @ R 776.77/h X8hours + R2000.00 delivery & fuel	R8214.16/day
Grader Cat 140K	R 1 000.00/h
Tipper Truck 15m³	R 500.00/h
B25 dumper Cat 740B	R1400.00/h
Loader Cat 962H	R 900.00/h
Manual labour	R 24.34/h

- **Cost factor 1 - Reinstate topography of access points**

Total Cost per Ha R2053.54

- **Cost factor 2 - Level and rip compacted areas**

Total Cost per Ha R1000.00

- **Cost factor 3 - Final clean-up**

Total Cost per Ha R76.04

6.4 Total estimated cost for requirements to fully decommission the mining site at final closure

Closure Element Mitigating measures	Unit	No Units	Unit Cost	Cost per Element
Remove all stockpiles	Ha	2.5	R2,053.54	R5,133.85
Compacted area - Stockpile and hauling area (ripping & levelling)	Ha	2.5	R1,000.00	R2,500.00
Area covered by normal surface disturbance roads (ripping & levelling)	Ha	5	R1,000.00	R5,000.00
Spread topsoil dumps over ripped areas	Ha	5	R2,053.54	R10,267.70
Reinstate original profile of the riverbank by back filling of access points with the original material excavated	Ha	1	R2,053.54	R2,053.54
Promote re-vegetation of bank with natural riparian vegetation (ripping & levelling)	Ha	2	R1,000.00	R2,000.00
Prompt rehabilitation and maintenance of erosion events	Refer annual rehab plan			
Preventing attenuating or diverting any of the natural flow	Refer annual rehab plan			
Prevent canalisation of the flow	Refer annual rehab plan			
Levelling of the river bed to prevent impeding and damming upstream	Refer annual rehab plan			
Final clean-up	Ha	5	R76.04	R380.20
Annual rehabilitation plan	Year 1			R14,750.00
Total financial provision required to fully decommission and rehabilitate the mining operation				**R42,085.29**

7 THE PUBLIC PARTICIPATION PROCESS

7.1 Principles and Objectives

The Public Participation Process (PPP) was designed to fulfil the requirements of several pieces of legislation applicable to mine closure. It forms an integral component of the mine closure process by affording Interested and Affected Parties (I&AP) the opportunity to identify environmental issues and concerns relating to the proposed closure, which they feel should be addressed. This is consistent with the provisions of the National Environmental Management Act (Act No. 107 of 1998), Section 2(4)(f), which states that "the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured".

The objective of the sand mining operation public consultation process is to inform key stakeholders, I&APs and the general public about mine closure objectives and activities during the life of the mine.

The PPP was designed to provide sufficient and accessible information to I&APs in an objective manner to assist them to:

- Identify issues of concern, and provide suggestions for enhanced benefits and alternatives associated with mine closure,
- Identify risks not yet identified during the risk assessment exercise,
- Identify risks associated with mine closure and rehabilitation,
- Contribute local knowledge and experience,
- Verify that their issues have been considered.
- Comment on the Risk Assessment and Mine Closure Plan at the time of final decommissioning of the project, including the significance of potential risks that have been identified and associated impacts,
- Play an oversight role in the monitoring and evaluation of mine closure.

7.2 Stakeholder Identification and Project Data Base

Existing databases were used to inform the list of stakeholders. Special consideration was given to ensure that organizations and individuals that had expressed interest in the activities of the operation, and those who are potentially affected by mine closure, were included on the data base. The following are principles which govern the PPP:

- Key stakeholder groups and the general public comprise the target audience in the development of the PPP.
- Providing information to lay people to allow them to contribute to and participate meaningfully in the process.
- Stakeholder participation is most effective when the proponent and the practitioner recognise, acknowledge and validate stakeholder values when designing a PPP (i.e. there should be no underestimation of the technical and professional competence of citizens).
- The recognition that in the current political climate of South Africa, consultation, empowerment and capacity building is particularly important.

The process of involving stakeholders had three main objectives:

- Steps should be taken to ensure that stakeholder input into the project is relevant and representative.
- Stakeholders should be made aware of their objectives and role in the process,
- An efficient communication and feedback mechanism should be developed during the process to ensure that all stakeholders are kept informed of progress.

Stakeholders were drawn from the sectors outlined below:

- National (DWS, DMR), Provincial (DENC, DALR)
- Local Government (Local and District Municipalities)
- National Department of Transport
- SAHRA

Names of persons and organisations will be added to or deleted from the database where appropriate.

8 WAY FORWARD

This Final Rehabilitation, Decommissioning and Mine Closure Plan will be reviewed on an annual basis to align such approved financial provision set out in regulations 9 and 11, of the NEMA Financial Regulations. Concurrent rehabilitation and remediation will be provided for in the annual rehabilitation plan and will contain information that defines activities on an annual basis and how these relate to the closure vision, as detailed in this final rehabilitation, decommissioning and mine closure plan.

When final planned closure is applied for the operation will submit a final environmental performance audit report to DMR as lead agent for final perusal with the objective to issue a closure certificate. At that point, the closure process, and associated public participation program, will close.

21 Appendix E1: Heritage Impact Assessment prepared by Dr. David Morris (January 2018)

McGregor Museum
Department of Archaeology

Heritage Impact Assessment of proposed sand mining in the bed of the Donkerhoekspruit on Jannelsepan, near Louisvale, Northern Cape.

David Morris
McGregor Museum, Kimberley
January 2018

Heritage Impact Assessment of proposed sand mining in the bed of the Donkerhoekspruit on Jannelsepan, near Louisvale, Northern Cape.

David Morris, McGregor Museum, Kimberley
P.O. Box 316 Kimberley 8300
Tel 082 2224777 email dmorriskby@gmail.com
January 2018

1. INTRODUCTION

Van Zyl's Blasting en Grondwerke CC approached the McGregor Museum archaeology department to conduct a heritage impact assessment on a proposed sand mining site along the Donkerhoekspruit on the farm Jannelsepan, north east of Louisvale, !Kai Garib Municipality, Northern Cape.

The site was visited and inspected on 15 December 2017. This report accounts for findings made.

1.1. Focus and Content of Specialist Report: Heritage

This archaeology and heritage specialist study is focused on a circa 860 m stretch of the dry sandy bed of the Donkerhoekspruit where sand mining ("new permit") is proposed to take place for use in the building industry in the Upington area. Additional observations were made further upstearm that provide broader context on archaeological traces in the landscape.

This study outlines:

- Introduction, explaining the focus of the report (1.1) and introducing the author in terms of qualifications, accreditation and experience to undertake the study (1.2)
- Description of the affected environment (2) providing background to the development and its infrastructural components (2.1); background to the heritage features of the area (2.2); and defining environmental issues and potential impacts (2.3)
- Methodology (3) including an assessment of limitations (3.1); statement of expectations or predictions (3.2) and outline of EIA procedures including criteria for assessing archaeological significance (3.3).
- Observations and assessment of impacts (4), including field observations (4.1); characterizing archaeological significance (4.2); and characterizing the overall significance of impacts (4.3).
- Summary of Significance of Impacts is stated in tabular form (4.3.1).
- Measures for inclusion in a draft Environmental Management Plan for the development are set out in tabular form (5).
- Conclusions (6).

1.2 The author of this report

The author of this report is a qualified archaeologist (PhD, University of the Western Cape) accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists. The author has worked as a museum archaeologist in the Northern Cape since 1985 and has since the late 1980s carried out surveys in the general area of Upington-Kakamas (Morris 2002, 2005, 2006; Morris & Beaumont 1991; Morris & Seliane 2006). In addition, the author has a comprehensive knowledge of Northern Cape history and built environment, and received recent UCT-accredited training at a workshop on Architectural and Urban Conservation: researching and assessing local (built) environments (S. Townsend, UCT). He is also Chairman of the Historical Society of Kimberley and the Northern Cape.

The author is independent of the organization commissioning this specialist input, and provides this Specialist Report within the framework of the National Heritage Resources Act (No 25 of 1999).

The National Heritage Resources Act no. 25 of 1999 (NHRA) protects heritage resources which include archaeological and palaeontological objects/sites older than 100 years, graves older than 60 years, structures older than 60 years, as well as intangible values attached to places. The Act requires that anyone intending to disturb, destroy or damage such sites, objects and/or structures may not do so without a permit from the relevant heritage resources authority. This means that a Heritage Impact Assessment should be performed, resulting in a specialist report as required by the relevant heritage resources authority/ies to assess whether authorisation may be granted for the disturbance or alteration, or destruction of heritage resources.

2. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The environment in question is within the banks of a narrow spruit on Jannelsepan, some 5.5 km east of the Orange River, and 4.5 km north east of Louisvale near Upington. The surrounding landscape is typical of that occurring generally away from the Orange River in this region, tending to be rocky with shallow sandy soils and relatively to extremely sparse vegetation. This particular stretch of the Donkerhoekspruit has quite marked riverine vegetation, where patches of deeper sediment are preserved. Where archaeological materials might occur on the surface up the bank from the spruit they would often be highly visible, but they may be buried in the sediment immediately alongside the spruit.

It was indicated that the major anticipated impact of sand mining would be directly within the dry sandy bed of the spruit, between its current banks. In the event of archaeological materials occurring here they would clearly be in secondary context. The features noted are plainly visible in the Google Earth image included in Figure 1.

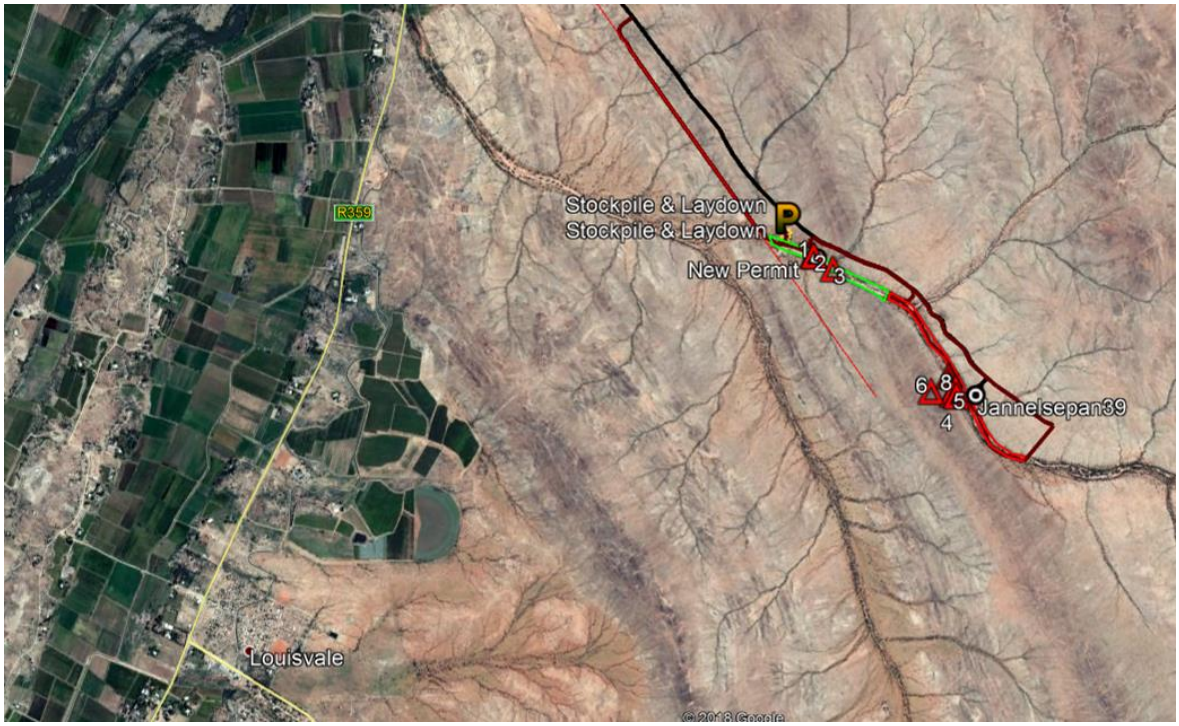


Figure 1. The location of the Jannelsepan sand mining area and 5.5 km east of the Orange River near Louisvale.

Figure 2. Sandy bed of the spruit.

2.1 Background to the development – description of proposed infrastructure

As indicated, sand mining is proposed to take place within the bed of the Donkerhoekspruit (Fig. 2) over a distance of about 860 m (New Permit). Existing farm roads and an existing stockpile and laydown area (Fig 3) would be used. Operations would take place essentially within the dry river bed.

Figure 3. Existing cleared stockpile and laydown area.

2.2. Heritage features of the region

No previous archaeological survey work had been carried out on this particular locality. In the wider landscape studies have been carried out at Steynmond Boerdery on Kakamas North Farm 339 (Beaumont 2007), and at the Cillie cemetery and township extensions (Dreyer 2013; van Schalkwyk 2013). De Jong (2010; see also Morris 2016) and Morris (2017a) assessed areas for intended agricultural development to the north and south of the Orange River on Kakamas North and Kakamas South respectively. At a general level the following summary statements provide pointers to potential heritage sensitivities in the local environment.

2.2.1 Colonial frontier

The eighteenth- and nineteenth-century records for this region (Penn 2005) pertain mainly to the areas south of and along the Orange River. The travellers Wikar and Gordon followed the river as far as and beyond this region in the 1770s, describing communities living along the river (see Morris & Beaumont 1991 for a summary).

Gordon, in 1779, noted a group of Bushmen living in the area whose encampments were on the north bank of the river, and who were known as *Khein eis* (= lean and thin people) (transcription of Gordon's Journal by Fredi Pheiffer nd:41, cf, Mossop 1935). Where the river was rocky, these people would subsist by fishing. There is reference to trapping of hippos (presumably in pits) near what is today Kakamas. Gordon refers to the inhospitable adjacent terrain, with hillocks strewn with irregular chunks of hard loose rocks and smaller sharp pieces so that "one walks one's shoes through very quickly in this veld" (transcription of Gordon's Journal by Fredi Pheiffer nd:34). This would be an accurate description of the wider study area reported on in this report.

Dunn and others describe the situation a century later (Robinson 1978). Frontiersmen such as the colourful Stephanos can be linked with particular places in the landscape – nearer to Keimoes (Morris 2002).

The region was caught up in the Koranna War of 1879-1880, while further military activity in the area included the risings of 'rebels' during the Anglo-Boer War and again in January-February 1915 when there was also an incursion of German troops some of whom were killed in the area (Hopkins 1978:128-129).

One of the most significant historical watersheds for the particular vicinity under consideration was the establishment of the agricultural settlement at Kakamas in 1898. The irrigation scheme set up by this community included canal construction, beginning at the upper end of Neus Island (Hopkins 1978). The Kakamas settlement is also known for its pioneering development of a hydro-electric power generator, brought into operation in 1924 (Hopkins 1978). The building which housed the generator was ear-marked as a museum.

2.2.2 Later Stone Age

Late Holocene Later Stone Age (LSA) sites are frequently noted in surveys south of and west of the region, including along the Orange River (e.g. Morris & Beaumont 1991; Beaumont et al. 1995). These are generally short-duration occupations by small groups of hunter-gatherers. In contrast, there are substantial herder encampments along the Orange River floodplain itself (Morris & Beaumont 1991) and in the hills north of Kakamas (Parsons 2003). In a range of hills north east of Keimoes, on Zovoorby, a rock shelter and specularite working (a sparkling mineral with known cosmetic and ritual use in the precolonial past) has been excavated (Smith 1995). LSA sites are usually focused on a particular feature in the landscape such as a hill or rocky outcrop and in relation to resources like water and associated habitats richer in animals and plant foods. Gordon's account of 1779 seems to suggest that particular locales were inhabited with inhospitable terrain separating such favoured spots.

2.2.3 Pleistocene: Middle and Earlier Stone Age

Beaumont et al. (1995:240-1) note a widespread low-density stone artefact scatter of Pleistocene age across areas of Bushmanland to the south where raw materials, mainly quartzite cobbles, were derived from the Dwyka glacial till. Similar occurrences have been noted north of Upington in situations where raw materials are abundant.

Systematic collections of this material at Olyvenkolk south west of Kenhardt and Maans Pannen east of Gamoep could be separated out by abrasion state into a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately to heavily weathered Earlier Stone Age (ESA) (Beaumont et al. 1995).

The ESA included Victoria West cores on dolerite and quartzite (a fine example has been found at Hondeblaf north of Upington), long blades, and a very low incidence of handaxes and cleavers. The Middle (and perhaps in some instances Lower) Pleistocene occupation of the region that these artefacts reflect must have occurred at times when the environment was more hospitable than today. This is suggested by the known greater reliance of people in Acheulean times on quite restricted ecological ranges, with proximity to water being a recurrent factor in the distribution of sites.

2.3 Description and evaluation of environmental issues and potential impacts

Heritage resources including archaeological sites are in each instance unique and non-renewable resources. Area and linear developments can have a permanent destructive impact on these resources. The objective of an HIA would be to assess the sensitivity of such resources where present, to evaluate the significance of potential impacts on these resources and, if and where appropriate, to recommend no-go areas and/or measures to mitigate or manage said impacts.
In relation to the proposed sand mining on Jannelsepan, principally a linear impact between the banks of the dry Donkerhoekspruit over a distance of about 860 m is anticipated.

2.3.1 Direct, indirect and cumulative impacts (in terms of nature, magnitude and extent)

The destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the sand mining phase. In the long term, the proximity of such mining operations in a given area could result in secondary indirect impacts resulting from the movement of people or vehicles in the immediate or surrounding vicinity.

3. METHODOLOGY

A site visit was carried out on 15 December 2017, with Mr Piet Louw, to inspect the proposed sand mining area on Jannelsepan on foot. The greater extent of the sand mining area further upstream was also inspected, and an adjacent hill was included in the survey to broaden the context of archaeological observations made. Heritage traces would be evaluated in terms of their archaeological and heritage significance (see tables below). A set of predictions was made which the study would test with observations made in the field. The McGregor Museum head of archaeology (D. Morris) was assisted by Abenicia Henderson with archaeology intern Jani Louw.

3.1 Assumptions and limitations

It was assumed that, by and large in this landscape, with its sparse vegetation and often shallow soil profiles, some sense of the archaeological traces to be found in the area would be readily apparent from surface observations (including assessment of places of erosion or past excavations that expose erstwhile below-surface features).

A proviso is routinely given, that should sites or features of significance be encountered during mining on the site (this could include an unmarked burial, an ostrich eggshell water flask cache, or a high density of stone tools, for instance), specified steps are necessary (beginning with immediate suspension of work, and reporting to the heritage authority).

3.2 Predictions

It may be predicted that:
In the broader landscape the local environment and topographic features close to the spruit may have provided places favoured for Stone Age encampments.

The adjacent terrain is strikingly inhospitable in terms of arid, rocky ground. Gordon encountered no encampments in these latter kinds of settings when moving through the area in October 1779.

A ridge on the south side of the spruit has rocky outcrops at its crest which suggested a possible locale for archaeological traces – and hence this was investigated to gain, potentially, a sense of broader landscape use in Stone Age times.

3.2.1 Potentially significant impacts to be assessed in the HIA process

Any area or linear, primary and secondary, disturbance of surfaces in the proposed mining locale could have a destructive impact on heritage resources, where present. In the event that such resources are found, they are likely to be of a nature that potential impacts could be mitigated by documentation and/or salvage following approval and permitting by the South African Heritage Resources Agency and, in the case of any built environment features, by the Northern Cape Heritage Resources Authority. Although unlikely, there may be some that could require preservation in situ and hence modification of intended mining.
Disturbance of surfaces includes any mining, construction or agricultural farming (quarries, pits, roads, pipelines, pylons, sub-stations or plants, buildings), or any other clearance of, or excavation into, a land surface. In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible). Without context, archaeological traces are of much reduced significance. It is the contexts as much as the individual items that are protected by the heritage legislation.

3.3 Determining archaeological significance

In addition to guidelines provided by the National Heritage Resources Act (Act No. 25 of 1999), a set of criteria based on Deacon (nd) and Whitelaw (1997) for assessing archaeological significance has been developed for Northern Cape settings (Morris 2000a). These criteria include estimation of landform potential (in terms of its capacity to contain archaeological traces) and assessing the value to any archaeological traces (in terms of their attributes or their capacity to be construed as evidence, given that evidence is not given but constructed by the investigator).

Estimating site potential

Table 1 (below) is a classification of landforms and visible archaeological traces used for estimating the potential of archaeological sites (after J. Deacon nd, National Monuments Council). Type 3 sites tend to be those with higher archaeological potential, but there are notable exceptions to this rule, for example the renowned rock

engravings site Driekopseiland near Kimberley which is on landform L1 Type 1 – normally a setting of lowest expected potential. It should also be noted that, generally, the older a site the poorer the preservation, so that sometimes any trace, even of only Type 1 quality, can be of exceptional significance. In light of this, estimation of potential will always be a matter for archaeological observation and interpretation.

Assessing site value by attribute

Table 2 is adapted from Whitelaw (1997), who developed an approach for selecting sites meriting heritage recognition status in KwaZulu-Natal. It is a means of judging a site's archaeological value by ranking the relative strengths of a range of attributes (given in the second column of the table). While aspects of this matrix remain qualitative, attribute assessment is a good indicator of the general archaeological significance of a site, with Type 3 attributes being those of highest significance.

Table 1. Classification of landforms and visible archaeological traces for estimating the potential for archaeological sites (after J. Deacon, National Monuments Council).

Class	Landform	Type 1	Type 2	Type 3
L1	Rocky surface	Bedrock exposed	Some soil patches	Sandy/grassy patches
L2	Ploughed land	Far from water	In floodplain	On old river terrace
L3	Sandy ground, inland	Far from water	In floodplain or near feature such as hill	On old river terrace
L4	Sandy ground, Coastal	>1 km from sea	Inland of dune cordon	Near rocky shore
L5	Water-logged deposit	Heavily vegetated	Running water	Sedimentary basin
L6	Developed urban	Heavily built-up with no known record of early settlement	Known early settlement, but buildings have basements	Buildings without extensive basements over known historical sites
L7	Lime/dolomite	>5 myrs	<5000 yrs	Between 5000 yrs and 5 myrs
L8	Rock shelter	Rocky floor	Sloping floor or small area	Flat floor, high ceiling

Class	Archaeo-logical traces	Type 1	Type 2	Type 3
A1	Area previously excavated	Little deposit remaining	More than half deposit remaining	High profile site
A2	Shell or bones visible	Dispersed scatter	Deposit <0.5 m thick	Deposit >0.5 m thick; shell and bone dense
A3	Stone artefacts or stone walling or other feature visible	Dispersed scatter	Deposit <0.5 m thick	Deposit >0.5 m thick

Table 2. Site attributes and value assessment (adapted from Whitelaw 1997)

Class	Attribute	Type 1	Type 2	Type 3
1	Length of sequence/context	No sequence Poor context Dispersed distribution	Limited sequence	Long sequence Favourable context High density of arte/ecofacts
2	Presence of exceptional items (incl regional rarity)	Absent	Present	Major element
3	Organic preservation	Absent	Present	Major element
4	Potential for future archaeological investigation	Low	Medium	High
5	Potential for public display	Low	Medium	High
6	Aesthetic appeal	Low	Medium	High
7	Potential for implementation of a long-term management plan	Low	Medium	High

4. OBSERVATIONS AND ASSESSMENT OF IMPACTS

The manner in which archaeological and other heritage traces or values might be affected by proposed sand mining at Jannelsepan may be summed up in the following terms: it would be any act or activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999)). The obvious impact in this case would be land surface disturbance associated with any proposed mining, which was expected to be essentially limited to the dry sand-filled bed of the spruit.

4.1 Fieldwork observations

The site was visited on 15 December 2017. Mr Piet Louw had been delegated to guide us to the stretch of the dry bed of the Donkerhoekspruit on Jannelsepan which is to be mined for sand. He indicated that mining impacts would essentially be limited to the area between the banks of the spruit. The length of proposed mining area (about 860 m for the new permit application plus the further extent to the farm boundary) was examined (Fig. 6). A few archaeological materials were observed in the sandy sediment in the bed of the spruit (Fig 4), but these are of no particular significance, occurring in secondary context.

Figure 4. Bed of the Donkerhoekspruit near its north-western end.

Figure 5. Sections in the banks of the spruit were examined and while pebble-rich lenses were noticed, none of these was found to be bearing artefacts.

Summary findings in relation to predictions made in section 3.2 above can be reported as follows:

4.1.1 Occurrence of Stone Age traces:

The thick soft river sand between the banks of the spruit – the resource to be mined (Fig. 4) – yielded a few artefacts but these are all in secondary context. A few isolated artefacts were noted at various places on the sand sediments alongside the spruit bed. Previous studies had mentioned similar landscapes in the surrounding area as being virtually entirely bereft of Stone Age traces (Beaumont 2007; de Jong 2010; Dreyer 2013; van Schalkwyk 2013), so that the scarcity of finds is not completely surprising.

A ridge rising to the south of the spruit, with rocky outcrop at its crest, was found to provide sheltering rocks and a relatively constrained flat surface that had been a place of concerted artefact production and use in Later Stone Age times. It corroborates other observations (e.g. alongside a sand mining site on Kakamas South – Morris 2017b) that suggest Latter Stone Age hunter gatherer use of higher ground alongside rivers/spruits or leegtes in this environment.

Table 3. Plotted artefact scatters and observations made.

	Lat (S)	Long (E)	Comment	Significance
1	28º32’54.9”	21º14’06.0”	Isolated quartz flake (Fig 7)	LOW
2	28º32’55.0”	21º14’06.2”	Isolated jaspilite flake (Fig 8)	LOW
3	28º32’57.8”	21º14’10.9”	Isolated jaspilite flake (Fig 7, 8)	LOW
4	28º33’25.2”	21º14’40.8”	Few LSA artefacts, quartz	LOW
5	28º33’24.8”	21º14’39.9”	Isolated jaspilite core	LOW
6	28º33’24.2”	21º14’34.6”	LSA surface scatter at crest of ridge, between outcrops	MEDIUM
7	28º33’20.9”	21º14’39.0”	Isolated MSA quartz flake (facetted butt)	LOW
8	28º33’23.6”	21º14’40.6”	Isolated quartz flake	LOW

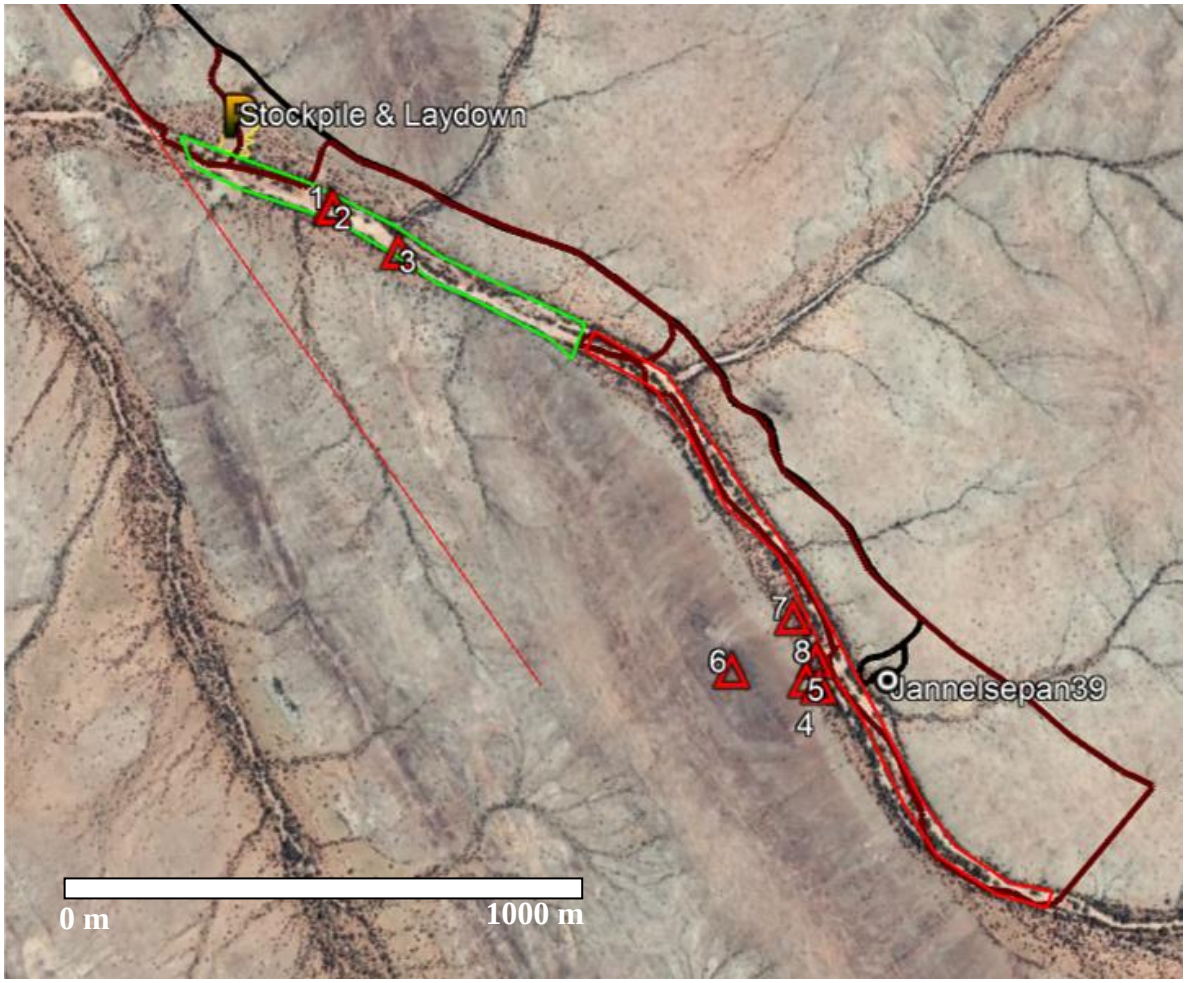


Figure 6. Plotting of archaeological observations as tabulated in Table 3. The green (new permit) and red outlines indicate extent of proposed sand mining.

Figures 7 & 8. Isolated stone artefacts (jaspilite and quartz) found in the bed of the spruit, corresponding with observations 1 and 2 in the map (Table 3).

Figure 9. View of Donkerhoekspruit from the LSA site (No 6 in Fig 6) at the top of the ridge.

Figure 10. Later Stone Age site (No 6 in Fig 6) at the crest of the ridge overlooking the spruit.

Figure 11. Random selection of artefacts at site 6.

4.1.2 Colonial era traces

No colonial era features or artefacts other than farm roads, fences and stock pens were observed in proximity to the section of Donkerhoekspruit scheduled for sand mining.

4.2 Characterising the archaeological significance (Refer to 3.4 above)

In terms of the significance matrices in Tables 1 and 2 under 3.4 above, the archaeological observations fall under Landform L1, generally Type 1 or 2, i.e. of low or very low potential. In terms of archaeological traces they all fall under Class A3 Type 1. These ascriptions (Table 1) reflect low potential for these criteria. For site attribute and value assessment (Table 2), the observations may be characterised as Type 1 for each of the Classes 1-7, again reflecting low significance.

On archaeological grounds, the Stone Age occurrences, extremely sparse, can be said to be of generally low significance, yet instructive about the exploitation of this landscape in Later Stone Age times.

For colonial era context, the site has no particular significance in terms of physical heritage traces.

4.3 Characterising the significance of impacts

The criteria on which significance of impacts is based include **nature**, **extent**, **duration**, **magnitude** and **probability of occurrence**, with quantification of significance being grounded and calculated as follows:

- The **nature**, namely a description of what causes the effect, what will be affected, and how it will be affected.
- The **extent**, indicating the geographic distribution of the impact:
    - local extending only as far as the development site area – assigned a score of 1;

    - limited to the site and its immediate surroundings (up to 10 km) – assigned a score of 2;
    - impact is regional – assigned a score of 3;
    - impact is national – assigned a score of 4; or
    - impact across international borders – assigned a score of 5.
- The **duration**, measuring the lifetime of the impact:
    - very short duration (0–1 years) – assigned a score of 1;
    - short duration (2-5 years) - assigned a score of 2;
    - medium-term (5–15 years) – assigned a score of 3;
    - long term (> 15 years) - assigned a score of 4;
    - or permanent - assigned a score of 5.
- The **magnitude**, quantified on a scale from 0-10:
    - 0 is small and will have no affect on the environment;
    - 2 is minor and will not result in an impact on environmental processes;
    - 4 is low and will cause a slight impact on environmental processes;
    - 6 is moderate and will result in environmental processes continuing but in a modified way;
    - 8 is high (environmental processes are altered to the extent that they temporarily cease); and
    - 10 is very high and results in complete destruction of patterns and permanent cessation of environmental processes.
- The **probability of occurrence**, indicating the likelihood of the impact actually occurring (scale of 1-5)
    - 1 is highly improbable (probably will not happen);
    - 2 is improbable (some possibility, but low likelihood);
    - 3 is probable (distinct possibility);
    - 4 is highly probable (most likely); and
    - 5 is definite (impact will occur regardless of any prevention measures).
- The **significance**, determined by a synthesis of the characteristics described above and expressed as low, medium or high. Significance is determined by the following formula:
  S= (E+D+M) P; where S = Significance weighting; E = Extent; D = Duration; M = Magnitude; P = Probability.
- The **status**, either positive, negative or neutral, reflecting:
    - the degree to which the impact can be reversed.
    - the degree to which the impact may cause irreplaceable loss of resources.
    - the degree to which the impact can be mitigated.
- **The significance weightings for each potential impact are as follows:**
    - < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
    - 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
    - > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

4.3.1 SUMMARY OF THE SIGNIFICANCE OF IMPACTS

Table 4. Significance of Impacts, with and without mitigation – based on the worst-case scenario – for all area investigated.

Nature: Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological or other heritage material or object (what affected). The following assessment refers to impact on physical archaeological/heritage traces.		
	Without mitigation	**With mitigation**
Extent	1	Not needed
Duration	5	Not needed
Magnitude	2	Not needed
Probability	3	Not needed
Significance	**24**	
Status (positive or negative)	WEAKLY NEGATIVE	
Reversibility	No	
Irreplaceable loss of resources?	Low density and significance and outside area of proposed sand mining.	Loss of context but possible to mitigate.
Can impacts be mitigated?	Not needed	Not needed
Mitigation: Not needed.		
Cumulative impacts: Cumulative Impacts: where any archaeological contexts occur, direct impacts are once-off permanent destructive events. Secondary cumulative impacts may occur with the increase in development and operational activity associated with the life of the proposed sand mining.		
Residual Impacts: -		

5. MEASURES FOR INCLUSION IN THE DRAFT ENVIRONMENTAL MANAGEMENT PLAN

The objective

Archaeological or other heritage materials that may occur in the path of any surface or sub-surface disturbances associated with any aspect of the sand mining are likely to be subject to destruction, damage, excavation, alteration, or removal. The objective is to limit such impacts to the primary activities associated with the mining and hence to limit secondary impacts during the medium and longer term operational life of the operation.

Project component/s	Any road or other infrastructure construction over and above what is outlined in respect of the proposed site development.
Potential Impact	The potential impact if this objective is not met is that wider areas or extended linear developments may result in further destruction, damage, excavation, alteration, removal or collection of heritage objects (minimal as they are) from their current context along the route.
Activity/risk source	Activities which could impact on achieving this objective include deviation from any planned development without taking heritage impacts into consideration.
Mitigation: Target/Objective	An environmental management plan that takes cognizance of heritage resources in the event of any future extensions of infrastructure. Mitigation (based on present observations and mining proposal as communicated) is not considered to be necessary.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Provision for on-going heritage monitoring in an environmental management plan which also provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of mining.	Environmental management provider with on-going monitoring role set up by the mining company for the mining phase and for any instance of periodic or on-going land surface modification thereafter.	Environmental management plan to be in place before commencement of mining.
Should unexpected finds be made (e.g. precolonial burials; ostrich eggshell container cache; or localised Stone Age sites with stone tools, pottery; military remains), the relevant Heritage Authority should be contacted.	Environmental Control Officer should become acquainted at a basic level with the kinds of heritage resources potentially occurring in the area and should report to the Heritage Authority as needed (see next column).	In the event of finding any of the features mentioned in column 1, reporting by the developer to relevant heritage authority should be immediate. Contact: SAHRA Ms N. Higgins 021-4624502 or NC Heritage Resources Authority Mr Andrew Timothy 053-8312537/8074700.

Performance Indicator	Inclusion of further heritage impact consideration in any future extension of mining or any infrastructural elements.
Monitoring	Officials from relevant heritage authorities (National, Provincial or Local) to be permitted to inspect the site at any time in relation to the heritage component of the management plan.

6. CONCLUSIONS

Precolonial/Stone Age material noted at the portion of Jannelsepan investigated in this study was found to be generally of low significance, where present at all. Minimal isolated archaeological finds found in the sand source area within the dry bed of the spruit are in secondary context. Criteria used here for impact significance assessment for archaeological traces rate the impacts as not worthy of further mitigation. Mining should however be limited to the intended zone within the bed of the spruit so as not to disturb possible materials in *in situ* sediments alongside the spruit.

ACKNOWLEDGEMENTS

I thank McGregor Museum archaeology staff member Ms Abenicia Henderson and intern Ms Jani Louw who assisted with fieldwork, and Mr Piet Louw who accompanied us to the site and indicated areas of expected mining impact.

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22 Appendix E2: Palaeontological Impact Assessment prepared by Prof. Marion Bamford (February 2018)

Palaeontological Impact Assessment for the proposed sand mining operation farm Jannelsepan northeast of Louisvale, !Kai Garib Municipality, Northern Cape Province

Desktop Study

For

Van Zyl's Blasting en Grondwerke CC

25 February 2018

Prof Marion Bamford
Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 30 years research; 22 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Van Zyl's Blasting en Grondwerke CC, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision-making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

Van Zyl's Blasting en Grondwerke CC approached the palaeontologist to conduct a desktop Palaeontological assessment for the proposed sand mining site along the Donkerhoekspruit on the farm Jannelsepan, north east of Louisvale, !Kai Garib Municipality, Northern Cape.

The proposed mining area lies on Kalahari sands and ancient volcanic and plutonic rocks of the Namaqua-Natal Province and in particular the Jannelsepan Formation migmatitic amphibolites and calc-silicates and the amphibolites of the Dagbreek Formation. These rocks are too old for body fossils and of the wrong type, being igneous. The sand to be mined is alluvial and would not contain fossils either. As far as the palaeontological heritage is concerned the project can continue and no further assessment is required.

Table of Contents

1. Background

Van Zyl's Blasting en Grondwerke CC approached the palaeontologist to conduct a desktop palaeontological impact assessment on a proposed sand mining site along the Donkerhoekspruit on the farm Jannelsepan, north east of Louisvale, !Kai Garib Municipality, Northern Cape.

The environment of the proposed mining site is within the banks of a narrow spruit on the farm Jannelsepan, about 5.5 km east of the Orange River, and 4.5 km north east of Louisvale near Upington. The surrounding landscape is typical of what occurs a short distance away from the Orange River in this region. It tends to be rocky with shallow sandy soils and relatively little to extremely sparse vegetation. This particular stretch of the Donkerhoekspruit has quite marked riverine vegetation, where patches of deeper sediment are preserved. It was indicated that the major anticipated impact of sand mining would be directly within the dry sandy bed of the spruit, between its current banks.

As requested here is the palaeontological impact assessment.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014)

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	**Relevant section in report**
Details of the specialist who prepared the report	Appendix A
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix A
A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
An indication of the scope of, and the purpose for which, the report was prepared	Section 1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section ii **Error! Reference source not found.**
An identification of any areas to be avoided, including buffers	N/A
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5

A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
Any mitigation measures for inclusion in the EMPr	n/a
Any conditions for inclusion in the environmental authorisation	n/a
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	n/a
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A
A description of any consultation process that was undertaken during the course of carrying out the study	N/A
A summary and copies if any comments that were received during any consultation process	N/A
Any other information requested by the competent authority.	N/A

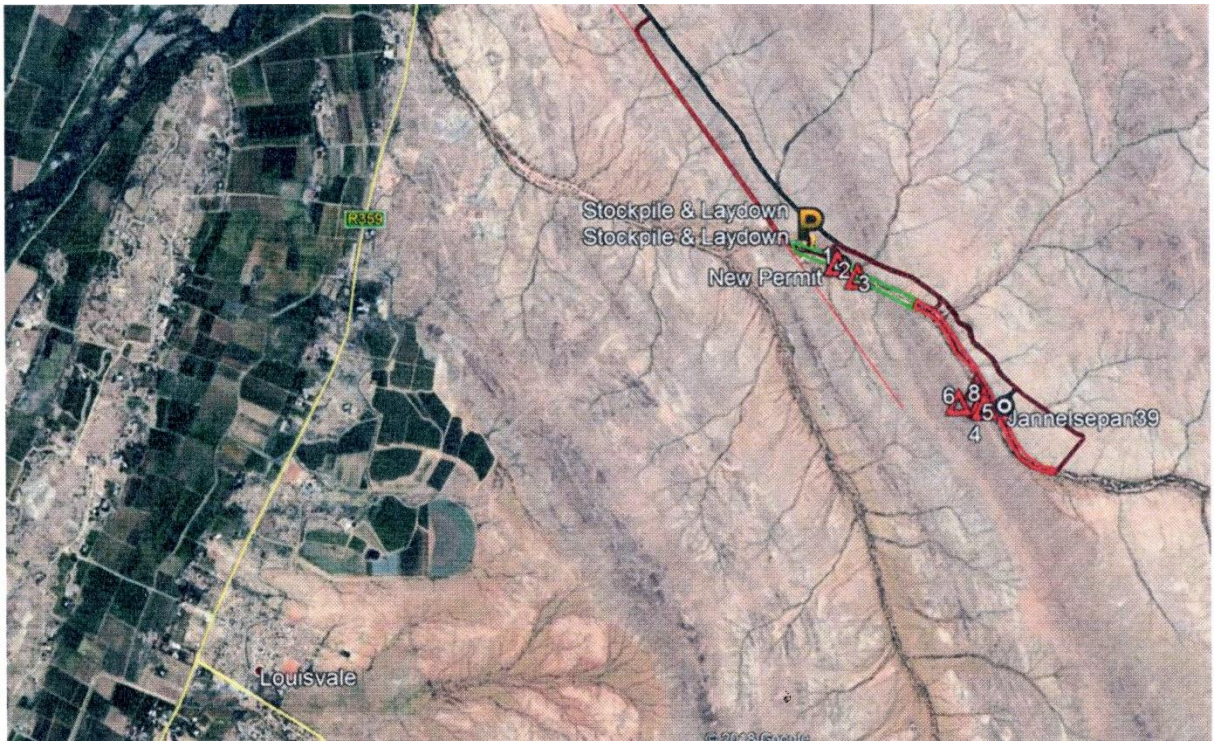

Figure 1: Detailed map from Google Earth of the proposed mining areas along the Donkerhoekspruit about 5.5km east of the Orange River, and 4.5 km northeast of Louisvale near Upington, Northern Cape Province.

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

3. Geology and Palaeontology

i. Project location and geological context

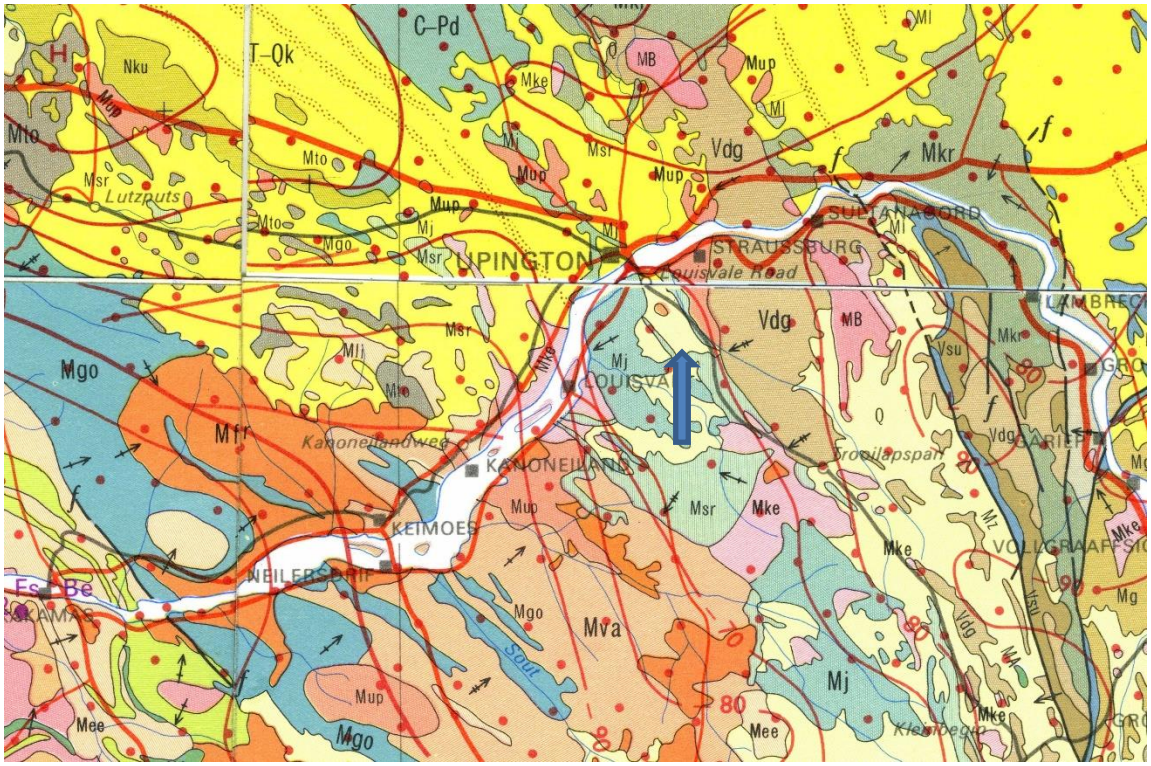

Figure 2: Geological map of the area northeast of Louisvale and south of the Orange River that has been selected for sand mining operations. The proposed site is indicated by the blue arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 2: Explanation of symbols for the geological map and approximate ages (Cornell et al., 2006; Erikssen et al., 2006. Johnson et al., 2006; Partridge et al., 2006). SG = Supergroup; Fm = Formation.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary sand; Gordonia Fm	Sands, alluvium, calcrete	Last 2.5 Ma
Mho	Hoogoor Suite	Pink gneiss	
Mva	Vaalputs Gneiss, Keimos Suite	gneiss	
Mfr	Friersdale Charnockite, Keimos Suite	Charnockitic adamellite	1080-1090 Ma
Mke	Granite (undifferentiated)	granite	
MA	Basic intrusive rocks	Metanorite, met gabbro	
MB	Daberas Granodiorite	Gneiss, granite	
Mto	Toeslaan Fm, Koranaland Group	Kinzigite	Ca 1240 Ma
Msr	Eierdoppan and Sprigg, Koranaland Group	Schist, gneiss, kinzigite	
Mj	Jannelsepan Fm, (Koranaland) Areachap Group	Migmatitic amphibolite, calc-silicate rocks	
Mgo	Goede Hoop Fm, Koranaland Group Sequence	Pink gneiss, quartzite, schist, amphibolite, calc-silicate rocks	
Mge	Geelvloer	Quartzite, calc-silicate rocks	
Vdg	Dagbreek Fm, Vaalkoppies Group	Schist, quartzite, amphibolite	Ca 1300 Ma

The proposed sand mining site lies in the Areachap Terrane of the Namaqua-Natal Province which has been broadly dated to between 1200 and 1000 Ma (Cornell et al., 2006). This complex of metamorphic rocks has been intruded by pre-tectonic intrusive orthogneisses and also by syn- to late-tectonic granitoids, such as the Eendoorn Suite and Daberas Granodiorite, and the Friersdale Charnokite.

This region is called the Namaqua-Natal Province and comprises igneous and metamorphic rocks that were formed or metamorphosed during the Namaqua Orogeny about 1200-1000 million years ago. The Jannelsepan Formation comprises migmatitic amphibolite and calc-silicate rocks. It has been interpreted as metamorphosed basaltic lavas and dolerite (Cornell et al., 2006). Precise dating of the various rocks is problematic. To the northeast are the schists, quartzites and amphibolites of the Dagbreek Formation. They are close to the Trooilapspan Shear Zone.

Overlying part of these ancient rocks are extensive deposits of the Kalahari Group that are considerably younger and are composed of aeolian sands, alluvium and calcrete. A thin film of haematite on the rounded sand grains gives them a reddish colour (Partridge et al., 2006). In some parts the sands form dunes that have been stabilised by vegetation.

ii. Palaeontological context

The intrusive rocks are plutonic or volcanic in origin and post-date the surrounding metamorphic rocks of the Areachap and Koranaland Groups. The broad age range of 1200 – 1000 Ma is too old for body fossils and the rock type, metamorphic or igneous, would not preserve fossils. Sedimentary rocks are required for preservation of fossils. Because of the age and rock type there would be no chance of finding fossils in this region.

Quaternary alluvial sands do not preserve fossils because of their friable and transported nature. Almond and Pether (2009) do not record fossils from this region.

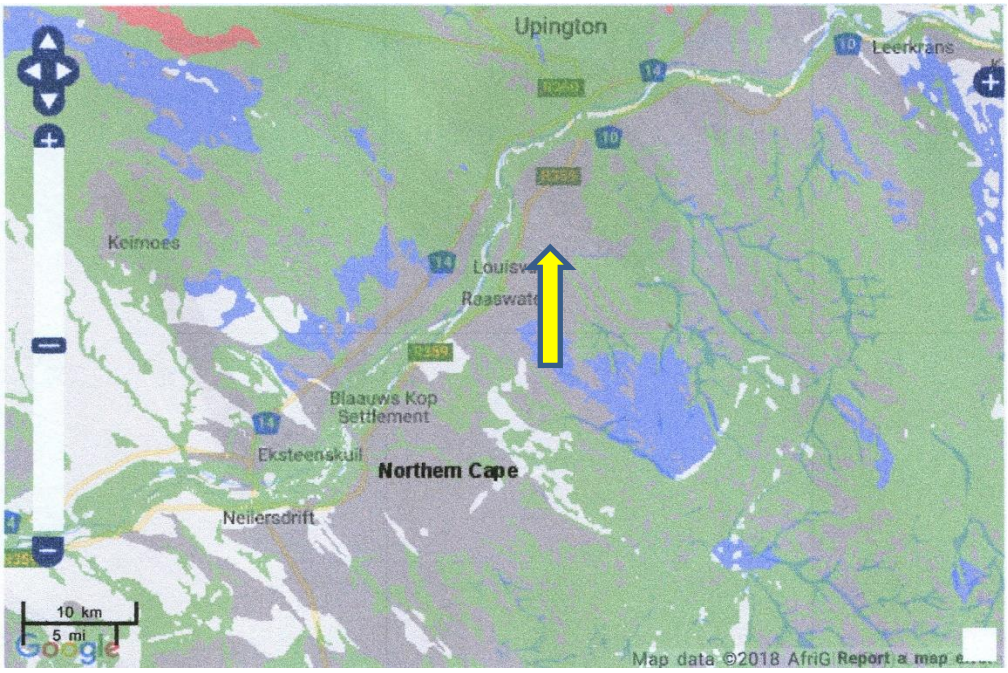

Figure 3: SAHRIS palaeosensitivity map of the region around Louisvale. The site in the grey area (arrow). Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:
Based on the nature of the project, the alluvial sands only will be removed and the ground would not be penetrated. Since there is no chance of finding fossils in either the hard rock or loose surface sands there would be no impact on the fossil heritage. There is no chance of finding fossils so a phase 2 or site visit is NOT recommended. Taking account of the defined criteria, the potential impact to fossil heritage resources is zero.

TABLE 3A: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

TABLE 3B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	There is no chance of any fossils being found here
	L+	-
	M+	
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	The spatial scale is extremely small.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	
	L	There is no chance of finding fossils in the surrounding rocks or in the sand.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the gneisses, schists, granites, amphibolites and sands are typical for the country and do not contain any microfossils, fossil plant, insect, invertebrate and vertebrate material.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely any fossils would be identified in the proposed site. No further palaeontological assessment is required. As far as the palaeontology is concerned the project may continue.

7. References

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Cornell, D.H., Thomas, R.J., Moen, H.F.G., Reid, D.L., Moore, J.M., Gibson, R.L., 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 325-379.

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Appendix A – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
January 2018

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

II) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

III) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

IV) Membership of professional bodies/associations

Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+

PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

V) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	5	2
Masters	6	3
PhD	9	3
Postdoctoral fellows	5	3

VI) Undergraduate teaching

Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

VII) Editing and reviewing

Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Cretaceous Research: 2014 -

Review of manuscripts for ISI-listed journals: 25 local and international journals

VIII) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells

- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC

IX) Research Output

Publications by M K Bamford up to January 2018 peer-reviewed journals or scholarly books: over 110 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 22; Google scholar h index = 24;
Conferences: numerous presentations at local and international conferences.

X) NRF Rating

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)
NRF Rating: C-2 (1999-2004)