Mining Closure and Rehabilitation Plan

SAND MINING PERMIT APPLICATION

Application to mine Silica Sand over an approximate 4,89ha section of the Farm Zandplaats No.178 situated within the Alfred Nzo District Municipality, Eastern Cape.


Prepared on behalf of Helen Harley (Applicant/Proponent):

<table>
<thead>
<tr>
<th>Applicant – Contact person</th>
<th>Postal Address</th>
<th>Physical Address</th>
<th>Telephone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms. Helen Claire Harley</td>
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</tbody>
</table>

By (Independent consultant):

DMR Reference: (Pending)

February 2017
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ABBREVIATIONS

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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>C</td>
<td>Construction</td>
</tr>
<tr>
<td>CBA</td>
<td>Critical Biodiversity Area</td>
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<td>DMR</td>
<td>Department of Mineral Resources</td>
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<td>EA</td>
<td>Environmental Authorisation</td>
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<tr>
<td>EAP</td>
<td>Environmental Assessment Practitioner</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EMP</td>
<td>Environmental Management Programme</td>
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<tr>
<td>ECBCP</td>
<td>Eastern Cape Biodiversity Conservation Plan</td>
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<td>ETo</td>
<td>Potential Evaporation</td>
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<tr>
<td>FEPA</td>
<td>Freshwater Ecosystem Priority Area</td>
</tr>
<tr>
<td>HA</td>
<td>Hectare</td>
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<td>IDM</td>
<td>Integrated Development Management</td>
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<tr>
<td>NF Ep A</td>
<td>National Freshwater Ecosystem Priority Area</td>
</tr>
<tr>
<td>O</td>
<td>Operational</td>
</tr>
<tr>
<td>WM</td>
<td>With Mitigation</td>
</tr>
<tr>
<td>WMA</td>
<td>Water Management Area</td>
</tr>
<tr>
<td>WOM</td>
<td>Without Mitigation</td>
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1 BACKGROUND AND INTRODUCTION

1.1 INTRODUCTION
An application to mine Silica Sand along a 4.89ha section of the Farm Zandplaats No 178, has been submitted to the Department of Mineral Resources (DMR) under pending reference (to be determined) on behalf of Helen Clair Harley. IDM Environmental (IDME) has been appointed as the independent Environmental Assessment Practitioner (EAP) by Helen Harley (the applicant) to conduct a Basic Environmental Assessment (BA) for the mining permit.

As part of the environmental and DMR legislative assessment process, a Mining Closure and Rehabilitation Plan is required to be formulated and attached as an appendix to the Basic Assessment Report. This is to ensure that an acceptable plan is in place – both before, during and post mining activities – to ensure that the affected site is adequately rehabilitated in accordance with the sustainable principals of Integrated Environmental Management, promoted by the National Environmental Management Act (Act No. 107 of 1998) (NEMA), that **aims to prevent, minimise and mitigate against potential adverse long-term environmental and social impacts** caused as a result of the relevant mining activities.

1.2 LOCATION OF PROJECT
The location of the proposed sand mine is situated on the Farm Zandplaats No.178 which is located on the Cedarville Flats, approximately 26 km North East from the town of Cedarville off the road P606 as depicted below in **Figure 1**. The Sand mine is located within the Matatiele Local and the Alfred Nzo District Municipalities respectively in the Eastern Cape Province. A summary of location details is in **Table 1**.

<table>
<thead>
<tr>
<th>Farm Name</th>
<th>Farm Zandplaats No.178</th>
</tr>
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<tbody>
<tr>
<td>Application Area (Ha)</td>
<td>4.89ha</td>
</tr>
<tr>
<td>Magisterial District</td>
<td>Matatiele Local and the Alfred Nzo District Municipalities</td>
</tr>
<tr>
<td>Distance and Direction to nearest town</td>
<td>26 km North East from the town of Cedarville off the road P606. Nearest major town is Kokstad</td>
</tr>
<tr>
<td>SG 21 Code</td>
<td>C11900000001702400000</td>
</tr>
</tbody>
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**Table 1: Summary of proposed Harley Sand Mine location**
1.3 Mine Description and Phases

1.3.1 Site Preparation

While no infrastructure development will occur in or around the mine footprint, the site will however be prepared for mining commencement. These activities will include:

- Environmental training and awareness for workers;
- The removal and storage of topsoil that will be kept for the closure and rehabilitation phase;
- The demarcation of the mining site and ‘no-go’ areas;
- The erecting of signage and fences (where applicable);
- The placement of a portable toilet, bins, spill kits and first aid kits;
- Facilitating the access road to mining site;
- Preparing equipment and vehicles for operation;
- Ensuring that there are no protected trees or fauna on site (in keeping with the EMP); and
- Implementing erosion control on site (in keeping with the EMP).
1.3.2 **Mine operation**

The mineral proposed to be mined is Silica Sand. The method to be implemented is a very basic form of Open Cast Mining. Extraction of sand will be facilitated through the use of an excavator and/or front end loader. An area less than 5ha will be accurately demarcated for mining in accordance with the specific sketch plan and will not compromise any infrastructure, watercourses or wetlands. An excavator and/or front end loader will be used to strip a 30cm layer of topsoil which will be stockpiled along the northern and southern flanks of the pit for use in later rehabilitation. The topsoil stockpiles will be positioned to create a wind barrier thus preventing wind erosion across the pit and to shield the working equipment and prevent the creation of excessive dust. The excavator and/or front end loader will excavate sand from the pit to a depth of 1m to 3m and stockpile the sand on the west side of the pit. The sand will be deposited onto the stockpile area within the permit site and loaded onto tip trucks by the front end loader for transport off the site and for sale to the local market. The sand will therefore not be processed on site.

There is one access road to the site as illustrated in **Figure 2** below. Access to the proposed mining site is off the P606. A gravel access road which is approximately 1,06 km in length has also been proposed leading from the P606 to the proposed sand mine, if in fact such gravelling is required. This will follow the existing access road leading to the mine which is used frequently by the applicant and farm workers to reach that portion of the farm.

![Figure 2: Proposed Access Road to the Harley silica sand mine](image-url)
1.3.4 Closure and Rehabilitation of the Mine

The Closure and Rehabilitation Plan – to be read with the EMP - must be used to guide the site establishment, operation and decommissioning phases of the mining operation and guide the final rehabilitation of the permit site.

Mine rehabilitation must be viewed as an on-going process aimed at restoring the site to a pre-mining state.

The aim of the Plan is, therefore, to ensure activities associated with mine construction, operation and closure will be designed in a manner to prevent, minimise or mitigate against potential adverse long-term environmental and social impacts.

The report must be updated in conjunction with a mine plan (to be formulated) on a regular basis to ensure that it is fully applicable to the activities associated with the proposed operations. The Plan is required to be monitored by the mine’s appointed Environmental Control Officer (ECO) in accordance with and in conjunction with the EMP prepared for mining application and mining operational purposes.

This Plan is required to be safeguarded in the possession of both the Mine Manager (MM) and the ECO at all times.
2 BASIS OF CLOSURE PLAN

2.1 LEGAL OBLIGATIONS

South African mining and associated legislation and policy places ultimate responsibility for mitigating environmental and social damage as a result of mining operations on mining companies themselves. The liability exists throughout the different phases of the mine, from commencement, during operations, post operations and mine closure. This includes compulsory legislative commitments for remediation and/or rehabilitation and ultimate close out. The key relevant legislation applicable to rehabilitation and closure includes the following:

- Constitution of the Republic of South Africa (Act 108 of 1996) (Constitution);
- Mineral and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA);
- National Environmental Management Act (Act No. 107 of 1998) (NEMA);

The following sections provide a brief description of the legislation as it pertains to the closure of a sand mining operation.

2.1.1 THE CONSTITUTION (ACT 108 OF 1996)

While the constitution does not address rehabilitation specifically, it does pave the way for environmental legislation in South Africa. The constitution enshrines environmental wellbeing as a fundamental human right that must be protected. In terms of Section 24 of the Constitution, it states:

“Everyone has the right –

- to an environment that is not harmful to their health or well-being;
- to have the environment protected, for the benefit of present and future generations”.

This must be achieved through reasonable legislative and other measures and ensures that environmental considerations are taken into consideration during the closure of a mine. The Constitution also provides rights pertaining to administrative justice, capacity or standing to institute legal proceedings and access to information. These all become relevant within the context of protection and management of the environment during all stages of the mine’s life cycle.

2.1.2 MINERALS AND PETROLEUM RESOURCES DEVELOPMENT (ACT 28 OF 2002)

The MPRDA contains certain transitional measures with regards to mineral rights, prospecting permits, and mining authorizations. The legal framework for the regulation of the mining industry underwent transformation with the promulgation of the Minerals and Petroleum Resources Development Act 28 of 2002 (MPRDA), which came into effect on the 1 May 2004. These requirements and a summary of other regulatory considerations are discussed below.

In Section 37, the MPRDA confirms that the principles set out in the National Environmental Management Act 107 of 1998 (NEMA) apply to all prospecting and mining operations and that these operations must be carried
out in accordance with the generally accepted principles of sustainable development. This is further supported by the stated objective of the MPRDA being to “give effect to Section 24 of the Constitution by ensuring that the nation’s mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development”.

Section 38 stipulates that the general objectives of integrated environmental management must be applied in accordance with NEMA and this will include the assessment and management of impacts identified as part of the Environmental Management Programme (EMP) process laid out in Section 39.

R527 specifies that the EMP must include environmental objectives and specific goals for mine closure. The applicant for a mining permit/right must make prescribed financial provision for the rehabilitation or management of negative environmental impacts.

R527 provides principles for mine closure which state that the holder of a mining permit/right must ensure:

- The closure of its mining operation incorporates a process which starts at the commencement of operation and continues throughout the life of mine;
- Risks pertaining to environmental impact are quantified and managed proactively, which includes gathering relevant information throughout the mine’s operations;
- Safety and health requirements of the Mine Health and Safety Act (MHSA) 29 of 1996 are complied with;
- Residual and possible latent environmental impacts are identified and quantified;
- The land is rehabilitated, as far as practicable, to its natural state, or to a predetermined and agreed standard or land use which conforms to the concept of sustainable development;
- Mining operations are closed efficiently and cost effectively;
- Key objectives for mine closure to guide project design development and management of environmental impacts are included in the EMP, which include broad future land use objectives, and proposed closure and rehabilitation costs.

As with NEMA and NWA, there is a provision in the MPRDA (Section 45) for the DMR to direct an operation to investigate, evaluate, assess and report on the impact of any pollution or environmental degradation and take such measures as may be specified within a specified time period. If the operation fails to carry out such a direction, the DMR can initiate the necessary actions and recover the costs from the MM. In addition, Section 38 makes the owners of the mine severally liable for any unacceptable negative impacts or failure to comply with this Plan read with the EMP.

2.1.3 National Environmental Management Amendment Act (Act No. 107 of 1998)

NEMA is the overarching and enforceable body of environmental legislation in South Africa. This act paves the way for an EIA process to assess developments that may have a harmful impact on the environment. NEMA aims to establish overarching guidelines and principles to help facilitate environmental management in South Africa.
It promotes Integrated Environmental Management (IEM) (Sections 23 and 24), which aims to integrate environmental management with development.

Sections 28 (1) and (3) of NEMA set out the duty of care principle, which is applicable to all types of pollution and imposes a duty of care to prevent, or where permitted, to minimise environmental degradation. It also provides examples of steps that should be taken to prevent environmental degradation, including the provision for rehabilitation in Section 28 (3) (f), which states that the measures may include measures to “remedy the effects of pollution and degradation”.

Section 2 of the Act lists a set of principles with which environmental management must comply and to which Section 37 (1) of the MPRDA refers directly as follows: “The principles set out in Section 2 of the National Environmental Management Act, 1998 (Act No.107 of 1998)

(a) apply to all prospecting and mining operations, as the case may be, and any matter relating to such operation; and

(b) serve as guidelines for the interpretation, administration and implementation of the environmental requirements of this Act.”

Section 2 (b) of NEMA states that they “serve as the general framework within which environmental management and implementation plans must be formulated”.

The principles of Section 2 of NEMA that are particularly applicable to rehabilitation are:

- The precautionary principle (2 (4) (a) (vii)), which lays the onus on the developer or (mine) operator to take a risk averse and cautious approach during decision making, that recognizes the “limits of current knowledge about the consequences of decisions and actions”. Where uncertainty exists, action must be taken to limit the risk;
- The cradle-to-grave (or lifecycle responsibility) principle (2 (4) (e)) states that “responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.”;
- The polluter-pays principle (2 (4) (p)) is generally regarded as an important guiding principle for environmental management and
- The project must comply with the requirements for sustainable development (2 (3)), which requires consideration of all relevant factors (2 (4) (a)). A holistic, integrated approach must be followed and the “best practicable environmental option”, (defined as being “the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term”) must be selected.
2.1.4 Other Legal Obligations
Legal obligations relating to the closure of a mine are contained in the EMP prepared in respect of the activities that occur or are planned within the proposed mine permit area. The EMP mitigation table compiled for this particular mining permit application mitigation table is included in Appendix 1 of the EMP.

2.2 Closure Vision
The closure vision of the mining operation is to ensure that the Harley mining area is left as a sustainable environment area, which is not harmful to the health and safety of the surrounding communities and protects and enhances the local biodiversity and the natural landscape of the mining area and surrounds.

2.3 Closure Objectives
The following closure objectives are required to be implemented by the mine owner/operator to support the abovementioned closure vision:

- Adhere to all statutory and other legal requirements (National and Local);
- Implement progressive rehabilitation measures where possible to ensure protection of the local environment;
- Maintain and minimize impacts to any functioning wetlands and water bodies within the area;
- To develop land-uses that are stable, sustainable and aesthetically acceptable on closure;
- Ensure safety & health of all stakeholders during closure and post closure and that communities using the site after closure are not exposed to unacceptable risks.
- Ensure that closure supports productive uses considering pre-mining conditions and are in agreement with commitments to stakeholders.
- Utilize closure strategies that promote a self-sustaining condition with little or no need for ongoing care and maintenance.

2.4 Post Closure Land Use
Once rehabilitation has taken place, it will be the responsibility of the mine owner/operator to ensure that the land will be returned to a natural state and no further mining will occur on that site. The pre-mining site is identified as being degraded due to extensive livestock grazing and thus the mine site must be rehabilitated to a condition better than before. The Closure Plan of Action in section 3 contains the necessary information to achieve this.

2.5 Health and Safety Hazards
The closure health and safety hazards are likely to be similar to those encountered during operations. These have been highlighted in the applicable EMP (and corresponding mitigation measures set out).
### 3 CLOSURE ACTION PLAN

The Closure Action Plan aims to create a post-mining environment that is stable and capable of supporting an indigenous vegetation community and preventing pollution and contamination, erosion and the spread of invasive alien species. The visual aesthetics associated with the mine will be improved as a consequence of the establishment of natural vegetation within the post-mining footprint. In order to gain the best possible rehabilitation outcomes from the resultant mining operation, different actions are required to occur at different times within the different phases of the project.

The phases of the Harley mine include Planning, Site Establishment, Operational and Decommissioning phases. Prior to construction and preparation of the land for mining, best practices need to be implemented and compliance to legislation needs to be adhered to.

The following needs to be implemented to ensure successful closure and rehabilitation of the mine.

### 3.1. LAND PREPARATION

The overall aim of land preparation is to ensure that the mining area is limited as far as possible and that pollution or contamination does not occur. The most important factors to bare in mind when preparing for mining are:

- To limit the areas that will be affected by the proposed mining development;
- To minimize potential future contact of toxic or polluting materials with the environment; and
- To maximize the recovery and effective storage of those mining profile materials that could be most useful during the rehabilitation process after mining has been completed (Chamber of Mines, 2007; Department of Minerals and Energy, 2008).

The following points should be considered during the implementation and operational phase of the project:

> Note: The specialist study accompanying this mining permit documentation (and captured in the relevant permit EMP as [Annexure C thereto](#)) should be read with this section in so far as minimization of impacts are concerned.

- Mine planning should be designed in a way so as to ensure the area to be occupied by mine infrastructure is minimized.
- The affected area should be kept as small as is practically possible and should be clearly defined and demarcated;
- Care should be taken around sensitive landscapes e.g. the various wetlands on the applicants farm to ensure that associated impacts are preferably non-existent but if marginal, are minimized, and that the buffer zones around these sensitive landscapes are addressed and respected. A buffer of 50m between the mining footprint and wetland must be strictly enforced.
• Mine operators should restrict their activities to planned areas. Clear instructions and control systems should be in place and compliance to the instructions should be policed by inter alia the mine manager and the ECO.

• All stockpiles should be located in demarcated and approved areas where they will not have to be removed far prior to final placement.

• Sand and soils which cannot be replaced directly onto rehabilitated land should be stockpiled.

• All stockpiles should be clearly and permanently demarcated and located in defined no-go areas, re-vegetated and monitored on an annual basis; and

• Infrastructure (if any) should be designed with closure in mind, and should either have a clearly defined dual purpose or should be easy to demolish.

3.2 SAND REMOVAL AND DISTURBANCE OF SOILS

3.2.1 SOIL STOCKPILING

Soil disturbance is only envisaged within the demarcated stockpile area. Sufficient soil through soil stockpiling should be available for rehabilitation of mining area and of adequate quality to support vegetation growth and thus ensure successful rehabilitation.

The stripping of soil must be carefully planned, executed and monitored by the Mine manager in consultation with the Environmental Control Officer. This to ensure soils are being stripped from the correct areas within the mining footprint, at the correct depths and placed in the correct location. The stockpiles should be used to help buffer the mine site during operation against the elements. The locations of the stockpile area should be on a topographical crest to ensure free drainage in all directions. If this is not possible then an alternative is a side-slope location with suitable cut-off berms constructed upslope. Soils are further at risk to compaction when there is a high moisture content. The dry winter months are thus preferred to commence stockpiling during the site establishment phase. If soil stripping can only occur during the wet months there should be the adoption of methods that cause minimum compaction.

To minimize the impact on the soil located within the stockpile area, the following measures should be adhered to:

• Plan site clearance and alteration activities for the Winter dry season (May to October);
• Soils should be stockpiled loosely;
• Restrict extent of disturbance within the designated areas of disturbance;
• Minimize the period of exposure of soil surfaces through dedicated planning;
• During stockpiling, preferably the ‘end-tipping’ method should be adopted to keep the stockpiled soils loose;
• Vegetation establishment and the removal of invasive alien plans should occur on the stockpiles;
• Should vegetation not establish itself, then fertilisers will need to be applied into the stockpile to vegetate;
• Ensure stockpiles are placed on a free draining location to limit waterlogging; and
• Limit stockpile height.

The steps that should be taken during sand stockpiling are as follows:

1. Mark stockpile locations accurately on a plan (Planning phase) to ensure that re-handling is minimized (i.e. sand will not have to be moved a second or third time);
2. The soils should be stockpiled on the parent soils and within the 4,89ha demarcated mining area close to stripped and final rehabilitation areas as possible;
3. The stockpiles should be used as a buffer against the elements.
4. Ensure that the location is free draining to minimize erosion loss and waterlogging;
5. Erosion control measure and berms be installed;
6. Minimize compaction during stockpile formation; and
7. Ensure that the stockpiled sand is only used for the intended purposes.

Soils should be exposed for the minimum time possible once cleared of vegetation, i.e. the timing of clearing and grubbing should be coordinated as much as possible to avoid prolonged exposure of soils to wind and water erosion. The latter will facilitate the succession of indigenous vegetation.

Once soils are stockpiled they should be managed and monitored progressively (during the mine operation phase) to ensure no damage or degradation of the soils occur. The soil stockpile areas should be strictly no-go areas and security measures in place to ensure there is no theft of the fertile soil. Assessing post-mining soil characteristics and associated land capability and land uses is necessary to ensure that the end land uses goals can be met.

After closure of the mine soil replacement must occur. The equipment used during this replacement process can have a major impact on compaction and erosion levels. Heavy machinery as far as possible should be avoided. Soil should be ripped to ensure no compaction should occur followed by Revegetation. Post mining and the mining area must further be re-shaped to its original state prior to mine establishment and operation.

3.2.2 Erosion Control
During all the phases of the mine, active soil erosion prevention and rehabilitation should occur. Active monitoring by the Mine Manager and ECO must occur to ensure prevention or early detection of soil erosion. Early detection will increase the successful chances of rehabilitation of that area. Surrounding trees and vegetation must be kept to act as screens that reduces erosion. Areas susceptible to erosion must be installed with temporary and permanent works as soon as possible.

Regarding silt fences / traps the following must occur:

• There must be a construction of silt fences / traps in areas prone to erosion such as on the periphery of the mining footprint, to retain sediment-laden runoff;
• Remove sediment from silt fences/traps on a regular basis;
• Ensure silt fences / traps are adequately maintained; and
• Monitor the mining footprint and general surroundings, weekly, for sedimentation and erosion and implement erosion and sediment control measures immediately where needed.

There must further be a diversion of stormwater runoff and sheet runoff away from areas susceptible to erosion.

### 3.3 Infrastructure Removal

No infrastructure shall be erected within the permit site.

Due to the mine’s small scale, the operation will require no permanent infrastructure on site. Temporary toilets located on site will be removed, as well as any mining machinery and designated waste bins.

The Mine access roads is needed after closure as the farmer uses it to obtain access to that portion of the farm.

There will also be the removal of all signage, fencing, traffic barriers, etc.

### 3.4 Re-vegetation

The main aim when re-vegetating is to restore the area back to the pre-mining environmental state. It must be noted that the site is degraded due to extensive farming and livestock grazing. There thus must be an improvement on the current system to one that is self-sustaining with a natural nutrient cycle in place and with ecological succession initiated. Although the rehabilitated land may have variable land capability, including arable land capability for some areas, the main aim of this re-vegetation process is to establish a stable, sustainable grass cover. The rehabilitation “seed cocktails” generally consist of grasses as they rapidly establish and provide excellent protection against surface erosion

Re-vegetation of the stockpile area (site establishment and mine operation) must occur. The stockpile pad surface will be ripped, have topsoil spread across the area and replanting and re-establishment of vegetative cover. The stockpile area will be deep ripped with a tractor drawn ripper and the entire area (100m x 50m) will be re-grassed.

During the closure phase re-vegetation must occur.

**The objectives for the re-vegetation are to:**

• Prevent erosion;
• Re-establish eco-system processes to ensure that a sustainable land use can be established without requiring fertilizer additions over and over again; and
• Restore the biodiversity of the area as far as possible.

The main aim of re-vegetation for the mining site is to restore the area to the indigenous vegetation.

**Re-vegetation steps within the stockpile and access road zones include:**
• Ensure that any disturbed soils have been replaced correctly;
• Prepare the soil by adding lime and fertilizer and ploughing the area, followed by tillage to prepare the seed bed;
• Plant a grass seed mixture consisting of a range of indigenous or non-invasive naturalized species.
• The majority of plant species present in the un-mined areas will re-establish naturally, provided the soils are replaced correctly and the tillage is done correctly;
• Control and remove weeds where necessary;
• Repeat the procedure for the next growing season;
• Application of fertilisers is crop and site specific, analysis of the soils and stockpiles should be undertaken to determine the appropriate fertilisers to be used;
• Grass needs regular defoliation if it is to be sustainable;
• Leave pasture to allow natural grasses to become re-established;
• Conduct annual monitoring (repeatable demarcated transect surveys); and

The common methods used to establish vegetation include seeding and hydroseeding. Control and management of alien vegetation will contribute to the conservation of the natural vegetation. Long term post-closure rehabilitation will allow the re-vegetation of the grasses, bushes and trees.

3.5 Alien plant control

Alien invasive species tend to out-compete indigenous vegetation; this is due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches (Bromilow, 1995). If stockpile site could become overrun with invasive species. Therefore rehabilitation must involve control of invasive species. Alien species on site must be identified, categorised and removed, using one or a combination of methods.

Invasive alien plant species are difficult to control. Methods should be used that are appropriate for the species concerned, as well as to the ecosystem in which they occur. When controlling invaders, damage to the environment must be limited to a minimum. There are three basic methods by which encroachers or weeds are controlled:

Physical (mechanical):

• Uprooting (hand pulling);
• Cutting back;
• Chopping, slashing and felling; and
• Ring-barking (girdling).

Chemical:

• Foliar application;
• Stem notching and application;
• Stump treatment; and
• Soil treatment.

**Biological treatment**

• Which involves the use of host-specific natural enemies of weeds or invaders from the plant's country of origin, to either kill or remove the invasive potential of these plants.

The following additional measures are recommended in order to prevent the future introduction or spread of alien species, and to ensure the rehabilitation of transformed areas:

• There must be no planting of alien plants (e.g. black wattle, eucalyptus and pampas grass) anywhere within the mining area;
• Annual surveys, aimed at updating the alien plant list and establishing and updating the invasive status of each of the alien species, should be carried out;
• The transportation of soils or other substrates infested with alien species should be strictly controlled; and
• Benefits to local communities as a result of the alien plant control programme should be maximised by not only ensuring that local labour is employed, but by also ensuring that cleared alien trees are treated as a valuable wood resource that can be utilized.

**3.6 Wetland Rehabilitation**

Erosion control methods during operation and re-vegetation phase are important to ensure protection of the surrounding wetlands. There must be a further diversion of storm water runoff from the mining footprint into a sediment trapping device. Ensure it is not channelled directly or nearby into surrounding watercourses. A buffer of 50m between mining operations and wetlands must be strictly enforced and under no circumstances may any transgressions occur. Fencing should also be placed. No dewatering of wetlands may occur. A Spill contingency plan must be in place. If any transgressions into wetlands occur, mining operations shall cease, action should immediately occur and a wetland specialist shall be required to formulate a wetland rehabilitation plan. However, this is a last resort and due to the mine operations avoiding the wetlands (Thus the risk is deemed low), no further wetland rehabilitation will be discussed in this report.
The objective of the monitoring program will be to document the recovery of the site towards the closure land use goals, in accordance with the overall closure objectives stated in Section 2.3. Rehabilitation will require monitoring on a monthly basis for the first 6 months, thereafter every 6 months for two years.

The monitoring that will be required during the post-closure period is summarized below:

<table>
<thead>
<tr>
<th>Surface</th>
<th>Pollution/Land contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Water pollution</td>
</tr>
<tr>
<td></td>
<td>Stormwater run off</td>
</tr>
<tr>
<td></td>
<td>Degradation of surrounding wetlands</td>
</tr>
<tr>
<td>Soil</td>
<td>Erosion</td>
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<td></td>
<td>Compaction</td>
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<td>Barrier to movement/ Hazard</td>
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<tr>
<td>Climate</td>
<td>Atmospheric Emissions</td>
</tr>
<tr>
<td>Air Quality</td>
<td>Dust Generation</td>
</tr>
<tr>
<td></td>
<td>CO and CO(_2) Emissions</td>
</tr>
<tr>
<td>Traffic</td>
<td>Increased Traffic and Safety</td>
</tr>
<tr>
<td>Noise</td>
<td>Noise Disturbance</td>
</tr>
<tr>
<td>Visual</td>
<td>Lighting</td>
</tr>
<tr>
<td>Domestic Waste</td>
<td>Litter</td>
</tr>
<tr>
<td>Social-Economic</td>
<td>Job creation</td>
</tr>
<tr>
<td></td>
<td>Impact on surrounding neighbours</td>
</tr>
<tr>
<td>Heritage</td>
<td>Impact on Heritage (If any)</td>
</tr>
</tbody>
</table>

Table 2: List of identified impacts requiring monitoring programmes

Whilst the Mine Manager must undertake to monitor activities on a daily basis, the ultimate responsibility for satisfying the monitoring requirements is the role of the Land Owner. The Environmental Control Officer (ECO) shall be responsible for ensuring compliance of all aspects of monitoring in accordance with the roles and responsibilities designated in terms of the EMP.
The liability for closure of the aspects associated with the Project has been determined using the approach advocated in the Department of Mineral Resources (DMR) Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provisions Provided by a Mine (2005).

The approach to calculating the closure quantum as specified in the DMR Guideline which was utilised in this assessment is as summarised as follows:

- **Step 1: Determine the Mineral Mined**
  
  In the first step the mineral mined has been identified in the tables provided in the DMR guideline (Table B.12) as “Silica Sand.”

- **Step 2A: Determine Primary Risk Class**
  
  The “Primary Risk Class” has been determined from Table B.12 of the DMR Guideline as “B (Low Risk)”.

- **Step 2B: Revision of Primary Risk Class**
  
  The Primary Risk Class can be revised on the basis of saleable by-products if required. However, this is not applicable.

- **Step 3: Determine Environmental Sensitivity**
  
  The “Environmental Sensitivity” has been determined by reference to Table B.4 of the DMR Guideline as “Medium”.

- **Step 4: Determination of weighting factors:**

  Weighting Factor 1: The nature of the terrain where the operation is located is flat.

  Weighting Factor 2: The proximity of the operation to an urban centre. Located in rural setting.