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Mineral Resources
REPUBLIC OF SOUTH AFRICA

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Enquiries: D. A. Watkins
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Reference: EC30/5/1/3/3/2/1(0461)EM
Date: 23 August 2010

South African Heritage Resources Agency
P.O. Box 758
GRAHAMSTOWN
6140

Case ID: 2150

ATTENTION: MR. T. LUNGILE

Sir

CONSULTATION IN TERMS OF SECTION 40 OF THE MPRDA OF 2002: SAND (GENERAL) MINING ON THE FARM WANSTEAD NO. 18090, DIVISION OF MATATIELE, EASTERN CAPE

1. Attached herewith, a copy of the Environmental Management Plan received from Mbali Rural Developers cc.

2. Any written comments or requirements your department may have in this regard can be forwarded to this office no later than **16 October 2010.** Failure to do so, will lead to the assumption that your department has no objection(s) or comments with regard to the said documents. Comments may be submitted at your earliest convenience in order to reduce the turnaround time for the application process.

3. Consultation in this regard has also been initiated with other relevant State Departments.

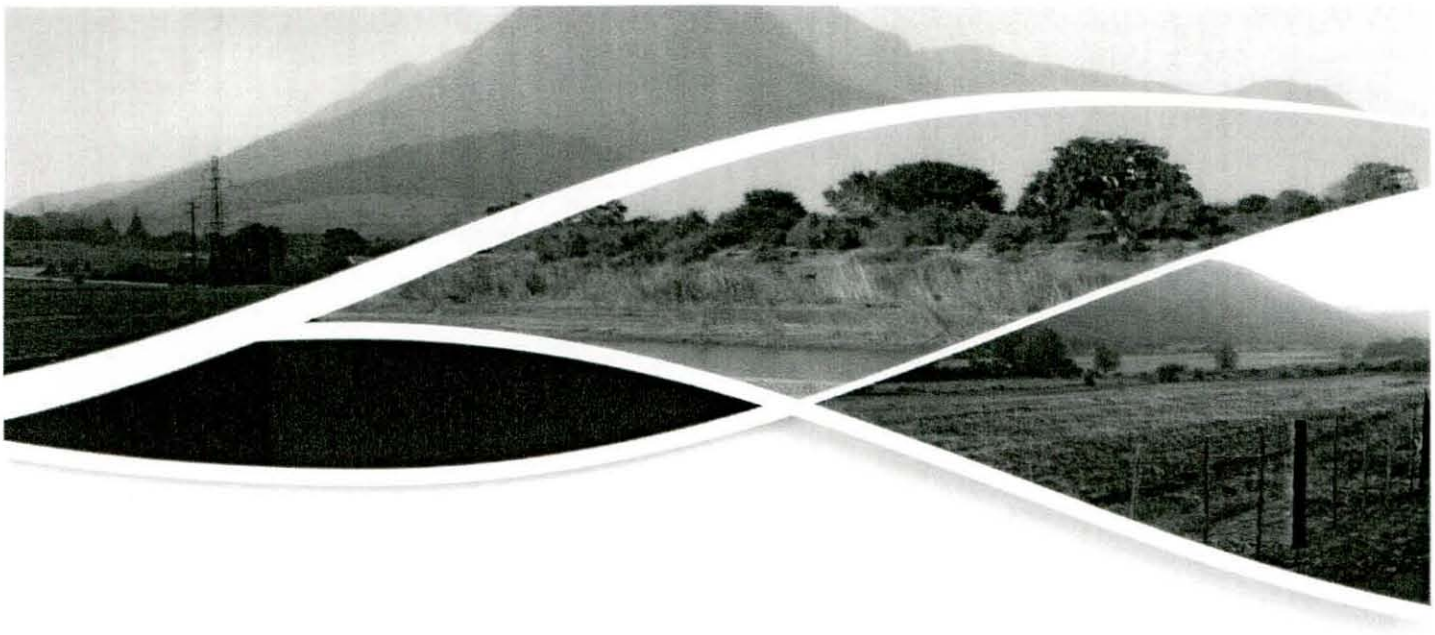
4. Please use the reference number (EC) 30/5/1/3/3/2/1(0461) EM in all future correspondence.

5. Your co-operation is appreciated.

Sincerely,

REGIONAL MANAGER

EASTERN CAPE



Environmental Management Plan: 2010 / 05 / 11 / EVN

Document version 1.0 – FINAL

Environmental Management Plan for the proposed Swartberg Sand Mine on Wanstead Farm along the Mzimvubu River, Alfred Nzo District Municipality, Eastern Cape

Prepared for:

MBALI RURAL DEVELOPERS CC.

JULY 2010

Compiled by
RDW WILLIAMS

AGES TOUCHING AFRICA GROUP

Environmental Management Plan: 2010 / 05 / 11 / EVN

Environmental Management Plan for the proposed Swartberg Sand Mine on Wanstead Farm along the Mzimvubu River, Alfred Nzo District Municipality, Eastern Cape

JULY 2010

Conducted on behalf of:
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REPORT DISTRIBUTION LIST

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MR. Z. NGEJANE	MBALI RURAL DEVELOPERS CC.

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LIST OF ABBREVIATIONS

Abbreviation	Description
CARA	The Conservation of Agricultural Resources Act
DEAET	Department of Economic Affairs, Environment and Tourism
DMR	Department of Mineral Resources
DOA	Department of Agriculture
DRE	District Roads Engineer
DRT	Department of Roads and Transport
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMP	Environmental Management Plan
IEM	Integrated Environmental Management
I&AP	Interested and Affected Parties
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NWA	National Water Act (Act No. 36 of 1998)
PPP	Public Participation Process
RHP	River Health Program
ROD	Record of Decision

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1 PROJECT INFORMATION

1.1 Introduction

Mining is of great importance to the South African economy. It should however be recognized that the processes of prospecting, extracting, concentrating, refining and transporting minerals have great potential for disrupting the natural environment. The environmental effects caused by the mining of sand from a river are often linked to causing adverse impacts to biota and their habitats. Because we depend on the many services provided by healthy aquatic systems, these ecosystems, as the resource base, must be effectively protected and managed to ensure that our water sources remain fit for the different water uses on a sustained basis. Sand mining in rivers is an important source of raw materials and sand is an important input to the construction industry, especially in developing countries such as South Africa, where there are pressing needs to provide infrastructure and housing.

AGES South Africa (Pty) Ltd was appointed by Mbali Rural Developers CC. to undertake the necessary environmental management services required for the authorisation of a mining permit for a sand mine on the Mzimvubu River in the Swartberg, Cedarville region (Alfred Nzo District). The government departments consulted and actively involved in the authorisation process include; the Department of Economic Affairs, Environment and Tourism (DEAET); the Department of Mineral Resources (DMR) and the Department of Water Affairs (DWA). In terms of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), authorization will be required from the DMR as the competent authority for the extraction of sand from the Mzimvubu River.

This Environmental Management Plan (EMP) is drafted in compliance with and in terms of Section 39 of the MPRDA, Act 28 of 2002. The project area is situated on Wanstead Farm just north of Cedarville Town within the jurisdiction of the Matatiele Local Municipality in the Alfred Nzo District of the Eastern Cape (**Figure1**).

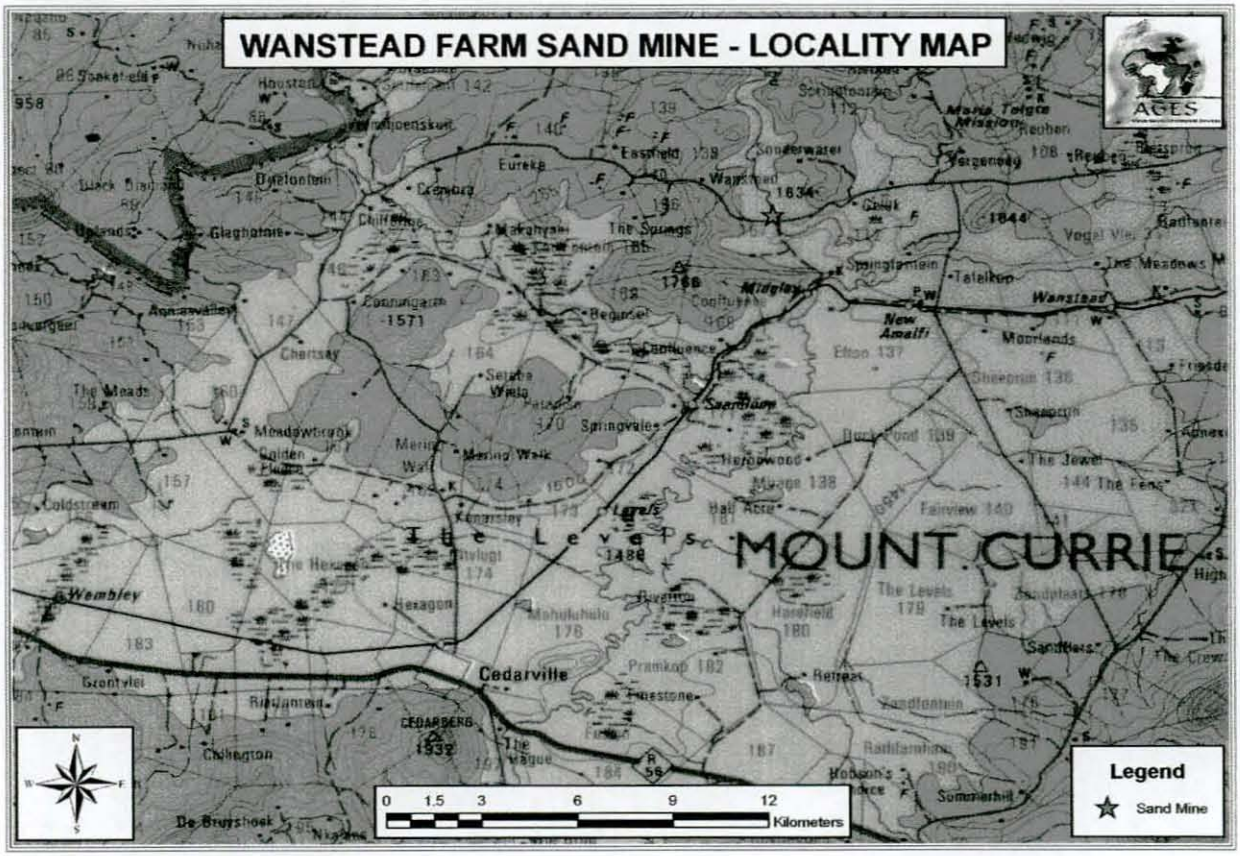

Figure 1 - Wanstead farm sand mine locality map

1.2 Project name

The proposed name of the sand mine is the "**Swartberg Sand Mine**" and will be referred to by this name throughout the EMP.

1.3 Contact details

Contact details of applicant	
Name	MBALI RURAL DEVELOPERS
Physical address	KEALSTREAM FARM, KARGS POST, KOKSTAD.
Postal address	P.O. BOX 263, KOKSTAD, KZN, 4700
Tel	039-727-2369
Fax	039-727-2369
Cell	082-339-1676
Contact's name	MR ZOVUYO NGEJANE

Contact details of land owner	
Name	WANSTEAD FARM NO. 18090
Physical address	WANSTEAD FARM NO. 18090, MATATIELE, 4730
Postal address	P.O. BOX 263, KOKSTAD, KZN, 4700
Tel	039-727-2369
Fax	039-727-2369
Cell	082-339-1676

Contact details of mine manager or responsible person	
Name	MR ZOVUYO NGEJANE
Physical address	KEALSTREAM FARM, KARGS POST, KOKSTAD.
Postal address	P.O. BOX 263, KOKSTAD, KZN, 4700
Tel	039-727-2369
Fax	039-727-2369
Cell	082-339-1676

Contact details of holder of mineral rights	
Name	STATE – REPUBLIC OF SOUTH AFRICA
Physical address	MOUNT CROIX C/O MOUNT AND DIAZ ROAD PORT ELIZABETH 6000
Postal address	DEPARTMENT OF MINERALS AND ENERGY PRIVATE BAG X 6076 PORT ELIZABETH 6000
Tel	041-502-0300
Fax	041-585-9097
Cell	NA

1.4 Title deed information

Please see attached copy of title deed under **Appendix B**.

1.5 Regional setting

Coordinates	S -30.255904
	E 29.134470
District Municipality	ALFRED NZO
Local Municipality	MATATIELE
Locality Map	**See Appendix A**

1.6 Direction and distance to neighboring towns

Swartberg Sand Mine is located approximately 18 km North North East of Cedarville Town, the closest urban development to the mine.

1.7 Presence of servitudes

There are no servitudes present on the mine site.

1.8 Ownership and use of immediately adjacent land

The immediately adjacent land is farmland owned by local farmers and secured by title deed.

1.9 Legislation/Regulations

The relevant sections of the MPRDA and its supporting Regulations are summarised below for the information of the applicant. The onus is on the applicant to familiarise him/herself with the provisions of the full version of the MPRDA and its Regulations.

Table 1 Relevant sections of the MPRDA

Section of Act	Legislated Activity/ Instruction/ Responsibility or failure to comply	Penalty in terms of Section 99
5 (4)	No person may prospect, mine or undertake reconnaissance operations or any other activity without an approved EMP, right, permit or permission or without notifying land owner	R 100,000 or two years imprisonment or both
19	Holder of a Prospecting right must: lodge right with Mining Titles Office within 30 days; commence with prospecting within 120 days, comply with terms and conditions of prospecting right, continuously and actively conduct prospecting operations; comply with requirements of approved EMP, pay prospecting fees and royalties	R 100,000 or two years imprisonment or both
20 (2)	Holder of prospecting right must obtain Minister's permission to remove any mineral or bulk samples	R 100,000 or two years imprisonment or both
28	Holder of a mining right or permit must keep records of operations and financial records AND must submit to the DG: monthly returns, annual financial report and a report detailing compliance with social & labour plan and charter	R 100,000 or two years imprisonment or both
29	Minister may direct owner of land or holder/applicant of permit/right to submit data or information	R 10,000
38 (1) (c)	Holder of permission/permit/right MUST manage environmental impacts according to EMP and as ongoing part of the operations	R 500,000 or ten years imprisonment or both
42 (1)	Residue stockpiles must be managed in prescribed manner on	A fine or imprisonment of

	a site demarcated in the EMP	up to six months or both
42 (2)	No person may temporarily or permanently deposit residue on any other site than that demarcated and indicated in the EMP	A fine or imprisonment of up to six months or both
44	When any permit/right/permission lapses, the holder may not or demolish buildings, which may not be demolished in terms of any other law, which has been identified by the Minister or which is to be retained by agreement with the landowner	Penalty that may be imposed by Magistrates Court for similar offence
92	Authorised persons may enter mining sites and require holder of permit to produce documents / reports/ or any material deemed necessary for inspection	Penalty as may be imposed or perjury
94	No person may obstruct or hinder an authorised person in the performance of their duties or powers under the Act	Penalty as may be imposed or perjury
95	Holder of a permit/right may not subject employees to occupational detriment on account of employee disclosing evidence or information to authorised person (official)	Penalty as may be imposed or perjury
All sections	Inaccurate, incorrect or misleading information	A fine or imprisonment of up to six months or both
All sections	Failure to comply with any directive, notice, suspension, order, instruction, or condition issued	A fine or imprisonment of up to six months or both

1.10 Other relevant legislation

Compliance with the provisions of the MPRDA (Act 28 of 2002) and its Regulations does not necessarily guarantee that the applicant is in compliance with other regulations and legislation. Other legislation that may be immediately applicable includes, but are not limited to:

- National Monuments Act, 1969 (Act 28 of 1969)
- National Parks Act, 1976 (Act 57 of 1976)
- National Environmental Management Act, 1998 (Act 107 of 1998)
- National Environmental Management Air Quality Act, 2004 (Act 39 of 2004)
- The National Water Act, 1998 (Act 36 of 1998)
- Mine Safety and Health Act, 1996 (Act 29 of 1996)
- The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)

2 MINING METHODOLOGY

2.1 Brief description of the proposed project

The applicant, who is the land owner, identified a large demand for coarse sand within the region. The current shortage of sand available is the result of there being no licensed coarse sand mines within the Alfred Nzo District and building contractors are having to transport sand large distances. The applicant acquired Wanstead Farm in 2008 and was made aware that a previous mining contractor had been illegally excavating coarse sand from within the Mzimvubu River that borders the Wanstead Farm. The availability of coarse sand on his farm coupled with the current large demand locally led the applicant to appoint AGES to assist in attaining a mining permit that would allow him to operate a small scale sand mine on his property in compliance with all legislation. The applicant seeks to provide coarse sand to the building industry within the region covering the urban areas of Kokstad, Cedarville and Matatiele.

The proposed mining site is situated in the upper / middle course of the Mzimvubu River in an area that experiences high fluctuations of stream flow and frequent flood events. In the past mining contractors have excavated directly from the stream bed on neighbouring properties and after a high flow event the sand in the stream bed was completely replenished naturally. The applicant therefore proposed on adopting a mining methodology that would be sustainable and see a system developed where the natural replenishment of sand would never be less than that which is excavated during the operation phase of the mine.

2.1.1 Minerals that will be mined

Commodity: Sand (General) (Type I)
Code: QY
Amount: Unable to estimate the volume as a result of the natural replenishment of coarse sand during high flow seasons – this will need to be monitored and will depend on the replenishment rate.

2.1.2 Estimated reserves and extent of the mine site

The total extent of the mine area is approximately 1.5 ha – of this 750m^2 falls within the river channel and this will form primarily the area where coarse sand will be excavated from the river bed. This area is 75m in length and 10m wide and forms a rectangle running parallel to the river bank. The remaining 750m^2 is an area of similar dimensions running parallel to the excavation site where the excavation platforms and access ramps will be developed. The total area to be impacted will therefore be 1.5 ha. At this stage it is not possible to estimate the exact sand reserves, however, previous excavators' experienced high levels of natural sand replenishment in the area and it is therefore predicted that a similar situation should unfold at the Swartberg Sand Mine. Monitoring will be fundamental in ensuring that the amount of sand excavated never exceeds that of the natural rate of replenishment.

2.1.3 Proposed mining method

The proposed mining method was developed as a result of research and consultation with all the relevant authorities involved in the authorisation process in order to identify the most environmentally sustainable option. Records in the past have shown the early months of the year to be the regions' high rainfall period and this obviously corresponds with level of water in the river. By winter the river has turned from a raging torrent to a gently meandering stream and it will be during this time that excavation will be taking place in the stream bed.

The mine site (**Appendix A**) is located on the inside of a river bend for the following reasons:

- These areas are characterised by slower moving waters that have high levels of sand deposition;
- During high flow periods the potential for erosion along the river banks is less because they are protected from the main channel flow;

- The higher levels of deposition will result in the faster replenishment of the sand that has been removed;
- The river banks are not as steep and therefore accessibility for the excavator is better;
- These areas have large amounts of coarse sand as a result of the high levels of deposition and are therefore key areas identified for excavation.

Four potential mine sites have been identified along the Mzimvubu River, Site A will form the main pioneering mine site and will be developed hand in hand with a thorough monitoring program to ensure the mining method is sustainable. The area to be mined will be divided into strips or stages and these should be completely mined before proceeding to the next stage – this method is often referred to as strip mining.

The following points summarise the proposed strip mining method (**Appendix G**):

- The excavation area (in the river channel) will be divided into five 10m × 15m strips – total area of 750 m^2;
- Excavation platforms and ramps will be established along the river bank for the excavators to operate from – this will entail the levelling of the river bank to allow for access. Mitigation measures will ensure that the material removed from the sand bank will be stockpiled for rehabilitation at a later stage;
- Excavators will strictly operate from along the river bank and will not enter the water;
- Excavation will begin at the most downstream strip and continue upstream from there – the logic is that any increase in sedimentation as a result of mining at the upstream sites will collect in the previously excavated areas;
- Each strip will be sand bagged off (refer to appended photo gallery for photos of the sand bag experiment – **Appendix D**) to direct the main flow of water away from the excavation site. A sand bag trial was undertaken to investigate the possibility of isolating a section of the stream bed for excavation. It proved successful and as a result only the sand bagged area will be impacted and experience high levels of turbidity etc – the EMP explains this;
- Excavation depth will not exceed 1 m and therefore it is expected that approximately 150 m^3 of coarse sand will be extracted from each strip;
- All the excavated coarse sand will be removed to a stock pile on higher ground where it will be loaded directly onto trucks;
- After mining a strip the sand bags will be removed to allow normal stream flow to replenish the excavated area. The sand bags will then be used to create an artificial river bank where the excavation platform was created in order to protect the river bank from erratic high river flows as well as limit any erosion;
- The excavation operations will then move upstream to the next strip and repeat the procedure.

A thorough monitoring program and performance assessment of the EMP has been compiled in **Section 8** that will monitor the mining method and where necessary adapt it. Little research has been completed on the impacts of sand mining in a river bed in South Africa and the monitoring will form a fundamental component of the project.

2.1.4 Planned lifespan of the mine

Mining will be limited to low river flow periods which are expected to be between the months of April and November – the level of the river will need to be assessed before mining can proceed. The proposed operation phase of the mine will initially be two years as restricted by the mining permit regulations, after which the option to extend annually will be considered pending the impacts of the mine and productivity.

3 DESCRIPTION OF THE ENVIRONMENT

3.1 Geology

According to the geological map 3028 KOKSTAD the proposed sand mine is located on a very large and prominent dolerite sill intrusion that is underlain by sedimentary rock from the Tarkastad Formation, comprising medium to fine grained yellow and grey sandstone as well as red, purple and blue green mudstone. The Tarkastad Formation is part of the Beaufort Group of the Karoo Supergroup. The lithology dip in a basic southerly direction at an angle of approximately 6 degrees. A prominent alluvial deposit occurs to the south of the project site.

Site inspection of the project area confirmed the occurrence and position of the dolerite sill intrusion. The area was however found to be covered by alluvial deposits along the floodplain of the regionally prominent Mzimvubu River. The proposed sand mine is therefore located on the most northern portion and origin of the very prominent alluvial deposit referred to as "The Levels" by local communities and farmers (**Figure 2**). It is expected that alluvium will be deposited during each flood event in this locality.

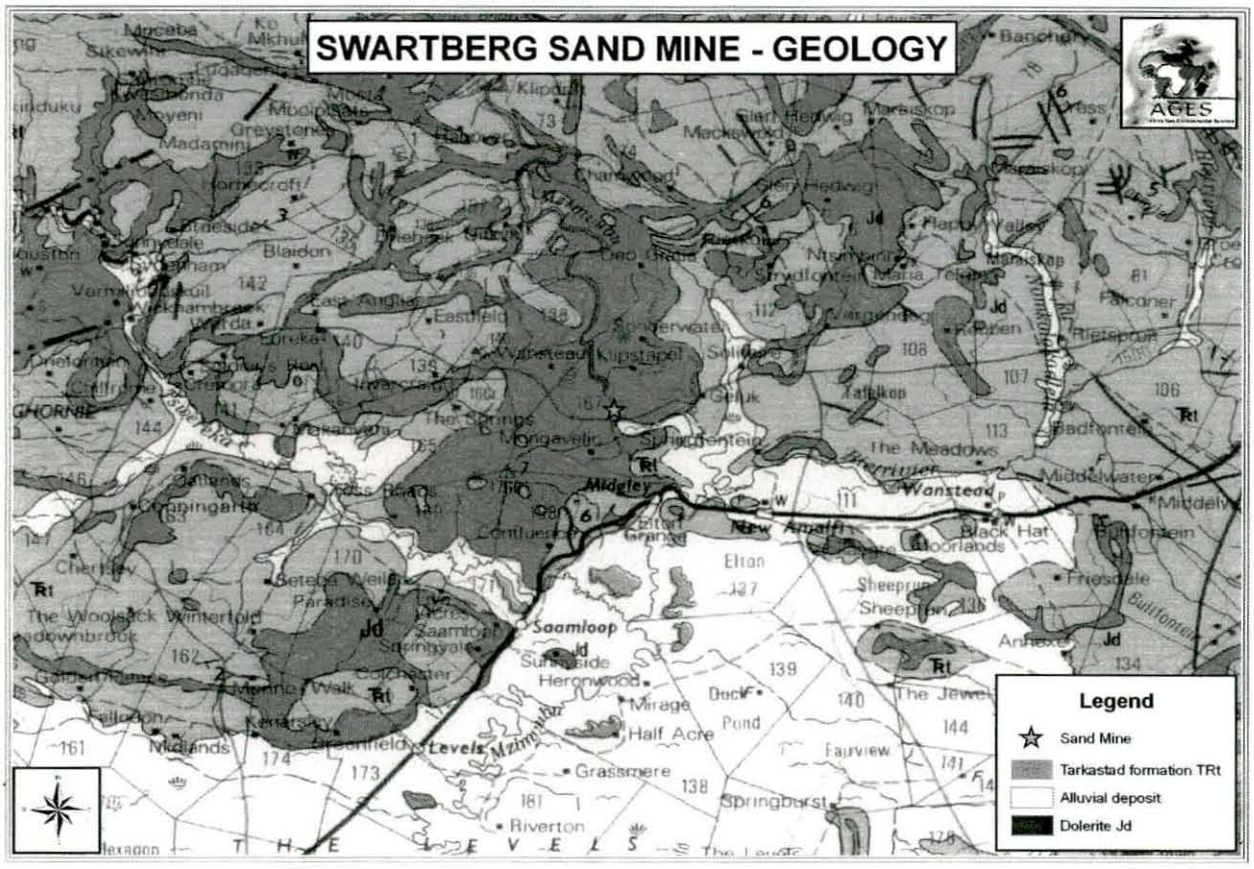

Figure 2 - Swartberg Sand Mine geology map

3.2 Climate

The region has mostly summer rainfall, with a Mean Annual Precipitation (MAP) of 780 mm, ranging from 620 – 816 mm. Kokstad records 88 rain days in a year and three of those occur in the midwinter (June – July). Both mist and snow occur less frequently than in Southern Drakensberg Highland Grassland and much of the rain comes in the form of thunderstorms. Mean Annual Temperatures (MAT) range between 12.9 – 15.6 °C. Moderately severe frosts occur 30 days in a year.

3.3 Topography

The topography of the project area is mostly hilly - consisting of low mountains and undulating valleys. There are no significant topographical features and the average elevation ranges from 1440 to 1500m AMSL. Swartberg Sand Mine is located at an average elevation of 1440m AMSL.

3.4 River catchment area

The Swartberg Sand Mine is located in the river catchment area T31D.

3.5 Soils

Soils are generally red-yellow apedal, freely drained soils, red and yellow dystrophic and/or mesotrophic.

3.6 Land capability

The land type is Ac465 - Moderate potential arable land.

3.7 Land use

3.7.1 Land use type

The land use is classified as agriculture land.

3.7.2 Historical agricultural production

The land is currently being used for livestock grazing purposes and commercial crop production.

3.7.3 Signs of misuse and/or soil erosion

There are minimal signs of both misuse and soil erosion in the area. An area of concern is upstream of the mine site along the western river bank on the Wanstead property where large amounts of scrap metal have been dumped in amongst a thicket of wattles.

3.7.4 Details of existing structures and distance from proposed/existing activities (also reservoirs, stock watering places, boundary and camp fences and soil conservation works)

The closest structure of significance is the bridge across the Mzimvubu River on the MR604 gravel access road – Site A is approximately 100 m upstream and is not expected to impact the structure.

3.8 Natural vegetation

Swartberg Sand Mine is situated within the grassland biome and is described by Acocks (1953) as VT 44 Highland Sourveld and Dohne Sourveld. Low and Rebelo (1996) also described the vegetation of the area as Moist Upland Grassland (LR 42). Mucina and Rutherford (2006), South Africa's newest and extensive vegetation map, describe the vegetation type as East Griqualand Grassland (Gs 12) (**Figure 3**). This vegetation type is distributed across the KwaZulu-Natal and Eastern Cape provinces, with Kokstad and Matatiele as centres. The vegetation and landscape is described as hilly country with slopes covered by grassland in places, with patches of bush clumps with *Leucosidea sericea* (only wet sites) or *Diospyros lycioides*, *Acacia karroo* and *Ziziphus mucronata* in low-lying and very dry sites.

3.8.1 Dominant species

Graminoids: *Aristida congesta, Brachiara serrata, Elionurus muticus, Eragrostis chloromelas, Heteropogon contortus, Hyparrhenia hirta.*

Herbs: *Acanthospermum australe, Conyza podocephala, Helichrysum herbaceum, Tolpis capensis, Vernonia natalensis.*

Shrubs: *Anthospermum rigidum subsp. pumilum, Chaetacanthus setiger, Felicia muricata, Rubus*

rigidus.

3.8.2 Endemic taxa

The following herbs are endemic: *Alepidea duplidens*, *Berkhey griquana*, *Wahlenbergia dentate* and *Wahlenbergia ingrate*. A biogeographically important taxa is the small tree: *Encephalartos friderici-guilielmi*.

3.8.3 Invader or exotic species

Acacia dealbata and *Acacia mearnsii* are invading these grasslands in some places, especially along drainage lines.

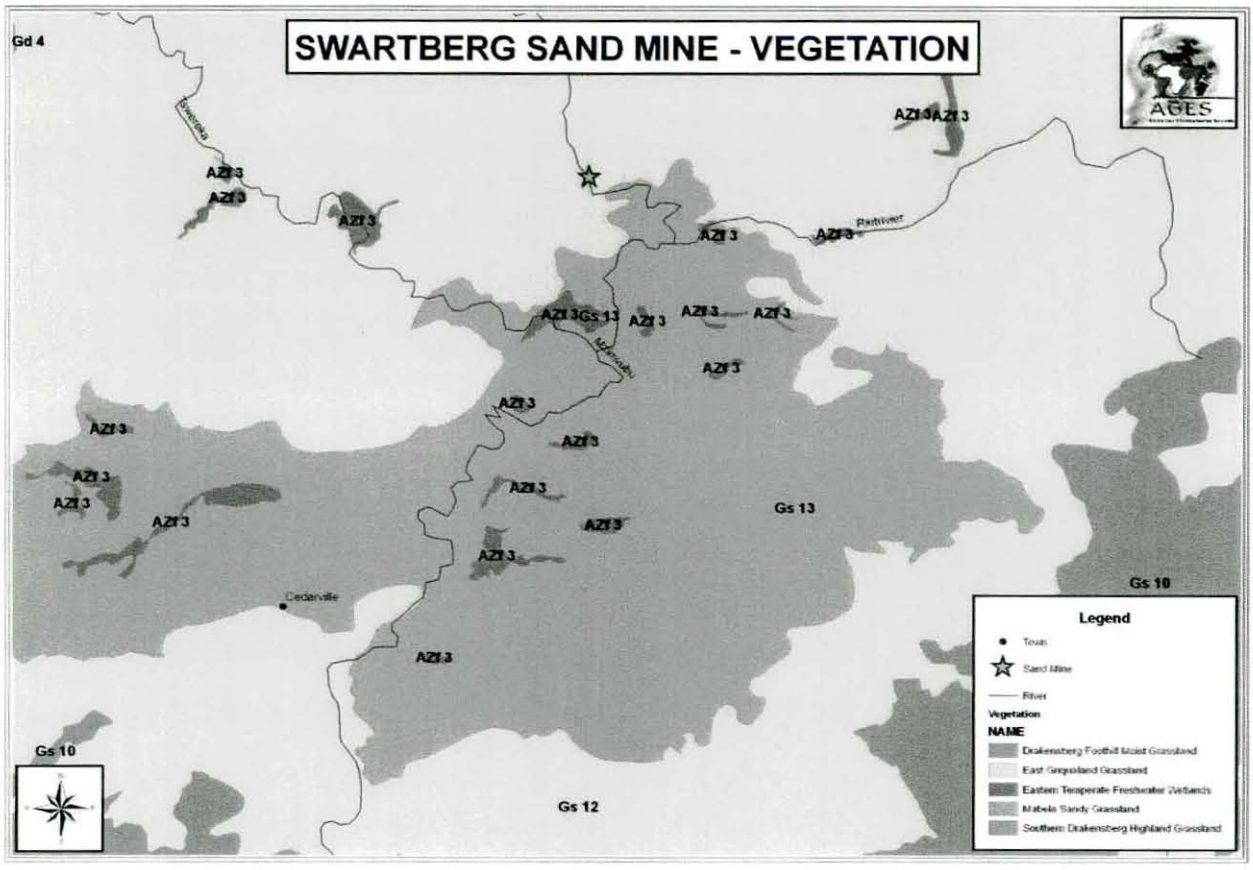

Figure 3 - Swartberg Sand Mine Vegetation Map

3.9 Animal life

There were a few signs of animal life in the area during site visits, however, it can be expected that there is a wide variety of wildlife in and around the project area, both in-stream and along the river banks. Whilst working in the stream it was very common to come across the spoor of otters on the exposed sand banks. The project area is comprised of a number of different habitat types as can be expected at the interface between terrestrial land and an aquatic ecosystem. A team from the Department: Water Affairs (DWA) was consulted to carry out a biological assessment of the project area (**Appendix J**). The project area is a healthy environment inhabited by animals that vary from micro-organisms to the birds and mammals. A comprehensive survey of all animals is a consuming task that will take a long time and several specialists to conduct. The environment at the project area can be considered a healthy ecosystem which is potentially home to numerous different wildlife species within the complexity of habitats.

3.10 Surface water

3.10.1 Rivers or water courses

The Swartberg Sand Mine is located along the upper course of the Mzimvubu River just above its confluence with the Rietrivier (**Figure 4**).

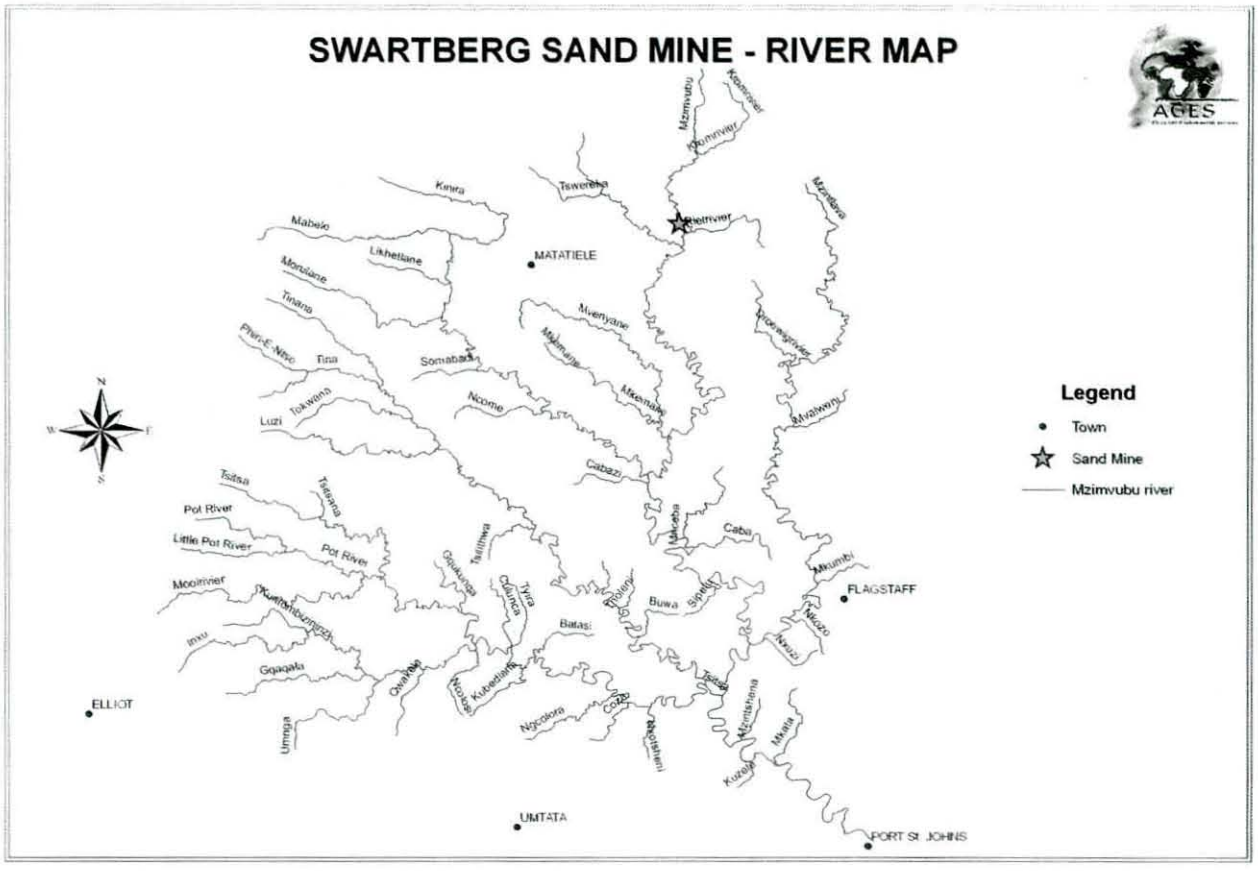

Figure 4 - Map showing the location of the Swartberg Sand Mine on the Mzimvubu River

3.10.2 Dams

No major dams are located within close proximity of the project area.

3.11 Air quality

The air quality in the area is good as there are no major sources of pollution in the surrounding farmland.

3.12 Noise levels

Noise levels in the project area are low.

3.13 Sites of archaeological, paleontological and cultural interest

A Heritage Impact Assessment was not completed; however, the previous and current farm owners were consulted to identify any sites of interest and there were none. Mitigation measures are included in the EMP in the case of anything of archaeological, paleontological and cultural interest being discovered.

3.14 Sensitive landscapes

Site investigations revealed that other than the sensitivity of the project area landscape, the flood

plain downstream is also a potential sensitive landscape together with its numerous scattered wetlands. However it is not foreseen that the impacts of the sand mine under the strict implementation of the mitigation measures drawn up in the EMP will affect these sensitive landscapes.

3.15 Visual aspects – visibility of the mine site from:

3.15.1 Existing roads

The MR604 gravel access road runs adjacent to the Swartberg Sand Mine approximately 100 m south of the mine site.

3.15.2 Existing residential areas

The closest residential areas are small farmhouses on the properties of the nearby farm neighbours.

3.16 Socio-economic structure of the region

3.16.1 Information available on the socio-economic structure of the region e.g. availability of electrical power, water, sewerage and labour.

During the public participation process it was identified that there was a need for jobs in the region and employment opportunities as a spin off from the mine would be beneficial to the community. There is also a major shortage of course sand in the area and building contractors are currently transporting material large distances – there is therefore a massive need for sand which is essential for development. In terms of civil services, there is electricity supply in the area; other basic services such as water and sewerage are taken care of by the local farmers.

4 PUBLIC PARTICIPATION

4.1 Introduction

A Public Participation Process (PPP) was facilitated by AGES (PTY) Ltd as a component of the mining permit authorisation process. The PPP is a required action and is essential for inclusion of the community and immediate stakeholders into the whole decision making process. The community needs to be informed, involved and consulted during the course of the project and it needs to be established whether the community was involved in the decision making process and whether the community and the developers are in agreement with regards to the scope of works. This section serves as a mechanism of reporting the process and results of the PPP.

4.2 Methodology

The following actions describe the PPP:

- The following **immediate stakeholders** were notified of the proposed mine development and invited to participate in the EIA process by giving their comments and concerns:
  - Alfred Nzo District Municipality – Municipal Manager
  - Matatiele Local Municipality – Municipal Manager
  - Department of Land Reform and Rural Development
  - Department of Agriculture
- The following **farm neighbours and downstream farmers** were also notified of the proposed development and were invited to give comment:
  - Mr Ambrose Makhoba
  - Mr Christian Heyns
  - Mr Pierre Joubert
  - Mr Johan Heyns
  - Mr Gabriel Pedlar
- A **Land Owners Consent Letter** was signed by the land owner, Mr Zovuyo Ngejane.

4.3 Results

4.3.1 Correspondence from Interested and affected parties

The following table summarises the correspondence received from the interested and affected parties (I & APs):

Table 2 - Correspondence from I&APs

I&AP	Comment received
Department of Agriculture	The Department wished to raise the following concerns: ➢ The dredging/excavation activity on the river bed could result in the erosion of the river banks; ➢ All activities for the mining of sand from the river should be in line with proper conservation measures to prevent any possible erosion of the river bank. The Department is not against the development but is concerned about the erosion danger and all possible measures should be taken to prevent any soil erosion and possible water contamination.
Mr. Ambrose Makhoba	The following comments were given: ➢ According to his knowledge there are no environmental issues with regards to the small scale sand mine; ➢ He is unaware of any potential cultural/historical issues in the area; ➢ He requested that job opportunities be made available for the local community to help benefit the local economy.
Mr. Christian Heyns	He is concerned about the possibility of water pollution in the river as a result of the mining activity.

Mr. Gideon Joubert	The following comments were given: ➢ He commented on the possible work opportunities for the Makoba community and how it would benefit; ➢ Neither environmental nor cultural/historical issues were commented on.
Mr. Johan Heyns	The river currently has high levels of sedimentation especially during high flow periods – the sand causes high maintenance on irrigation pumps and he believes that mining and the removal of sand is a good idea.
Mr. Gabriel Pedlar	He commented that the proposed sand mine was a good idea and specifically for the creation of jobs in the area.

4.4 Conclusion

The outcome of the public participation process was largely positive towards the project and in particular the community voiced their desire for the creation of jobs in the area. The feedback from the immediate stakeholders was poor, with only the Department of Agriculture putting forward their concerns. There were no major environmental and cultural/historical impacts identified during the PPP.

5 ENVIRONMENTAL IMPACT ASSESSMENT

5.1 Introduction

The following section of the EMP provides a discussion on the identified issues and impacts of the proposed sand mining activity. An impact can be defined as any change in the physical, chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need.

5.2 Assessment methodology

In order to adequately assess the potential impacts of any mining development the temporal scale or duration, likelihood or degree of certainty, extent, duration, intensity or magnitude and unmitigated significance of the impact should be assessed. Environmental impacts that were assessed are relative to the Construction (C), Operational (O), Decommissioning (D) and Post-mining (P) phases.

The different phases of activity during the life of the mine are:

- Construction - including the planning and implementation phases, creation of infrastructure, mine or pit footprint, access ramps and haul roads, waste, residue and product stockpiles, handling areas;
- Operation - including daily activities, mine development and expansion;
- Decommissioning - including scaling down of activities ahead of temporary or permanent closure, cessation of mining or production, implementation of rehabilitation programme, monitoring and maintenance for prescribed period after cessation of operations; and
- Post mining - including completion of rehabilitation goals, application for closure, transfer of liability to the State and agreed post-closure monitoring or maintenance.

The significances of the impacts were determined through a synthesis of the criteria below:

Table 3 - Assessment criteria

Probability: This describes the likelihood of the impact actually occurring.	
Improbable	The possibility of the impact occurring is very low, due to the circumstances, design or experience.
Probable	There is a probability that the impact will occur to the extent that provision must be made therefore.
Highly probable	It is most likely that the impact will occur at some stage of the development.
Definite	The impact will take place regardless of any prevention plans, and there can only be relied on mitigatory actions or contingency plans to contain the effect.
Duration: The lifetime of the impact.	
Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
Medium term	The impact will last up to the end of the phases, where after it will be negated.
Long term	The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
Permanent	Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.
Scale: The physical and spatial scale of the impact	
Local	The impacted area extends only as far as the activity, e.g. footprint.
Site	The impact could affect the whole, or a measurable portion of the above mentioned properties.
Regional	The impact could affect the area including the neighbouring residential areas.

Magnitude / Severity: Does the impact destroy the environment, or alter its function.	
Low	The impact alters the affected environment in such a way that natural processes are not affected.
Medium	The affected environment is altered, but functions and processes continue in a modified way.
High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Significance: This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.	
Negligible	The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
Low	The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
Moderate	The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
High	The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights were assigned to each attribute:

Table 4 - Weights assigned to each attribute

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude / Severity	Low	2
	Medium	6
	High	8
Significance	**Sum (Duration, Scale, Magnitude) × Probability**	
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

The significance of each activity is rated without mitigation (WOM) measures and with mitigation measures (WM) for the Construction (C), Operational (O), Decommissioning (D) and Post-mining (P) phases of the development.

5.3 Identification of key issues

The key issues listed in the following section have been determined through the following avenues:

- Views of interested and affected parties;
- Legislation; and
- The professional understanding of the project team and environmental assessment practitioners.

5.4 Impact analysis

The findings of the impact assessment have been consolidated in the sections below. The impacts have been classified as impacts on the biophysical environment and the socio-economic environment. The impacts are further classified in terms of the phase of the development in which they are likely to occur, namely Construction (C), Operational (O), Decommissioning (D) and Post-mining (P) phases of the development. The mitigation measures for the identified impacts are highlighted in Section 6.

Even though some impacts are perceived to be of high severity, it must be highlighted that the probability that these impacts will occur might be low and therefore the significance of the impact is reduced. The significance of residual impacts is marked according to the following colour code for ease of reference:

Table 5 - Colour rating of impacts

Colour	Significance
	Impact of high significance
	Impact of moderate significance
	Impact of low significance
	Impact unknown or negligible

The key impacts identified by the Environmental Assessment Practitioner (EAP) include:

- **Biophysical environment**
  - Topography impact
  - Impact on soils
  - Impact pre-mining land capability
  - Impact on land use
  - Impact on in-stream habitat
  - Impact on riparian vegetation
  - Impact on animal life
  - Surface water impact
  - Ground water impact
  - Impact on sensitive landscapes
- **Socio-economic environment**
  - Impact on socio-economic structure

- Visual impact
- Noise impact
- Air quality impact
- Impact on interested and affected parties
- Archaeological and cultural impact

5.4.1 Impact on topography

Environmental Aspect: Topography									
Project phase	Activity that causes the impact	Specific impact	Probability		Duration	Scale	Magnitude	Significance	
			Without mitigation	With mitigation				Without mitigation	With mitigation
C, O	Development of excavation ramps	Scarification of land and alteration of topography	Highly probable	Improbable	Long term	Site	Medium	Moderate	Negligible
D, P	Development of excavation ramps	Excessive disturbance of landform can lead to change in habitat and future land-use	Highly probable	Improbable	Long term	Site	Medium	Moderate	Negligible
C, O, D, P	Development of excavation ramps	Steep highwalls or side slopes are potentially unstable and slumping or gully erosion caused by run-off water flowing into the pit can lead to migration of erosion features and impact areas away from the mine site	Highly probable	Improbable	Long term	Site	Medium	Moderate	Negligible
O, D, P	Excavation of river bed	Altered riverbank alignment can influence downstream bank stability by causing undercutting or erosion	Probable	Improbable	Long term	Regional	Medium	Low	Negligible

5.4.2 Impact on soils

Environmental Aspect: Soils									
Project phase	Activity that causes the impact	Specific impact	Probability		Duration	Scale	Magnitude	Significance	
			Without mitigation	With mitigation				Without mitigation	With mitigation
C, O	Development of mine site	Disturbance or burial of soils by access roads and temporary stockpile areas	Probable	Improbable	Medium term	Local	Low	Negligible	Negligible
D	Rehabilitation of river bank	Inadequate topsoil restoration or creation of un-natural surface form	Probable	Improbable	Long term	Local	Medium	Low	Negligible
O	Movement of machinery and trucks	Compaction in vehicle loading or stockpile areas can alter rain filtration and cause ponding	Probable	Improbable	Long term	Local	Medium	Low	Negligible

C, O, D, P	Development of sand mine	Compaction and altered drainage can inhibit future agricultural production	Probable	Improbable	Long term	Local	Medium	Low	Negligible

5.4.3 Impact on pre-mining land capability

Environmental Aspect: Pre-mining land capability									
Project phase	**Activity that causes the impact**	**Specific impact**	**Probability**		**Duration**	**Scale**	**Magnitude**	**Significance**	
			Without mitigation	**With mitigation**				**Without mitigation**	**With mitigation**
C, O, D, P	Development of sand mine	Reduction of the areas long term agricultural capability	Probable	Improbable	Permanent	Local	Medium	Low	Negligible
C, O	Development of excavation ramps and excavation of river bed	Disturbance of in-channel sands or bank erosion can result in deposition of fine sediment downstream where water abstraction occurs	Highly probable	Probable	Medium term	Regional	Medium	Moderate	Low
C, O	Development of excavation ramps and excavation of river bed	Increase in water turbidity	Highly probable	Probable	Medium term	Regional	Medium	Moderate	Low
C, O	Excavation of river bed	Altered channel form or diverted flow path can impact pumping installations downstream	Highly probable	Probable	Medium term	Regional	Medium	Moderate	Low
D, P	Rehabilitation of mine area	Inadequately rehabilitated areas on the river bank can reduce agricultural potential through soil compaction or altered drainage	Probable	Improbable	Permanent	Site	Medium	Low	Negligible
P	Rehabilitation of mine area	Inadequately rehabilitated land will have low agriculture potential due to removal of soil	Probable	Improbable	Long term	Site	Medium	Low	Negligible
P	Rehabilitation of mine area	Inadequately rehabilitated land will have low agriculture potential due to possible invasion by alien species	Probable	Improbable	Long term	Site	Medium	Low	Negligible

5.4.4 Impact on land use

Environmental Aspect: Land use									
Project phase	Activity that causes the impact	Specific impact	Probability		Duration	Scale	Magnitude	Significance	
			Without mitigation	With mitigation				Without mitigation	With mitigation
C, O	Mining activity and vehicle traffic	Disturbance of agricultural or recreational potential	Probable	Improbable	Long term	Site	Medium	Low	Negligible
C, O, D, P	Development of excavation ramp	Impact on productivity or long-term utilisation of environment due to altered river bank	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
C, O, D, P	Excavation of river bed	Impact on productivity or long-term utilisation of environment due to altered channel form	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
D, P	Rehabilitation of mine area	Impact on productivity or long-term utilisation of environment due to inadequate rehabilitation	Highly probable	Probable	Long term	Site	Medium	Moderate	Low

5.4.5 Impact on in-stream habitat

Environmental Aspect: In-stream habitat									
Project phase	Activity that causes the impact	Specific impact	Probability		Duration	Scale	Magnitude	Significance	
			Without mitigation	With mitigation				Without mitigation	With mitigation
O	Excavation of river bed	Extraction of bed material in excess of natural replenishment by upstream transport can cause bed degradation	Definite	Probable	Long term	Site	Medium	High	Low
O	Excavation of river bed	Extraction of river bed material increases water turbidity	Definite	Probable	Long term	Regional	Medium	High	Low
O	Excavation of river bed	The most likely effects of suspended sediments on fish include: reduction in light penetration and of photosynthesis in micro- and macrophytes, resulting in reduced food availability and plant biomass; reduced visibility of pelagic food; reduced availability of benthic	Highly probable	Probable	Long term	Regional	Medium	Moderate	Low

		food due to smothering; clogging of gillrakers and gill filaments							
O, D, P	Excavation of river bed	Headcutting, erosion increased velocities and concentrated flows can occur upstream of the extraction site due to a steepened river gradient	Highly probable	Probable	Long term	Regional	Medium	Moderate	Low
O, D, P	Excavation of river bed	Creation of isolated ponds	Probable	Improbable	Medium term	Site	High	Low	Negligible
O, D, P	Excavation of river bed	Stockpiles, overburden and sandbags left in the river channel can alter channel hydraulics and habitat during high flows	Probable	Improbable	Long term	Site	Medium	Low	Negligible
O, D, P	Excavation of river bed	Removal or disturbance of in-stream roughness elements during sand extraction activities negatively affects both quality and quantity of in-stream habitat.	Highly probable	Probable	Long term	Site	Medium	Moderate	Low

5.4.6 Impact on riparian vegetation

Environmental Aspect: Riparian vegetation									
Project phase	**Activity that causes the impact**	**Specific impact**	**Probability**		**Duration**	**Scale**	**Magnitude**	**Significance**	
			Without mitigation	**With mitigation**				**Without mitigation**	**With mitigation**
C, O, D, P	Development of excavation ramps	Removal of indigenous vegetation and invasion by alien species	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
C, O, D, P	Development of excavation ramps	Removal of riparian vegetation affects in-stream habitat as it serves as a buffer to pollutants entering the river, controls erosion, and provides habitat and nutrient input into the stream	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
C, O	Development of excavation ramps	Stream bank destabilization resulting in increased erosion	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
C, O	Development of excavation ramps	Erosion of river banks resulting in increased sediment and nutrient inputs into the river as well as deterioration of the river bank	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
C, O, D,	Development of excavation	Removal of large woody debris	Highly	Probable	Long term	Site	Medium	Moderate	Low

P	ramps	from the riparian zone negatively affects the plant community, because large woody debris are important in protecting and enhancing recovering vegetation in streamside areas.	probable						
C, O, D, P	Development of excavation ramps	Overburden is very important in that it contains a rich seed bank and organic content which is vital for germination of seedlings. Overburden can be lost as a result of clearing excavation ramps and not stock piling in a safe area.	Probable	Improbable	Long term	Site	Medium	Low	Negligible
C, O	Development of excavation ramps and mine site	Destruction of red data species	Probable	Improbable	Long term	Site	Medium	Low	Negligible
O, D, P	Excavation of river bed	Alteration of channel depth, removal of in-channel sand bars, channel migration through deflection or diversion can erode the riverbank and destroy riparian communities	Highly probable	Probable	Long term	Site	Medium	Moderate	Low

5.4.7 Impact on animal life

Environmental Aspect: Animal life									
Project phase	**Activity that causes the impact**	**Specific impact**	**Probability**		**Duration**	**Scale**	**Magnitude**	**Significance**	
			Without mitigation	**With mitigation**				**Without mitigation**	**With mitigation**
O	Excavation of river bed	Extraction of sand may reduce sand delivery to downstream fish spawning sites	Highly probable	Probable	Long term	Regional	Medium	Moderate	Low
O	Excavation of river bed	The most likely effects of suspended sediments on fish include: reduction in light penetration and of photosynthesis in micro- and macrophytes, resulting in reduced food availability and plant biomass; reduced visibility of pelagic food; reduced availability of benthic food due to smothering; clogging of gillrakers and gill filaments	Highly probable	Probable	Long term	Regional	Medium	Moderate	Low

O, D, P	Excavation of river bed	Sand extraction causes a diversion of flow through the sand removal site. Mined areas that show decreased depth of surface flow could result in migration blockages for fish during low flows.	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
O, D	Excavation of river bed	Ponded water isolated from the main channel may strand entrapped fish carried there during high water events. Fish in these ponded areas could experience higher temperatures, lower dissolved oxygen, increased predation compared to fish in the main channel, and desiccation as the area dries out.	Highly probable	Probable	Medium term	Site	Medium	Moderate	Low
O	Excavation of river bed	Disturbance to aquatic ecosystem - Impacts include reduced feeding, resting, shelter and nesting areas	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
O, D	Operation of mining machinery	Operation of heavy equipment along the river bank can directly destroy spawning habitat for fish and macro invertebrate habitat.	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
O, D, P	Development of excavation ramps	Disturbance of remnant terrestrial wild mammal, avian, amphibian and insect fauna through physical habitat destruction, noise, traffic and movement of people.	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
C, O, D	Presence of humans on site	Illegal hunting or disturbance of nesting sites.	Probable	Improbable	Long term	Local	Medium	Low	Negligible

5.4.8 Impact on surface water

Environmental Aspect: Surface water									
Project phase	**Activity that causes the impact**	**Specific impact**	**Probability**		**Duration**	**Scale**	**Magnitude**	**Significance**	
			Without mitigation	**With mitigation**				**Without mitigation**	**With mitigation**
C, O, D, P	Entire mining activity	Permanent impact on catchment by capturing surface run-off or diverting drainage	Probable	Improbable	Long term	Regional	Medium	Low	Negligible

C, O	Development of access ramp and sandbagging	Altering the flow of the river	Probable	Improbable	Long term	Site	Medium	Low	Negligible
C, O, D	Operation of machinery in riparian zone	Potential contamination of river channel and banks from oil or fuel spillages	Highly probable	Improbable	Long term	Regional	High	High	Negligible
C, O, D	Presence of humans on site	Potential contamination of river channel and banks from sewage spillages	Highly probable	Improbable	Long term	Regional	High	High	Negligible
O	Excavation of river bed	Increased turbidity and suspended fine sediment concentration during excavation and erosion of river banks	Definite	Probable	Long term	Regional	Medium	High	Low
O, D	Excavation of river bed	High rate of extraction resulting in the development of ponds	Highly probable	Probable	Long term	Site	Medium	Moderate	Low

5.4.9 Impact on groundwater

Environmental Aspect: Groundwater									
Project phase	**Activity that causes the impact**	**Specific impact**	**Probability**		**Duration**	**Scale**	**Magnitude**	**Significance**	
			Without mitigation	**With mitigation**				**Without mitigation**	**With mitigation**
C, O, D, P	Excavation of river bed	Lowering of dry river bed can increase groundwater low	Highly probable	Probable	Long term	Regional	Medium	Moderate	Low
C, O, D, P	Excavation of river bed	Lowering of dry river bed can drain the flood plain aquifer	Highly probable	Probable	Long term	Regional	Medium	Moderate	Low
C, O, D, P	Excavation of river bed	Increasing the groundwater low will stress riparian vegetation	Highly probable	Probable	Long term	Regional	Medium	Moderate	Low
C, O	Excavation of river bed and sandbagging	Disturbance of groundwater flow path and base flow	Highly probable	Probable	Long term	Site	Medium	Moderate	Low
C, O, D, P	Operation of machinery	Potential contamination of groundwater due to oil and fuel spillages	Highly probable	Improbable	Long term	Regional	High	High	Negligible
C, O, D, P	Presence of humans on site	Potential contamination of groundwater due to leaking / spillage from temporary sanitation facilities	Highly probable	Improbable	Long term	Regional	High	High	Negligible

5.4.10 Impact on air quality

Environmental Aspect: Air Quality									
Project phase	Activity that causes the impact	Specific impact	Probability		Duration	Scale	Magnitude	Significance	
			Without mitigation	With mitigation				Without mitigation	With mitigation
C, O	Operation of machinery and vehicles	Dust generated by the movement of machinery and vehicles on site is a health risk	Highly probable	Probable	Medium term	Site	Medium	Moderate	Low
D, P	Rehabilitation of mine area	Dust generation from un-rehabilitated areas	Highly probable	Probable	Medium term	Site	Medium	Moderate	Low

5.4.11 Impact on noise

Environmental Aspect: Soils									
Project phase	Activity that causes the impact	Specific impact	Probability		Duration	Scale	Magnitude	Significance	
			Without mitigation	With mitigation				Without mitigation	With mitigation
C, O, D	Operation of machinery and vehicles	Noise generated by large plant and machines during excavation, loading, and transport. Open location precludes effective screening and valley sides can project noise to surrounding areas	Highly probable	Probable	Medium term	Site	Medium	Moderate	Low

5.4.12 Impact on archaeological and cultural aspects

Environmental Aspect: Soils									
Project phase	Activity that causes the impact	Specific impact	Probability		Duration	Scale	Magnitude	Significance	
			Without mitigation	With mitigation				Without mitigation	With mitigation
C, O, D	Earth moving	Disturbance of archaeological sites, cultural heritage sites or graves	Probable	Improbable	Permanent	Site	High	Low	Negligible
O	Excavation of river bed	Excavation of sand can change river flow dynamics and result in scour around bridge supports or deposition of sand that diverts the	Probable	Improbable	Long term	Site	Medium	Low	Negligible

		current against buttresses							

5.4.13 Impact on sensitive landscapes

Environmental Aspect: Soils									
Project phase	Activity that causes the impact	Specific impact	Probability		Duration	Scale	Magnitude	Significance	
			Without mitigation	With mitigation				Without mitigation	With mitigation
C, O, D, P	Development of the Swartberg Sand Mine	Damage to river banks, floodplains, wetlands, river channels and associated habitats are considered sensitive environments and afforded protection under a variety of legislation	Highly probable	Probable	Long term	Regional	Medium	Moderate	Low

5.4.14 Impact on visual aspect

Environmental Aspect: Visual aspect									
Project phase	Activity that causes the impact	Specific impact	Probability		Duration	Scale	Magnitude	Significance	
			Without mitigation	With mitigation				Without mitigation	With mitigation
C, O, D	Development of the Swartberg Sand Mine	Visual intrusion impact of mining activity on nearby roads and homesteads on neighbouring farms	Highly probable	Probable	Long term	Site	Low	Low	Negligible

5.4.15 Impact on socio-economic structure

Environmental Aspect: Socio-economic structure									
Project phase	Activity that causes the impact	Specific impact	Probability		Duration	Scale	Magnitude	Significance	
			Without mitigation	With mitigation				Without mitigation	With mitigation
O	Development of the Swartberg Sand Mine	Alluvial sand is an essential part of the socio-economic environment due to its use in concrete block products and aggregate in construction	Highly probable	Highly probable	Long term	Regional	Low	Low	Low

		concrete, mortar, plaster and pipeline bedding. A relatively small, low- impact operation can influence many service industries potentially employing hundreds of people							
C, O, D	Development of the Swartberg Sand Mine	Increased employment and training opportunities with improved standard of living for local community	Highly probable	Highly probable	Long term	Regional	Low	Low	Low
O	Development of the Swartberg Sand Mine	Considerable multiplier effect through downstream service industries such as construction, plant hire, mechanical repair and suppliers	Highly probable	Highly probable	Long term	Regional	Low	Low	Low

5.4.16 Impact on interested and affected parties

Environmental Aspect: Interested and affected parties									
Project phase	**Activity that causes the impact**	**Specific impact**	**Probability**		**Duration**	**Scale**	**Magnitude**	**Significance**	
			Without mitigation	**With mitigation**				**Without mitigation**	**With mitigation**
C, O, D	Development of the Swartberg Sand Mine	Communities concerned with limiting negative environmental impacts	Highly probable	Improbable	Long term	Site	Medium	Moderate	Negligible
O	Excavation of river bed	Downstream water users impacted by flow diversion and increased suspended sediment concentrations	Highly probable	Probable	Long term	Site	Medium	Moderate	Low

5.5 Description of the environment likely to be affected by the proposed mining operations

Extraction of alluvial material from within or near a streambed has a direct impact on the stream's physical habitat characteristics. These characteristics include channel geometry, bed elevation, substrate composition and stability, in-stream roughness elements (large woody debris, boulders, etc.) depth, velocity, turbidity, sediment transport, stream discharge and temperature. Altering these habitat characteristics can have deleterious impacts on both in-stream biota and the associated riparian habitat.

5.6 Impact on the natural environment

The detrimental effects to biota resulting from bed material mining are caused by three main processes: (1) alteration of the flow patterns resulting from modification of the river bed, (2) an excess of suspended sediment and (3) damage to riparian vegetation and in-stream habitat. The disturbance activities can also disrupt the ecological continuum in many ways. Local channel changes can propagate impacts upstream or downstream and can trigger lateral changes. Alterations of the riparian zone can result in changes in channel conditions that can impact aquatic ecosystems in a similar way as some in-channel activities.

After conducting an environmental impact assessment of the area, it can be assumed that the overall impact of the project on the environment will be low, midst the contractor adheres to mitigation / rehabilitation measures as outlined in the EMP. The proposed sand mine site does not present any fatal flaws in terms of negative impacts to the environment and therefore will not have any significant detrimental impacts to render the project unfeasible.

The potentially significant negative impacts that have been identified should however be mitigated through the implementation of the mitigation measures included in this report. It is expected that the proposed mitigation measures will effectively decrease the identified impacts to acceptable levels. Given the socio-economic imperatives of the project, the residual impacts are not of sufficient importance to thwart the development. The biophysical environment of the project area has been altered in the past as a result of a similar mine operation and has recovered significantly well without rehabilitation. In addition, the significant impact of the project on the socio-economy of the area outweighs any negative impact relating to the project.

5.7 Time factor

The mining operations will be conducted on Wanstead Farm for the entire validity of the mine permit, which is approximately 2 years with the option for renewal thereafter annually pending the decision of the DMR.

5.8 Impact on the socio-economic environment

The impact on the socio-economic environment is perceived to be positive as the mining operations will generate employment opportunities locally and also provide coarse sand to the regions building contractors. The project is thus expected to bring socio-economic growth to the region.

5.9 Impact on the cultural heritage of the surrounding environment

At this stage it is believed that the project will not impact the cultural heritage of the surrounding environment and mitigation measures are provided for in the EMP should the situation arise where the cultural heritage may be impacted.

6 ENVIRONMENTAL MANAGEMENT PLAN

6.1 Background

The recommendations contained herein do not supersede or cancel any of the regulations of the Department of Mineral Resources. These recommendations must be read in conjunction with the DMR conditions, which will always take precedence.

The contractor is to abide by all regulations and conditions of any Act applicable to the activity, which shall include but is not limited to the following:

- **National Environmental Management Act (Act No. 107 of 1998)**
- **National Water Act (Act No.36 of 1998)**
- **National Heritage Resources Act (Act No. 25 of 1999)**
- **Minerals and Petroleum Resources Development Act (Act 28 of 2002)**
- **Occupational Health and Safety Act (Act No. 85 of 1993)**

Significant (moderate/high) impacts identified in Section 5 will be managed as set out in this section. If any of the directives cannot be complied with, alternatives should be discussed and agreed upon in consultation with the relevant DMR Manager. Rehabilitation in respect of top-soiling and re-establishment of vegetation is dealt with further in Section 6.5 and is applicable to all the areas that are disturbed.

Successful rehabilitation should be integrated with the operational phase activities and not left entirely to the decommissioning phase. There should at least be rehabilitation trials conducted during the period of operation to ensure that the scope of mitigation activities or measures is adequate and costing is accurate. This will reduce the cost of implementing the final rehabilitation prior to closure and could be used to reduce the financial risk in terms of pecuniary provision for rehabilitation. It is therefore recommend that a rehabilitation trial be carried out at the start of the operational phase activities to establish immediate environmental control and restoration.

6.2 Environmental management plan objectives

The purpose of this section is to provide management responses that will ensure that the impacts of the mining activity are minimised. An EMP can be defined as an action plan which addresses integrating environmental mitigation and monitoring measures throughout an existing or proposed operation or activity. It encompasses all the elements that are sometimes addressed separately in mitigation, monitoring and action plans.

The process which was followed in compiling this EMP is in compliance with Sections 24(5) read with section 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), and applies the principles of Integrated Environmental Management (IEM). The main objectives of environmental management through out all the phases of the mining activity are:

- To minimise soil, surface and groundwater pollution;
- To minimise and control the production of waste and their effect on the environment;
- Ensure compliance with relevant environmental and mining legislation;
- To minimise destabilisation and erosion potential stemming from the project;
- To minimise the ecological "footprint" of the project on the environment.

The mitigation measures stated in the EMP should be adhered to during the applicable phases. It should be insured that the responsible persons have access to the monitoring program included in the plan and that all relevant parties are aware of the route that needs to be followed when action is required.

6.3 Environmental Management Plan – Construction and Operational Phases

The following table forms the core of the EMP for the construction and operational phases of the mining activity. This table should be used as a checklist on site and compliance with this EMP must be monitored according to the timeframes and criteria as defined in **Section 8 – the planned monitoring and performance assessment of the EMP**.

Construction and Operational Phases			
Activity that causes the impact	**Specific impacts**	**Mitigation measures**	**Responsible person**
Environmental Impacts:			
Topography			
Earthworks – development of an excavation platform along the river bank and removal of sand from within the river bed.	Excessive scarification of land and alteration of topography takes place during alluvial sand mining. Steep side slopes along the river bank are potentially unstable and prone to slumping or gully erosion.	Temporary sand bags and gabions should be used to protect the river bank from erosion and under cutting during the operation phase. After excavating an area, the river bank should be sufficiently protected using sandbags and gabions before proceeding to the next site. All the topsoil and overburden removed during the development of the excavation ramp should be stockpiled at least 30 m above the flood line and protected. Sand/Gravel extraction operations should be managed to avoid or minimize damage to the river banks and an adaptive management policy should be adopted to take action on negative impacts identified during monitoring.	Contractor / Applicant
Geology and soils			
Earthworks – development of an excavation platform along the river bank.	Activity results in naturally unstable slope conditions along the river bank prone to erosion and under cutting during high flows.	During the operational phase the sand bags used to divert the flow of water during excavation must be positioned along the river bank to create a temporary wall that will protect it during high flows. The sandbags should be held together by a geo-textile or wire re-enforcement and anchored to the bank by wooden anchor poles if necessary.	Contractor / Applicant
Excavation of sand from the river bed.	Excavation of sand developed in transported sands can result in the creation of a pit with steep high walls. The alteration of channel depth and channel migration through deflection	The maximum allowable depth of excavation should only be one meter below the initial level of the river bed before excavation begins. After excavation the sand bags should be removed to allow for natural sand recruitment and the area should only be excavated again once it is fully	Contractor / Applicant

	or diversion can erode the river bank and riparian communities.	replenished. This should be monitored by having cross sections of the river surveyed to investigate the geomorphic changes. At least 1 m of sand above the river bed (hard rock) must be left and not taken out during mining. The sandbags used in-stream during excavation should be removed immediately after the sediment has settled and placed along the river bank to protect the bank from high flows. The sand bags should be tightly sealed and compacted in an orderly fashion along the river bank to ensure they are not washed away downstream during high river flows.	
Disturbance or burial of soils by machinery and stockpiling.	Soils are disturbed as a result of access roads, temporary stockpiles areas and product stockpiles.	The existing access road is to be used by haul trucks to access product stockpiles. Temporary stockpiles should be located at least 30 m above the flood line and confined to a limited area identified by the EAP. The product stockpile should be located at the previously impacted stockpile site.	Contractor / Applicant
Earthworks – development of excavation platforms and access ramps.	The loss of river bank alluvial soil profiles.	All topsoil removed must be stockpiled above the flood line for rehabilitation and the river bank should be protected using sandbags and gabions.	Contractor / Applicant
Compaction of soils as a result of heavy machinery.	The compaction of soils in vehicle or stockpile areas can alter rain infiltration causing ponding and an increase in surface run-off and erosion.	If ponding is identified it should be rectified as soon as possible by the contractor.	Contractor / Applicant
Spillages and leaks (fuel, oils) from construction vehicles, mining machinery and storage containers at the site camp/storage area.	Contamination of topsoil.	Construction vehicles and mining machinery must be well serviced and maintained on a regular basis to prevent oil and fuel leaks. Drip pans must be used when refuelling and servicing construction vehicles or mining machinery. Drip pans must be placed underneath stationary construction vehicles when refuelling takes place at the construction areas or site camp and the hazardous waste (e.g. fuel, oils etc.) must be taken to the nearest approved	Contractor / Applicant

		oil refiner or fuel recycling point for recycling. In the event of oil/fuel spillages spill kits or absorbents must be kept at the construction site.	
Spillage from temporary chemical toilets.	Contamination of topsoil.	Chemical sanitation facilities must be used on site and regularly serviced by appropriate companies to ensure that no spills or leaks from toilets to groundwater or surface water take place. Chemical sanitation facilities must be positioned on level ground and not closer than 50 m from the existing natural drainage areas. The ratio of one toilet for every 15 workers on site must be maintained.	Contractor / Applicant
Transportation of stockpiled material by wind or rain and the increase in the level of erosion occurring on site, especially along slopes, gravel roads and cleared areas as a result of storm water run-off and wind.	Loss of topsoil and acceleration of erosion on exposed areas.	The stockpiled topsoil during construction activities must be managed in such a way that the material is not transported by wind or rain. This can be done be restricting the height of the stockpiles to 1.2 m. covering them by plastic sheeting or by the use of sandbagging. Slopes developed on the excavation ramp by removing of soil must be kept to a minimum to reduce the chances of erosion damage to the river bank. The roads used during construction and operation must be constructed with storm water diversion channels to slow down the movement of water over the road surface. This will reduce erosion along slopes and the ponding of water at low lying areas. The movement of construction vehicles and mining machinery must be limited to the mining areas to limit the unnecessary clearance of vegetation and the associated risk of erosion.	Contractor / Applicant
Unsustainable rate of sand extraction from the river bed.	The rate of sand extraction from the river bed exceeds the natural rate of replenishment.	Quantities should be strictly limited so that sand recruitment and accumulation rates are sufficient to avoid extended impacts on channel morphology and in-stream habitat. Although conceptually simple, annual sand/gravel recruitment to a particular site is highly variable and not well understood – this should be closely monitored and extraction levels adapted where necessary. In the first year following adoption of the EMP, a volume	Contractor / Applicant / Environmental monitor

		equal to the estimated annual replenishment should be extracted from the channel. Replenishment (up to the elevation of the selected channel configuration) would need to occur before subsequent extraction could take place.	
Pre-mining land capability and land use			
Alteration of land capability on-site due to mining activity.	In general flood plains are fertile agricultural resources and river channels have recreational and conservation value.	The footprint in terms of the area used for excavation and stockpiling should be limited to those areas that have previously been impacted. All mining activities should be concentrated in order to minimize disturbances.	Contractor / Applicant
Increase in river sedimentation levels.	Disturbance of in-channel sands or bank erosion can result in deposition of sediment downstream or increase turbidity in areas of the channel where water abstraction for irrigation or pumping of water for purification occurs.	Before removing sand from the river bed the mine site should first be sand bagged off to direct the flow of water around the site and contain the disturbed water and increase in sedimentation.	Contractor / Applicant
Reduction of agriculture potential.	Inadequately rehabilitated areas on the river bank can reduce agricultural potential through soil compaction or altered drainage, as well as removal of soil and possible invasion by alien plant species.	The overburden on the river banks should be stockpiled and protected to be used during rehabilitation. The mine site must be rehabilitated to its original state to ensure there is no reduction in its agricultural potential.	Contractor / Applicant
In-stream habitat			
In-stream mining activity.	Extraction of bed material in excess of natural replenishment by upstream transport causes bed degradation, increases suspended sediment and sand siltation. High levels of sediment deposition create an unstable and continually changing environment that becomes unsuitable for many aquatic ecosystems.	Excavation should avoid the main channel area and excavation sites should be sited on the inside of river bend where the flow of water is slowest and the rate of sand deposition is highest. Excavation should be done in small sections (10m × 15m) that are sandbagged off to divert the flow of water away from the excavation site and limit the sedimentation only to the mine site. The mining method should be strictly adhered to and adapted only when monitoring shows it is necessary to do so.	Contractor / Applicant

In-stream mining activity.	Removal of potential in-stream roughness elements.	In-stream roughness elements, particularly large woody debris, are critical to stream ecosystem functioning and the removal or disturbance of in-stream roughness elements during soil extraction activities should be avoided where possible. Those that are disturbed should be replaced or restored.	Contractor / Applicant
In-stream mining activity.	Operation of heavy equipment along the river bank can directly destroy spawning habitat for fish and macro-invertebrate.	The mining method should be strictly adhered to and adapted only when monitoring shows that the spawning habitat for fish and macro-invertebrate are being destroyed.	Contractor / Applicant
In-stream mining activity.	Headcutting, erosion, increased velocities and concentrated flows can occur upstream of the extraction site due to a steepened river gradient.	Monitoring sites should be established both upstream and downstream of the mine site to monitor the impacts and adapt the EMP where necessary to mitigate the impacts.	Contractor / Applicant
In-stream mining activity creating pits.	As active channels naturally meander, the channel may migrate into the excavated area creating isolated ponds of water that may entrap fish.	This needs to be monitored and mitigated immediately if it becomes apparent. The EMP should be adapted if necessary with regards to isolated ponds establishing. The continual undisturbed flow of water across the mine site should be strived for and must be monitored.	Contractor / Applicant
Riparian vegetation			
Earthworks and clearance of vegetation.	Loss of indigenous plant species and disturbance to sensitive habitats.	Removal of vegetation should be confined to the excavation ramps, platforms and mine site. The previous site used for stockpiling excavated material is already impacted and it is recommended that the same site be utilized. The removal of vegetation close to the existing drainage channels should be kept to the minimum. No indigenous trees may be cut or wood be collected for firewood or any other purposes. Protected tree species may only be removed after a permit from the Department of Forestry has been obtained. Any endemic species should be preserved in an ex situ conservation nursery. Should the mine site cross through an area of floral importance with a high percentage of indigenous species, these plants should be carefully removed and replanted in	Contractor / Applicant

		the appropriate manner after operation has been completed in these sections. Large indigenous trees should be retained as far as possible during the construction and operation phase to provide support to the river bank. No firewood is allowed to be collected by the construction team. All large willow trees should be retained in order to provide structural support to the river bank, especially those on the shoulder of the river bank. Access to mining sites must be through impacted areas.	
The occurrence of veldt fires on site.	Destruction of flora, habitats and loss of game/indigenous fauna.	No open fires are allowed at the mine site. Fires for cooking must be restricted to designated areas and cooking should preferably be done on gas stoves. Warning signs or notices must be displayed at the entrances to the site camp (e.g. no smoking), in accordance with the requirements of SABS 1186. Fire service and other emergency numbers should also be displayed at the site. General fire fighting equipment (e.g. portable fire extinguishers or fire hoses) must be made available at the site camp. Personnel must be given the appropriate training in the use of the fire fighting equipment and other emergency procedures.	Contractor / Applicant
The stockpiling of topsoil close to existing drainage channels and the river.	The spreading of exotic invasive plant species and loss of indigenous flora.	The stockpiled vegetation and topsoil must be managed in such a way that the material is not transported to the existing drainage sections by wind or rain. This can be done be restricting the height of the stockpiles to 1.2 m. covering them by plastic sheeting or by the use of sandbagging.	Contractor / Applicant
Animal life			
Mining activities.	The activity will result in the disturbance to aquatic ecosystems and adjacent habitats. Impacts include reduced feeding, resting, shelter and nesting areas.	All activities associated with the mine should be contained within the mine site so as to limit and localize all potentially negative impacts. Disturbance of remnant terrestrial wild mammal, avian, amphibian and insect fauna through physical habitat	Contractor / Applicant

		destruction should be kept to a minimum.	
The control of animals on the mine site, and killing, poisoning or hunting of animals.	Loss of indigenous fauna to the area.	No animals may be captured and no animals may intentionally be killed during the construction and operation phase. No poison should be used to control any animals without the input of an ecologist/zoologist.	Contractor / Applicant / Ecologist
Earthworks, removal of vegetation and mining activity.	Destruction and loss of habitat for small faunal species.	All potential niches, such as dead trees etc, should be carefully relocated to outside the impacted area and recreated.	Contractor / Applicant
Littering (e.g. cans and plastics) along the mining site.	Public nuisance and loss/death of indigenous fauna.	Regular clean up programs must be put into effect at the mine site and sufficient and adequate containers must be provided at random places. These containers must be removed on a regular basis to the local landfill site.	Contractor / Applicant
In-stream mining activities.	These and similar activities have the potential to release fine sediments into the stream, providing habitat conditions harmful to local fish and other living organisms.	Minimize the activities that release fine sediment in to the river - no washing, crushing, screening, stockpiling, or plant operations should occur at or below the streams "average high water elevation," or the dominant discharge. Excavation should be done in small sections (10m × 15m) that are sandbagged off to divert the flow of water away from the excavation site and limit the sedimentation only to the mine site.	Contractor / Applicant
Surface water			
Seepage / spillages from temporary sanitation facilities.	Surface water contamination and degradation of aquatic eco-systems.	Chemical sanitation facilities must be used on site and regularly serviced by appropriate companies to ensure that no spills or leaks from toilets to surface water take place. Chemical sanitation facilities must be positioned on level ground and not closer than 50 m from the existing natural drainage areas or river. The ratio of one toilet for every 15 workers on site must be maintained.	Contractor / Applicant
Spillages and leaks (fuel, oils) from construction vehicles, mining machinery and storage containers at the site	Surface water contamination.	Construction vehicles and mining machinery must be well serviced and maintained on a regular basis to prevent oil and fuel leaks. Drip pans must be used when refuelling and servicing	Contractor / Applicant

camp/storage area.		construction vehicles or equipment. Drip pans must be placed underneath stationary construction vehicles and mining machinery when refuelling takes place at the mine site and the hazardous waste (e.g. fuel, oils etc.) must be taken to the nearest approved oil refiner or fuel recycling point for recycling. Mining machinery may not under any circumstance operate within the river channel and only the excavator should be allowed to come in direct contact with the surface water. The sandbags barrier constructed in-stream should be developed in such a way that should an accidental spillage or leak of fuel/oil occur that it is contained within the barrier until further measures can be undertaken to mitigate the accident.	
The establishment of a site / storage camp.	Degradation of aquatic ecosystems.	Servicing of vehicles should not be done on the mine site. The site camp/storage area for fuel and other construction material should be fenced off and surrounded by green or black textile. The site camp/storage must also not be constructed close to the existing drainage sections or within the one in fifty year flood line. The storage of fuel at the site camp/storage area must be done in accordance with the following recommendations: ➢ Fuel must be stored in tanks with lids, which will be kept firmly shut and under lock and key at all times; ➢ Fuel storage areas are required to be bunded (in accordance with SABS 089: Part I, 1999: *Petrol and Products in the Bulk Petrol Industry – Storage and Distribution of Petroleum Products in Aboveground Bulk Installations*). The volume of the bunded areas must at least be 110% of the volume of the largest tank. The floor of the bund must be smooth and impermeable, constructed of concrete or plastic sheeting, with a layer of sand to prevent perishing. Bund walls must be formed of well-packed earth with the impermeable lining	

		extended to the crest. The floor of the bund is to be sloped towards an oil trap or sump from where the run-off can be easily removed and disposed of at the nearest approved fuel recycling collection point. ➢ Storage tanks must be at least 3.5 m from any buildings, boundaries or combustible / flammable material(s); ➢ Symbolic safety signs (in accordance with SABS 1186) must be erected at storage facilities and tank capacities must be clearly indicated (in accordance with SABS 0232); ➢ No smoking is to be allowed in the vicinity of storage or dispensing areas (smoking is only to be allowed in designated "safe" areas); ➢ Adequate fire fighting equipment must be available onsite and particularly at fuel storage areas at all times and at least one person present on the site must be trained in the use thereof; and ➢ Any electrical or petrol driven pump, used for dispensing purposes, must be equipped and positioned so as not to present danger of ignition of the product. If fuel is to be dispensed from 200 litre (or bigger) drums, proper dispensing equipment will need to be used (e.g. drums must not be tipped to dispense fuel).	
Storm water run-off over cleared areas, stockpiles, roads and excavation platforms.	Siltation of river, increased turbidity and decrease in water quality.	Removal of vegetation must be limited to the construction areas only. Slopes produced by removing of soil must be kept to a minimum to reduce the chances of erosion damage to the area. The existing road infrastructure must be used as far as possible in order to limit the unnecessary loss of topsoil through the clearance of vegetation. All stockpiles should be located on high ground at least 30 m away from the riparian zone.	Contractor / Applicant