ASSMANG LIMITED HOUSING PROJECT, BLACK ROCK MINE OPERATIONS, HOTAZEL, NORTHERN CAPE

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT (EMPR)

ESCIENCE ASSOCIATES

POSTAL ADDRESS:
PO Box 2950
Saxonwold
2132

PHYSICAL ADDRESS:
9 Victoria Street
Oaklands
Johannesburg
2192

TEL:
+27 (0)11 728 2683

CELL:
+27 (0)82 499 7926

FAX:
086 512 5681

E-MAIL:
info@escience.co.za

March 2013

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT: ASSMANG LIMITED HOUSING PROJECT, BLACK ROCK MINE OPERATIONS, HOTAZEL, NORTHERN CAPE

COMPILED BY EAP:

EScience Associates
PO Box 2950,
Saxonwold, 2132
9 Victoria Street,
Oaklands, Johannesburg, 2192

Tel: (011) 718 6380
Cell: 082 499 7926
Fax: 086 512 5681
E-mail: bradley@escience.co.za

ON BEHALF OF APPLICANT:

ASSMANG LIMITED
PO Box 187
Santoy
8491

Tel: (053) 751 5302
Fax: (053) 751 5251
E-mail: bonolol@brmo.co.za

PREPARED FOR REVIEW BY COMPETENT AUTHORITY

Northern Cape Department of Environment and Nature Conservation (NCDENC); and

March 2013

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

BEP:	Best Environmental Practice
BPEO:	Best Practicable Environmental Option
DEA:	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWA:	Department of Water Affairs
EAP:	Environmental Assessment Practitioner
ECO:	Environmental Control Officer
EO:	Environmental Officer
EIA:	Environmental Impact Assessment
IAPs:	Interested and Affected Parties
IPWM:	Integrated Pollution and Waste Management
LED	Local Economic Development
MPRDA	Minerals and Petroleum Resources Development Act
NCDENC	Northern Cape Department of Environment and Nature Conservation
NEMA:	National Environmental Management Act, No. 107 of 1998
NEMA EIA	
PSM:	Project / Site Manager
RDL:	Red Data Listed
Regulations:	Regulations GN R.453, R.454, 455 and R.456 (18 June 2010), as amended. promulgated in terms of Section 24(5) read with Section 44, and Sections 24 and 24D of the National Environmental Management Act, 1998
'The Mine':	Includes Black Rock, Gloria and Nchwaning operations

1. INTRODUCTION

1.1 INTRODUCTION

EScience Associates (Pty) Ltd. (hereinafter referred to as 'ESA') were commissioned, as an independent environmental assessment practitioner (EAP), by the Assmang Black Rock Mine Operations in the Northern Cape (hereinafter referred to as the 'BRMO') to undertaken a Basic Assessment EIA process, in terms of the provisions of the National Environmental Management Act, 1998 (Act No. 107 of 1998)[NEMA] and associated 2010 EIA Regulations (GN. R. 543 of 18 June 2010). The subject EIA process is being undertaken in support of an application for environmental authorisation to the Northern Cape Department of Environmental and Nature Conservation (DENC) for a proposed housing facility on Ptn. 3 of the Nchwaning 267, Hotazel District, Northern Cape.

Regulation 22 (j) of the 2010 NEMA EIA Regulations specifies that a Basic Assessment Report is to include, "*any environmental management and mitigation measures proposed by the EAP*". These recommendations have been formalised by the EAP through the compilation of a draft environmental management programme (EMP) conforming to the requirements specified under Regulation 33, as follows:

"*A draft environmental management programme must comply with section 24N of the Act and include –*

(a) details of –

(i) the person who prepared the environmental management programme; and
(ii) the expertise of that person to prepare an environmental management programme;

(b) information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of—

(i) planning and design;
(ii) pre-construction and construction activities;
(iii) operation or undertaking of the activity;
(iv) rehabilitation of the environment; and
(v) closure, where relevant.

(c) a detailed description of the aspects of the activity that are covered by the draft environmental management programme;
(d) an identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);
(e) proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;
(f) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures;

(g) a description of the manner in which it intends to —

(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
(ii) remedy the cause of pollution or degradation and migration of pollutants;
(iii) comply with any prescribed environmental management standards or practices;
(iv) comply with any applicable provisions of the Act regarding closure, where applicable;
(v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;

(h) time periods within which the measures contemplated in the environmental management programme must be implemented;
(i) the process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity;
(j) an environmental awareness plan describing the manner in which—

(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and
(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;

(k) where appropriate, closure plans, including closure objectives".

In addition to the above, this EMP is compiled in accordance with the Integrated Environmental Management (IEM) philosophy which aims to achieve a desirable balance between conservation and development (DEAT, 1992). IEM prescribes a methodology for ensuring that environmental management principles are fully integrated into all stages of the development process. It advocates the use of several environmental management tools that are appropriate for the various levels of decision-making. One such tool is an Environmental Management Programme (EMP).

The IEM guidelines encourage a pro-active approach to sourcing, collating and presenting information in a manner that can be interpreted at all levels. The basic principles underpinning IEM are that there be:

- informed decision-making;
- accountability for information on which decisions are taken;
- accountability for decisions taken;
- a broad meaning given to the term environment (i.e. one that includes physical, biological, social, economic, cultural, historical and political components);
- an open, participatory approach in the planning of proposals;
- consultation with interested and affected parties;
- due consideration of alternative options;
- an attempt to mitigate negative impacts and enhance positive aspects of proposals;
- an attempt to ensure that the 'social costs' of development proposals (those borne by society, rather than the Mine) be outweighed by the 'social benefits' (benefits to society as a results of the actions of the Mine);
- democratic regard for individual rights and obligations;

- compliance with these principles during all stages of the planning, implementation and decommissioning of the proposals (i.e. from 'cradle to grave'); and
- the opportunity for public and specialist input in the decision-making process.

This EMP is compiled using the following concepts and implementation requirements, so that the higher principles of sustainable development are realised:

- **Continuous improvement.** The project proponent (or implementing organisation) must commit to review and to continually improve environmental management, with the objective of improving overall environmental performance.
- **Broad level of commitment.** A broad level of commitment is required from all levels of management as well as the workforce in order for the development and implementation of this EMP to be successful and effective.
- **Flexible and responsive**. The implementation of the EMP must respond to new and changing circumstances, i.e. rapid short-term responses to problems or incidents. The EMP is a dynamic "living" document and thus regular planned review and revision of the EMP must be carried out.
- **Integration across operations**. This EMP must integrate across existing line functions and operational units such as health, safety and environmental departments in a company/project. This is done to change the redundant mindset of seeing environmental management as a single domain unit.
- **Legislation.** It is understood that any development project during its construction phase is a dynamic activity within a dynamic environment. The Proponent, Engineer, Contractor and Sub-contractor must therefore be aware that certain activities conducted during construction may require further licensing or environmental approval, e.g. river or stream diversions, bulk fuel storage, waste disposal, etc. The Contractor must consult the ER, EO and ECO on a regular basis in this regard.

1.2 BACKGROUND

1.2.1 ASSMANG LIMITED

Assmang Limited is jointly owned by African Rainbow Minerals Limited (ARM) and Assore Limited, and currently has three independently operating divisions based on three respective commodities – chrome, manganese and iron ore (Figure 1-1). Assmang's Manganese Division consists of the Nchwaning II, Nchwaning III and Gloria manganese mines in the Northern Cape, as well as the ferromanganese works at Cato Ridge in Kwazulu-Natal.

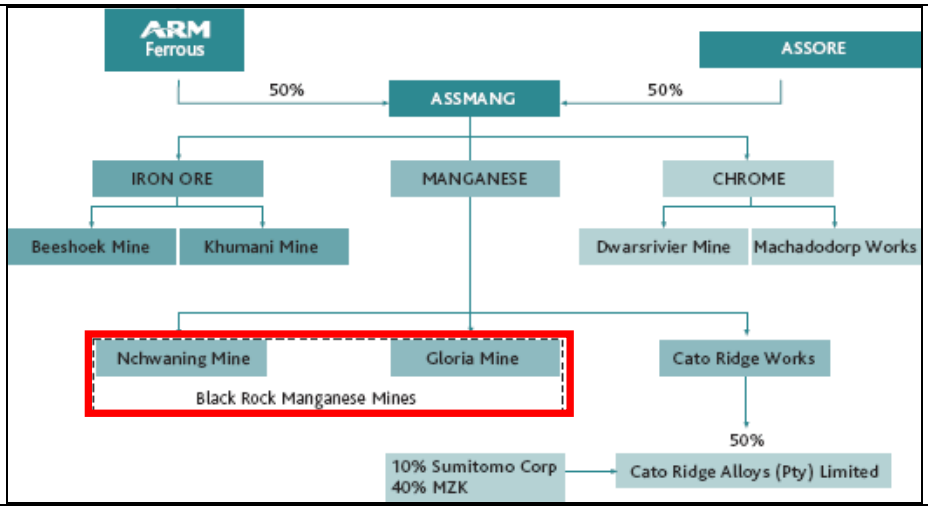

Figure 1-1: Overview of Assmang Limited South African Operations

1.3 ADMINISTRATIVE INFORMATION

The following section and associated set of tables, provides pertinent administrative information pertaining to the BRMO, associated mine lease area, as well as the environmental assessment practitioner who developed the EMP (Table 1-1 to Table 1-5).

Table 1-1: Name and Address of Mine	
Owner and Name of Mine	Assmang Limited, Black Rock Mine Operations
Company Registration	1935/007343/06
Physical Address	Portion 1 of the Farm Santoy
Postal Address	PO Box 187 Santoy 8491
Telephone	(053) 751 5200
Fax	(053) 751 5252

Table 1-2: Details of Mine Environmental Specialist	
Name	Mr. Bonolo Lekwa
Physical Address	Main Offices BRMO, Black Rock, Northern Cape Portion
Postal Address	PO Box 187 Santoy

	8491
Telephone	(053) 751 5302
Fax	(053) 751 5251
Email	bonolol@brmo.co.za

Table 1-3: Details of EAP	
Name of Company	EScience Associates (Pty) Ltd.
Contact Person	Mr. Bradley Thorpe
Postal Address	PO Box 2950 Saxonwold 2132 JHB
Physical Address	9 Victoria Street Oaklands 2192 JHB
Telephone	(011) 718 6380
Fax	086 512 5681
Email	bradley@escience.co.za
Qualifications	BSc. (Hons), MSc. (Env. Management) – in progress
Curriculum Vitae	Refer Appendix 3

Table 1-4: Mining Rights, Surface Rights and Title Deed Description Relevant to the BRMO

Mine	Farm Name	Title Deed	Surface Rights	Mining Rights
Black Rock	Ptn. 1 Belgravia 264	No. 541 of 1940	Assmang Limited	Assmang Limited
	Ptn. 1 Santoy 230	No. 1491 of 1970	Assmang Limited	Assmang Limited
Gloria	Ptn. 1 Gloria 226	No. 506 of 1966	Assmang Limited	Assmang Limited
Nchwaning II	Ptn. 1 Nchwaning 267	No. 541 of 1940	Assmang Limited	Assmang Limited
	Ptn. 3 Nchwaning 267	No. 1491 of 1970	Assmang Limited	Assmang Limited
Nchwaning III	Ptn. 1 Nchwaning 267	No. 541 of 1940	Assmang Limited	Assmang Limited
	Ptn. 3 Nchwaning 267	No. 1491 of 1970	Assmang Limited	Assmang Limited

Table 1-5: Project Applicable Servitudes		
Mine	**Servitude Type**	**Servitude No.**
Gloria	Rail	K38 / 83S
Gloria	Water pipeline (Sedibeng Water Vaal-Gamagara Supply)	K36 / 1978S

1.4 LAND TENURE AND ADJACENT LAND USE

Assmang Limited holds both the surface- and mining rights over the properties encompassing the greater BRMO and its four constituent mining operations (i.e. Black Rock-, Nchwaning- and Gloria Mines). The land surrounding the BRMO is dominated by mining, industrial and agricultural (extensive livestock production systems) land uses (Figure 1-2). For example, land in the immediate vicinity of Black Rock Mine that is not used for mining / industrial purposes, is utilised for extensive livestock farming (i.e. sheep, goats, cattle) and game farming.

Table 1-6 and Table 1-7, in combination with Figure 1-2, provide a concise overview of mining activities and neighbouring towns associated with the Assmang BRMO.

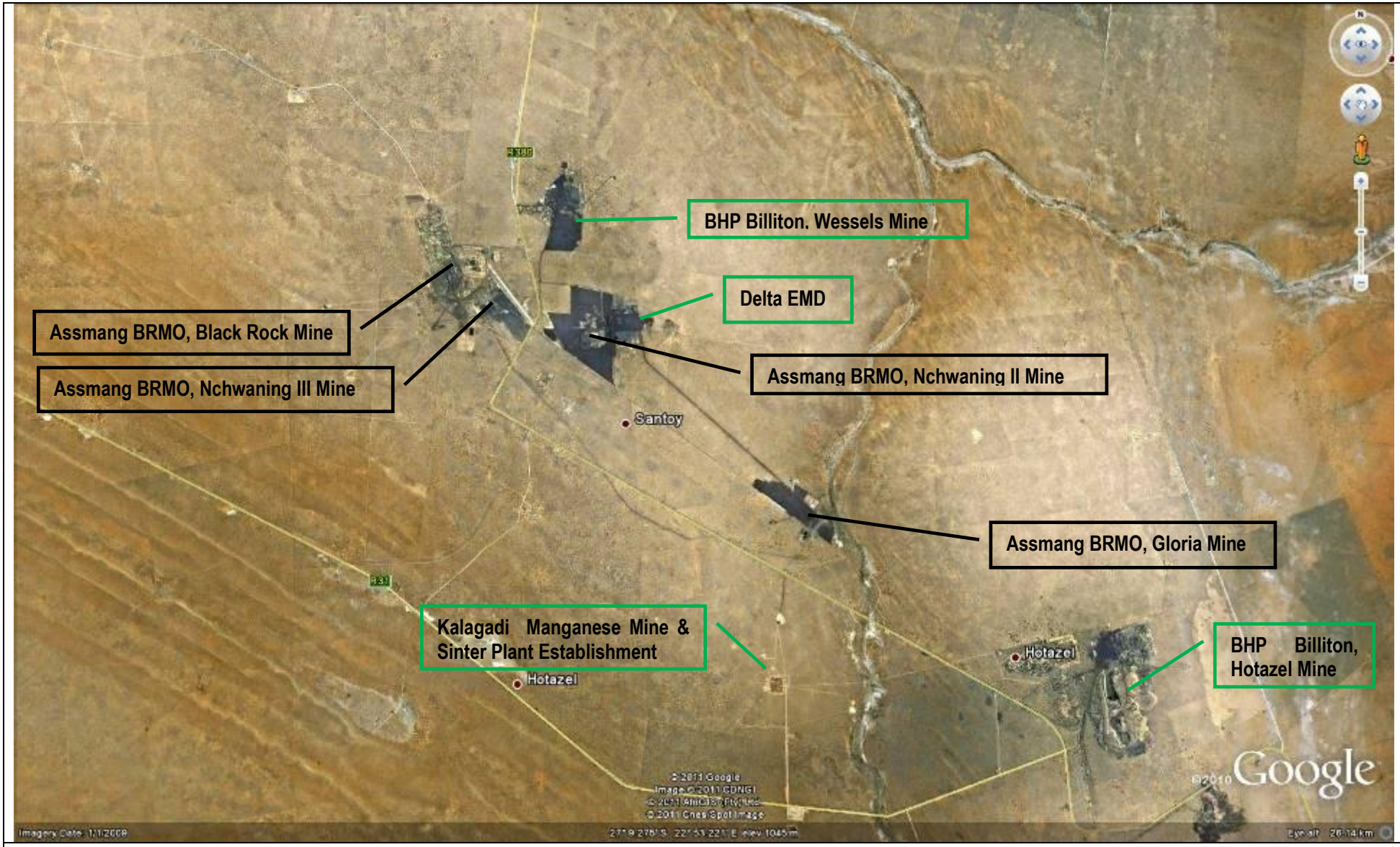

Figure 1-2: Aerial image showing Existing Mining / Industrial Land Use in the Vicinity of the Assmang Limited BRMO

Table 1-6: Neighbouring Mining / Industrial Activity/ies	
Mine / Industry	**Distance/Direction from BRMO**
Delta EMD	Immediately east of Nchwaning II Mine
BHP Billiton Wessels Manganese Mine	Approximately 1.3km north of Nchwaning II Mine
Kalagadi Manganese Mine	Approximately 2.5 km south of Gloria Mine
BHP Billiton Hotazel Manganese Mine	Approximately 7km south east of Gloria Mine

Table 1-7: Neighbouring Towns	
Town	**Distance/Direction from BRMO**
Black Rock Mine Village	Located at the BRMO
Hotazel	Approximately 17km south east of the BRMO
Kuruman	Approximately 80km south east of the BRMO
Upington	Approximately 267km south west of the BRMO
Kimberley	Approximately 320km south east of the BRMO

2. PROJECT DESCRIPTION

The Assmang Black Rock Mine Operations (BRMO) proposes to establish approximately 120 residential dwelling units at their operations north of Hotazel in the Northern Cape (proposed development footprint of 15ha in extent). Each dwelling unit would house 4 people (Figure 2-1). The project would thus ultimately provide housing for 480 Assmang employees and contractors over the operational lifetime of the mine (life of mine estimated at approximately 30 years). The proposed development (preferred site alternative, S1) would occur on Ptn. 3 of the farm Nchwaning 267 (Appendix 1 – Locality Map, refers). A second site alternative was investigated on Ptn. 1 of the farm Santoy; where this site is also owned by the BRMO.

Figure 2-1: Photograph of 4 Sleeper 'Housing Unit' Demo Model

The construction and development of the residential units is proposed in a phased manner; whereby Assmang's immediate priority is to establish an initial 40 units (Phase 1 - housing for 160 people) with an approximate development footprint of 3.5ha in extent. These 40 units are required in order to relocate staff living in hostel accommodation at the BRMO to more suitable accommodation in line with the requirements of the Mining Charter (i.e. one person per room with their own bathroom / shower and kitchenette, etc.).

The preferred development site is an undisturbed ('green-fields') site located immediately east of the Santoy Rec. Club, and north and east of the associated soccer field and pavilion (Figure 2-2). The development of such residential units elsewhere on the BRMO surface rights area is limited largely by land ownership, as well as the current operational mining activities taking place on the greater site. The preferred development site would

be effectively fenced off from remaining mining activities/sites at the BRMO; whereby staff housed at the facility would need to enter the mine site through an access control point.

The proposed development would tie in with the existing sewage reticulation and associated treatment plant at the Black Rock Village (new pump station required). There would be no immediate need to upgrade the sewage treatment plant capacity as part of the development and occupation of the first 40 units (phase 1); where the treatment demand is merely being moved geographically from the hostels to the new development site, and no additional burden will be placed on the treatment plant. The development of the further 80 units (Phases 2 and 3) would potentially require the proponent to upgrade the plant and apply for any requisite licences in terms of the 'Waste Act' (Act 59 of 2008)[NEM:WA] to do so (as necessary).

Similar to the above, the potable water- and electrical demand for the development would be sourced from existing connections for each in close proximity to the site. The proposed development also makes provision for parking and hard landscaping associated therewith (e.g. internal roads, parking bays, walking paths, etc.). Access to the preferred development site would be established along the northern side of the BRMO Rec. Club.

Figure 2-2: Aerial Imagery Showing Approximate Development Footprint (15ha in extent)

3. SENSITIVE ENVIRONMENTAL FEATURES

The following section aims to briefly provide a summary of the more pertinent site sensitivities that need to be understood and acknowledged in implementing the EMP. The sensitive elements described in the section that follow were identified at the hand of specialist assessments commissioned by the BRMO in 2011/12. The said specialist assessments, furthermore, assisted in providing additional relevant information on the baseline receiving environment that has until now been lacking in relation to environmental management efforts at the greater BRMO.

3.1 BIODIVERSITY

A comprehensive specialist biodiversity assessment was commissioned for the BRMO that aimed to, *inter alia,* identify sensitive ecological features on the site applicable to the on-going mining operations on the site. Two primary elements in this regard need to be noted, as follows.

3.1.1 RED DATA LISTED PLANTS

The study most notably confirmed the presence of several red data listed (RDL) / protected floral species on the site, as shown in Figure 3-1 and Table 4-1. The species identified were not confined to one specific section of the development site, but were identified throughout all proposed development areas.

Figure 3-1: Protected Floral Species Identified on Site

Table 3-1: Protected Floral Species Identified on Site		
Scientific Name	**Common Name**	**Regulation**
Acacia erioloba	Camel Thorn	National Forests Act (1998)
Acacia haemotoxylon	Grey Camel Thorn	National Forests Act (1998)
Ammocaris coranica	Karroo Lily	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)
Harpogophytum procumbens	Devil's Claw	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)
Babiana hypogaea	Bobbejaanuintjie	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)
Boophane disticha	Bushman's poison bulb	Schedule 4 Environmental and Conservation Ordinance No. 19 (1974)

None of the aforementioned floral species may be cut, removed, relocated, or destroyed without permits having been issued by the relevant competent authorities, in terms of the legislation listed in Table 3-1.

3.2 GROUNDWATER

A specialist ground water study was commissioned by the BRMO in 2011 to inform their understanding of the hydrogeological regime applicable to their operations. Considering the geology and hydro-geological characteristics of the site (i.e. the calcrete aquifer used by the surrounding farming communities, as well as boreholes visited during the hydrocensus and used for general farming), the aquifer should be regarded as "Major aquifer system", based on the following:

- Public supply and other purposes: The aquifer plays a major role in the livelihood of the farming community surrounding BRMO; and
- Water quality: The water quality is good.

A groundwater specialist deemed there to be a low risk for the users found in the hydrocensus to be impacted by either dewatering, or contaminated groundwater originating from the proposed project. This was based on:

- The lack of groundwater encountered at BRMO; and
- Current water levels and water quality data, and the vicinity of water users encountered at BRMO during the hydrocensus.

In spite of the above and due to the presence of this major calcrete aquifer underlying the development site, as well as information gaps leading to the aforementioned impact statement, specific and focused management actions are necessary to avoid detrimental impacts on the underlying groundwater environment. All parties having a role in the implementation of the EMP need to be aware of the aquifer's importance and of the management actions required to sustain the integrity thereof.

4. ENVIRONMENTAL MANAGEMENT PROGRAMME

The environmental consequences / impacts on the receiving 'environment' associated with the proposed project are addressed within the associated Basic Assessment Report (attached hereto). This EMP is a tool used to provide the assurances that Assmang have made suitable provision for the effective mitigation of the aforementioned consequences / impacts. The EMP, furthermore, describes the method and procedures required for the effective mitigation and monitoring of impacts; where the prescribed mitigation and monitoring actions are closely linked with environmental objectives and targets that the proponent needs to achieve in order to reduce, or eliminate, negative impacts over the full project lifecycle (Aucamp, 2010).

To ensure that the impacts associated with the project are properly mitigated, managed and / or avoided (where possible), a number of specific environmental objectives have been defined for the project. The environmental objectives need to be attained and / or maintained to ensure satisfactory 'environmental' (i.e. social, economic, bio-physical) management of the directly affected area and the potential cumulative impacts on the surrounding environment.

One also needs to make a distinction between the objectives for on-going environmental management applicable to the construction and operational phases, as well as the objectives for rehabilitation of the development footprint at mine closure; where the inherent linkages between such objectives also need to be acknowledged. The most effective means of ensuring that closure objectives are achieved, is by ensuring that all preceding development phases are managed with 'mine closure' in mind, as follows:

- Design with closure in mind;
- Construct with closure in mind; and
- Operate with closure in mind.

In terms of The Constitution of the Republic of South Africa (Act No. 108 of 1996), everyone has the right to, "*an environment that is not harmful to their health or well-being and to have the environment protected, for benefit of present and future generations, though reasonable legislation and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while prompting justifiable economic and social development*". The needs of the environment, as well as Interested and Affected Parties (IAPs) should thus be integrated into overall mine management. This EMP provides a tool for meeting this objective by providing detailed mitigation and management commitments by BRMO for the proposed project (including decommissioning and rehabilitation thereof).

The environmental mitigation tables in the following sections provide the management measures recommended to manage the potential impacts rated in the Basic Assessment Report. In addition to the management measures provided the table indicates the person responsible to ensure that these commitments are adhered to and implemented and the priority of these commitments (either prior a phase, during a phase and/or on-going).

The responsible persons from the side of the proponent have assessed these commitments in detail and have committed to the specific management measures where indicated in the tables.

4.1 LEGISLATION

The environmental component of the project will comply with the requirements of, *inter alia*, the following national legislation and relevant Regulations promulgated hereunder (Table 4-1).

Table 4-1: Key legislation considered for EMP development
Constitution of South Africa (Act No. 108 of 1996);
The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002), as amended;
The National Environmental Management Act (Act No. 107 of 1998), as amended;
The National Water Act (Act No. 36 of 1998);
The Conservation of Agricultural Resources Act (Act No.43 of 1983);
The National Environmental Management: Air Quality Act (Act No. 39 of 2004);
The Hazardous Substances Act (Act No. 15 of 1973);
The National Heritage Resources Act (Act No. 25 of 1999); and
The National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

Notwithstanding the BRMO's requirements to ensure that all activities undertaken on the site (for all phases of the project) are compliant with the provisions and objectives of, *inter alia*, the aforementioned legislation, the following objectives shall act as a core frame of reference for the implementation of this plan in the event of any uncertainty(ies).

Table 4-2: Environmental Objectives for the BRMO	
Soils	To conserve and protect site soils, through practical and feasible means, such that any impact on such does not impede the BRMO from achieving the stated 'ecological' and 'end land-use' objectives for the site at closure or any other environmental objectives applicable to construction- and operational related phases of their on-going operations.
Biodiversity	To, through practical and feasible means, optimise the human use value of the site whilst still improving biodiversity levels of the specific systems present over the BRMO; toward meeting the stated 'ecological' and 'end land-use' objectives for the site at closure.
Surface- and Ground Water	To ensure that, through the implementation of appropriate pollution and storm water control and prevention measures and the efficient re-use and recapture of 'affected' water on site, that the Mine does not unnecessarily overburden ground- and surface water resources (quality and quantity) on which adjacent communities and industry in the catchment are dependent on for their livelihood and / or well-being.
Noise	No project phase should generate noise to the extent that such becomes intrusive beyond current, baseline, ambient noise levels at the site boundary.
Air	To manage emissions generated on-site (incl. fugitive dust) in such a manner that is not only legally compliant, but protective of human health and well-being.
Waste	To manage all waste generated on-site in a manner that is protective of human health and environmental resources, and that efforts to optimise waste recycling, reuse or recovery ultimately achieve a better environmental outcome than if waste were to be disposed of to landfill.

4.2 ROLES AND RESPONSIBILITIES

It is the responsibility of the BRMO to ensure that the commitments made in this chapter are realised. Mine Management needs to make sure that not only are sufficient funds set aside for this, but that a suitable management and working structure is in place. This includes a system whereby all employees, contractors, sub-contractors and anyone delivering a service to the Mine, is made aware and forced to abide by the commitments in this chapter.

4.2.1 THE PROJECT PROPONENT (ASSMANG LIMITED)

Assmang will be responsible for the overall implementation, monitoring and enforcement of the activities as outlined in the EMP. The project manager, or other senior designate from Assmang, will be responsible for overseeing that environmental compliance and monitoring is performed, and will undertake all correspondence with the relevant authorities.

Assmang remains ultimately responsible for ensuring that all activities are implemented according to the provisions of the EMP and all conditions of relevant licences/permits/approvals/authorisations. Although specific role-players will be appointed by Assmang to perform certain functions on its behalf, the ultimate responsibility is not delegated. Assmang has to ensure that sufficient resources (time, financial, human, equipment, etc.) are available to these other parties to efficiently perform their tasks in terms of the EMP. Because Assmang is liable for restoring negligent damage caused to the environment, each member of staff has to be responsible and accountable for compliance as per the EMP.

4.2.2 PROJECT/SITE MANAGER (PSM)

Assmang must appoint/designate a senior representative as Project / Site Manager (PSM) to act on its behalf. The duties of this representative, as relevant, would include:

- Ensure that the EMP is part of relevant contractual documentation so that any contractors are bound to the conditions of the EMP and relevant licences, permits / approvals / authorisations;
- Monitor the undertaking of environmental awareness training for all new personnel coming onto site, or undertake environmental awareness courses themselves;
- Appoint an Internal Environmental Officer/Specialist (IEO) to assist with day-to-day EMP implementation and monitoring duties;
- During the construction phase, the IEO must oversee all the environmental aspects relating to the development and provide auditing of compliance with the EMP;
- Ensure that the necessary waste licenses, environmental authorisation and permits have been obtained and are maintained;
- Comply with the contents of the EMP to ensure that the requirements of the EMP are met;
- Monitor and verify that the EMP is adhered to at all times and take action if the specifications are not followed;
- Monitor and verify that environmental impacts are kept to a minimum;
- Review operational procedures in conjunction with the IEO;
- Assist the IEO in finding environmentally responsible and effective solutions to any problems encountered during implementation;
- Inspect the site and surrounding areas from time to time; and
- Monitor, review and verify compliance with the EMP as reported by the IEO.

4.2.3 INTERNAL ENVIRONMENTAL OFFICER (IEO) / (PRACTITIONER)

Assmang's Internal Environmental Officer / Manager (IEO) will be responsible for monitoring, reviewing and verifying compliance with the EMP on a day-to-day basis. This role may be fulfilled by any suitably qualified and responsible representative involved with daily on-site operations (e.g. Environmental Manager / Officer / Practitioner. In particular, the IEO shall:

- Regularly inspect and continuously monitor the site to ascertain the level of compliance with the EMP;
- Maintain inspection reports on file;
- Monitor and verify through quarterly audits that the EMP is adhered to at all times and take action if the specifications are not followed;
- Monitor and verify that environmental impacts are kept to a minimum;
- Assist Assmang in finding environmentally responsible solutions to problems;
- Keep records of all activities/incidents concerning environment performance;
- Keep a register of complaints from IAPs;
- Provide material/manuals and support for raising environmental awareness of staff;
- Ensure that activities on site comply with legislation of relevance to the environment;
- Liaise with relevant authorities;
- Liaise with contractors regarding environmental management.
- Complete checklists as necessary; and
- Continually, internally review the EMP and submit monthly reports to the PSM.

a) Liaison with Authorities

The IEO would be responsible for liaising with all relevant competent authorities (e.g. NCDENC, DAFF).

b) Liaison with Contractors

The IEO will be responsible for informing the contractors of any decisions that are taken concerning the natural and social environment during the project activities. This would also include informing the contractors of the necessary corrective actions to be taken against employees transgressing the management activities stipulated in this EMP.

4.2.4 ENVIRONMENTAL CONTROL OFFICER (ECO)

It is recommended that an independent Environmental Control Officer (ECO) be appointed by Assmang to oversee relevant environmental aspects relating to this development for the construction phase. He / she would need to conduct independent quarterly, external, audits to assess compliance with the EMP and be responsible for providing feedback on potential environmental problems associated with the activities on site.

The ECO will:

- Assist the IEO in ensuring that necessary authorisations and other relevant license / permits / approvals / authorisations have been obtained;
- Undertaking routine monitoring and/or appointing a competent person / institution to be responsible for specialist monitoring, if necessary;
- Undertake independent audits with regards to compliance with the EMP;

- Compile audit reports identifying areas of non-compliance and proposals for rectification thereof; and
- Assist Assmang in achieving and maintaining first-rate environmental management practices.

4.3 MONITORING, AUDITING, RECORDING, REPORTING AND UPDATING

An essential aspect of any EMP is the review process. This includes monitoring, auditing, record keeping, reporting and updating. The findings of the review process can inform planning on the mine, allowing future operations to benefit from the experiences of the past.

4.3.1 MONITORING

Monitoring needs to be kept to a manageable task and therefore needs to target the most important instructions in the EMPR, where the risk of environmental damage is the greatest. Monitoring needs to include both a routine aspect and allow for erratic or unpredictable events, such as floods or human caused incidents (spills, etc.). Some routine monitoring can be done at varied intervals (e.g. alien vegetation observations), but other monitoring requires regular sampling to allow easy scientific analysis of the results, such as monthly or quarterly water sampling.

GN. R. 527 of 2004 states:

> *"55. (1) ... a holder of such a permit or right must:-*
> *(a) conduct monitoring on a continuous basis;"*

Monitoring should cover the following:

- Monitor the higher risk activities/areas more frequently;
- Regular collection of samples for scientific analysis;
- Routine observations of behaviours and practices;
- Noting of unusual events, incidents and accidents (natural and human triggered);
- Brief statement whether or not conditions of the EMP are being met; and
- Possible reasons why conditions are not being met.

4.3.2 AUDITING

Auditing can be done internally, or by an external party. Internal audits are recommended, but optional, whilst an external audit is essential, as it provides an unbiased report on the implementation of the EMPR. An audit can be a thorough audit of every single instruction in the EMP, or a strategic sample of the most important instructions, but it must be made clear which type of audit is being done.

Audits must include the following three key investigation techniques:

- Document review, including previous audit reports, technical reports, monitoring data, etc.;
- Interviews with staff (not only the ENVIRONMENTAL Manager); and

- Site visit or walkabout.

An audit must always be documented in a report that contains observations/findings and recommendations. It is recommended that an audit be conducted at least quarterly during the construction phase on the EMP.

4.3.3 RECORD KEEPING

Record keeping must be done in such a way that all information generated can be accessed easily in the future. The information must also be clearly marked or labelled so that it is obvious to what the information applies. For example, all reports must be dated, and all monitoring results must belong to a monitoring point, which is located on a map, and so on. In this regard, metadata (or data about data) is important, such as who collected the sample, when, where it was analysed, and so forth.

The following types of information typically need to be stored:

- Raw data from analyses (numbers in a database or spreadsheet) and the metadata;
- Summary statistics, graphs and analyses of data;
- Observations and comments from monitoring of the EMP implementation;
- Monitoring reports presenting the above three categories;
- Audit reports, both internal and external;
- Incident/event reports;
- Correspondence: e.g. letters showing appointment of auditors, addressing non-compliant sub-contractors, government responses, etc.;
- Authorisations and approvals;
- Master documents, such as EIA reports and the EMP (including the latest approved EMP and any approved addendums); and
- A working copy of the EMP, with proposed amendments.

4.3.4 REPORTING

Adequate monitoring, auditing and record keeping make reporting a simple task. Information and existing reports can be assembled and presented to whoever may need them. Knowing what reporting is necessary can help inform the type of monitoring and the system of record keeping. Typical reporting requirements include:

- Company performance/management system reports (e.g. performance targets);
- Company environmental/sustainability reports (part of annual reports);
- Audit reports, including review of the EMP; and
- Incident/event reports.

4.3.5 UPDATING THE EMP

An EMP is a working document. As management methods are improved and as the mine operations change, requiring new methods and allowing others to fall away, the EMP needs to be adjusted to reflect these changes.

It is recommended that a working copy of the EMP be kept available at all times and any observations, thoughts or proposals be placed in the working file for consideration later. The need to revise the EMP is dependent upon how many changes are needed. A well established operation with few changes may not need to revise its EMP for many years, whilst a fast changing operation may need a revision at least annually.

4.4 NOTE ON DEVELOPMENT PHASES

Typically an EMP is divided into the actions required for each phase of a development, namely:

- Planning and design;
- Construction;
- Operations (the life of the activity); and
- Closure and aftercare.

The mitigation tables that follow have been compiled to consist of seven (7) criteria, as follows:

- "Activity / Structure / Infrastructure" - This row will identify the issue being addressed, e.g. potential biodiversity loss through vegetation clearance;
- Environmental Aspect – That being the environmental parameter/s potentially impacted upon by the activity, structure or infrastructure under consideration;
- Impacts – Describes, for every applicable environmental aspect, the potentially negative changes that could result from the activity, structure or infrastructure under consideration;
- Mitigation Actions - This column will include all the necessary environmental management measures for each activity, structure or infrastructure under consideration;
- Measurable targets - indicate what evidence is to be used as an indication to whether, or not, the 'Management Actions' have been effectively implemented;
- Responsible Party – Indicates that party who is ultimately responsible for ensuring that the prescribed mitigation measures are appropriately implemented within the specified time-frames; and
- Time-frames / Frequency of action – This column provides time guidelines for the 'Responsible party' by which he/she is to action or manage the required mitigation.

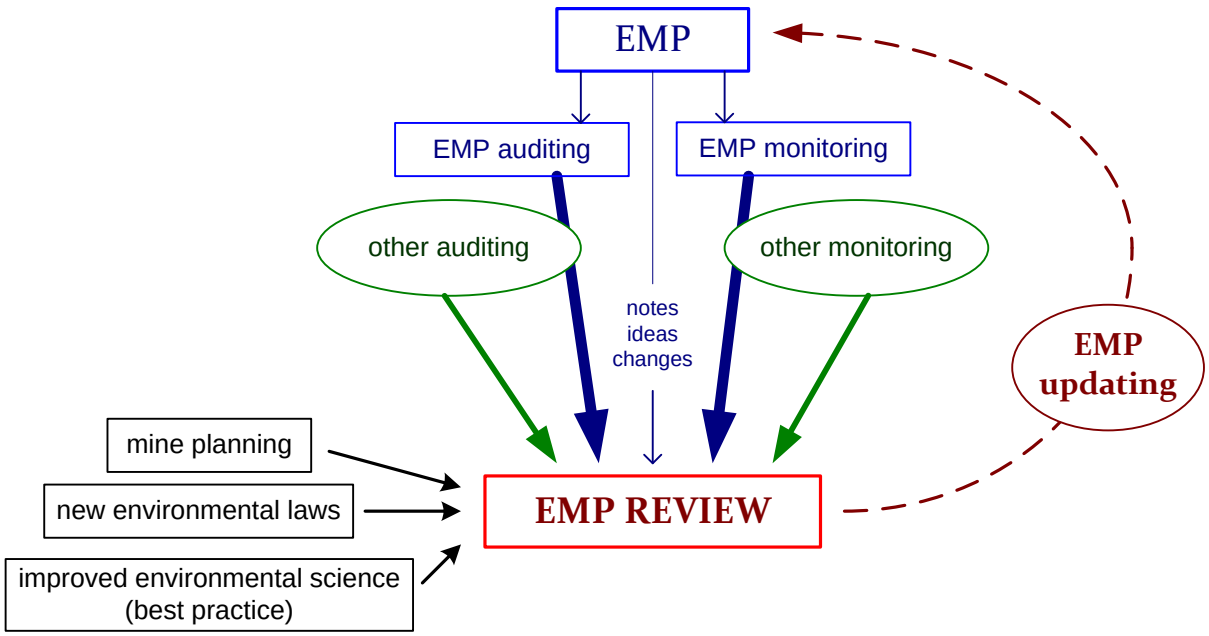

Figure 4-1: Conceptual diagram for EMP review cycle. Note the main division between internal information, such as auditing and monitoring, and external information, such as changes to environmental laws and regulations, which should provide input on the revision of the EMP.

4.5 PRE-CONSTRUCTION, PLANNING AND DESIGN

Table 4-3: Mitigation for Pre-construction, Planning and Design Phase

ASPECT	ACTIVITY	MANAGEMENT ACTIONS & MONITORING	RESPONSIBILITY	FREQUENCY
1. PROJECT PLANNING & DESIGN PHASE				
1.1 Management (Set-up structures and procedures for implementation of EMP)	Update the EMP after detailed design has been completed (if necessary)	This EMP must be updated to ensure that it is relevant to the detailed design of all applicable structures and supporting infrastructure	Proponent	Once-off prior to commencement
	Update the EMPR to reflect the requirements of the Environmental Authorisation	This EMP must be updated to ensure that all specific conditions of relevant approvals, licences and authorisations issued for this project have been incorporated into the EMP.	Proponent	Once-off prior to commencement
	Appointment and duties of ECO	The project proponent must appoint an independent Environmental Control Officer (ECO) who must monitor compliance with the EMP during the construction phase on a quarterly basis.	Proponent, ECO	Once-off prior to commencement
	Management of staff and contractors	The EMP must be made binding to contractors and should be included in tender documentation for the contract.	Proponent, Contractor/s	Once-off before contractor appointments
		The EMP must be made readily available to the contractors, staff, as well as other relevant role-players associated with the project.	Proponent	Continuous
1.2 Training	Training of staff and contractors	Contractors and staff must be properly trained in all environmental aspects relating to their role in the project's construction and operation, as per requirements of the associated environmental awareness plan.	Proponent, Contractor/s	Once-off prior to commencement & update as required
1.3 Legal Compliance	Environmental Authorisation	Obtain environmental authorisation, in terms of the National Environmental Management Act (107 of 1998), from the Northern Cape Department of Environment and Nature Conservation (NCDENC) for all activities triggered in either GN. R. 543, 544 or 545 of the 2010 NEMA Regulations of 18 June 2010	Proponent	Once-off prior to commencement
	Removal / destruction of protected floral species	Permits applicable to the removal, relocation or destruction of protected floral species must be obtained prior to undertaking any such activity	Proponent	Once-off prior to commencement
	Any other conditions	All relevant management and mitigation required by the Environmental Authorisation and any other environmental authorisations or licences or permits, must be incorporated into the project design	Proponent	Once-off prior to commencement (where practical)

4.6 CONSTRUCTION PHASE

Table 4-4: Construction Camp Establishment					
Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality through vehicle entrained dust generation within the camp/s	A dust palliative with at least 80% dust reduction efficiency must be applied to bare soil surfaces in the camp/s (See Appendix 4 for alternative palliative choices) **Contractor Method Statement Required.**	80% reduction in vehicle entrained dust generation	Proponent, Contractor	Initial once-off. Further application as necessary to meet target on an on-going basis
	Degraded air quality through the burning of waste	Under no circumstances is waste to be burnt, or buried, within the construction camp, or anywhere else on site	Safe disposal certificates available for all waste generated and removed from site for subsequent management	Proponent, Contractor	Continuous
Ground water	Negative quality impacts resulting from temporary ablution / sanitary facilities	Contractor/s must provide appropriate (capacity / effective containment of grey and black water), above-ground, ablution / sanitary arrangements for employees, and maintain / service such for the duration of their occupation within the camp/s **Contractor Method Statement Required.**	No contact between black /grey water and site soils. No offensive odours emanating from ablution facilities.	Proponent, Contractor	Once-off, with weekly maintenance thereafter
	Negative quality impacts resulting from cement / concrete batching activities	Concrete batching (if required) must take place on a durable, impermeable, bunded surfaces	No contact between concrete / raw material and site soils.	Proponent, Contractor	Once-off
		Run-off from batching activities must be effectively contained and prevented from entering the environment (i.e. soils, surface water) **Contractor Method Statement Required.**	No contact between potentially contaminated run-off and site soils or surface water	Proponent, Contractor	Continuous
	Negative quality impacts resulting from the storage of fuel, oil and hazardous materials	No underground fuel tanks may be established as part of the construction activities within the camp/s, or anywhere else on site during construction, or operation	No underground fuel tanks established on site	Proponent, Contractor	Continuous

Table 4-4: Construction Camp Establishment					
Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		Above ground fuel, or oil storage tanks, must be located within appropriately sized, impermeable, bund walls (inclusive of valve for release of storm water ingress, unless otherwise roofed), and must not exceed 80cubic meter storage capacity (cumulative threshold for the storage of hazardous substances on site).	Bund wall capacity sized to at least 110% of the cumulative volume of fuel and oil stored therein. Records of weekly bund wall integrity inspections kept on record	Proponent, Contractor	Continuous. Weekly inspections of bund wall integrity.
		Appropriate hydrocarbon spill management kits must be kept and maintained on site wherever fuels and oils are stored, and where refuelling and /or servicing of plant, vehicles and machinery takes place, in order to manage potential hydrocarbon spillages effectively	Spill management kits available on site and replenished as necessary	Proponent, Contractor	Continuous
		Training, in the use and maintenance of the abovementioned kits, as well as any contaminated waste products, must be provided to ALL staff either directly, or indirectly, involved in any of the activities identified above	Records of training kept on record	Proponent, Contractor	Once-off, with annual refresher training every year thereafter
		Bund establishment must be compliant with BRMO 'bund wall' procedure - Env-S/UG-GN-002	Compliance with existing BRMO procedure	Proponent, Contractor	Once-off
		Hazardous material / chemical containers must be stored within appropriately sized, impermeable, bund walls (inclusive of valve for release of storm water ingress, unless otherwise roofed)	Bund wall capacity sized to at least 110% of the volume of the largest chemical container stored therein. Records of weekly bund wall integrity inspections kept on record	Proponent, Contractor	Continuous. Weekly inspections of bund wall integrity.
		Soil contaminated through the spillages of fuel, oil or hazardous materials within the construction camp must be immediately collected and placed within a dedicated, water-tight, skip/container within the camp/s, for subsequent disposal at an appropriately licensed	Dedicated 'contaminated soil' skip/container on site. Contents removed to hazardous landfill site. Safe disposal certificates	Proponent, Contractor	Continuous

Table 4-4: Construction Camp Establishment					
Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		hazardous waste disposal facility	kept on record for all contaminated soil removed from site.		
	Negative quality impacts resulting from vehicle/plant workshops and wash bays	All servicing of plant and vehicles is to take place strictly within dedicated workshops within construction camp/s, or otherwise off-site at appropriate service yards.	No servicing of plant or vehicles outside of dedicated workshop areas	Proponent, Contractor	Continuous
		Furthermore, servicing and maintenance of plant and vehicles must take place on impermeable surfaces and under cover.	Covered, impermeable, platforms established for the servicing of vehicles and plant within the construction camp/s	Proponent, Contractor	Continuous
		Storm water run-off within the camp/s must be prevented from flowing through workshops and wash bays	Appropriate storm water management measures implemented, such that the generation of potentially contaminated surface water run-off is avoided	Proponent, Contractor	Continuous
		Potentially contaminated wash water must be effectively diverted, contained and managed, such that no hydrocarbon contaminants are ever in contact with site soils **Contractor Method Statement Required.**	No contact between potentially contaminated wash water and site soils or storm water flows	Proponent, Contractor	Continuous
Surface water	Generation of contaminated surface water run-off during rainfall events	Storm water diversions must be established on the up-slope of construction camp/s, such that storm water flows are diverted away from camp/s and the potential contamination of clean storm water run-off averted **Contractor Method Statement Required.**	Storm water management measures appropriately implemented	Proponent, Contractor	Once-off

Table 4-4: Construction Camp Establishment					
Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Biodiversity	Reduced biodiversity due to construction camp/s establishment in green-field areas	Construction camps may only be established within the approved development footprints of the proposed project elements	No vegetation cleared, that will not already require clearing as part of the approved project elements	Proponent, Contractor	Once-off
	Poaching / killing of indigenous site fauna	Under no circumstances is the poaching, or killing, of indigenous site fauna by the contractor, or his/her employees, to be tolerated	No harm to indigenous site fauna. Records kept on file of applicable training by contractor	Proponent, Contractor	Continuous. Once-off training, with annual refreshers every year thereafter
		Non-compliance with the above condition to constitute grounds for the immediate, permanent, removal of guilty parties from site	Signed declarations by contractor and all his/her employees in acknowledgement of this provision	Proponent, Contractor	Continuous
	Destruction of site flora through unauthorised 'harvesting' thereof	Under no circumstances are wood, or medicinal plants, to be 'harvested' by the contractor, or his/her employees	No destruction / 'harvesting' indigenous site flora. Records kept on file of applicable training by contractor	Proponent, Contractor	Continuous. Once-off training, with annual refreshers every year thereafter
		Non-compliance with the above condition to constitute ground for the immediate, permanent, removal of guilty parties from site	Signed declarations by contractor and all his/her employees in acknowledgement of this provision	Proponent, Contractor	Continuous
	Anthropogenic veld fires resulting in biodiversity loss	If fires, for the purposes of cooking, are to be tolerated within the construction camp/s, the following conditions are to apply: • Must be well removed from fuel and hazardous material storage areas, in line with appropriate BRMO safety standards; • Must be well removed from indigenous vegetation (at least 15m); • Fire-extinguisher must be readily available;	Well managed, clearly designated, area/s established for cooking fires.	Proponent, Contractor	Continuous

Table 4-4: Construction Camp Establishment					
Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		• Must be screened from wind with non-flammable material/s; and • Non-smouldering ash residues must be disposed of to general waste skip/s, or containers, in the camp.			
	Infestation and propagation of alien invasive floral species	Contractors must ensure that alien invasive floral species within the bounds of their camp/s are managed in accordance with relevant provisions of the BRMO alien invasive species management plan (Appendix 5)	No alien invasive floral species infestation within camp/s	Proponent, Contractor	Continuous
		Contractors to receive training and assistance by BRMO environmental officer in regard to the above requirements	Copy of BRMO alien invasive species management plan provided to contractor/s. Records available of relevant training	Proponent, Contractor	Once-off
Soils	Negative impacts on quality due to inappropriate waste management	Contractors must provide sufficient, water-tight, skips/containers on site for the separate storage of general and hazardous waste	Sufficient skips provided for. No mixing of general and hazardous waste streams	Proponent, Contractor	Once-off
		Under no circumstances must waste be stored on site anywhere but in the appropriate skips/containers provided for such; unless otherwise in water-tight drums placed intermittently throughout the camp/s, that will ultimately be decanted into primary waste storage skips/containers	No *ad hoc* waste stockpiling on bare soil surfaces.	Proponent, Contractor	Continuous
		Waste skips/containers must be cleared when full, such that waste doesn't over-flow onto adjacent ground	No evidence of full, or over-flowing, waste skips / bins	Proponent, Contractor	Continuous
		Safe disposal / management certificates must be obtained, and kept on file, for all waste removed from site; where the waste management facility / contractor used for such purposes must be appropriately licensed	Records of safe disposal / management certificates kept on record	Proponent, Contractor	Continuous

Table 4-4: Construction Camp Establishment					
Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		/ permitted for such			
		The contractor is responsible for ensuring that wind-blown litter is collected from the bounds of the camp/s on a daily basis.	No evidence of wind-blown litter. Records of daily collections / inspections kept on record.	Proponent, Contractor	Continuous
Socio-economics	Social impacts stemming from an influx of contractors and associated employees	Only contractor/s and his/her employees, or sub-contractors, may be housed within, or gain access to, such facilities in the construction camp/s **Contractor Method Statement Required.**	Well controlled access to camp/s	Proponent, Contractor	Continuous
		Access by the contractor and his/her employees to adjacent farms (i.e. other than those falling within the ambit of the project) is strictly forbidden; unless otherwise agreed upon, in writing, by the relevant landowner/s. Trespassing is to constitute immediate grounds for the permanent removal of guilty parties form the project	No trespassing	Proponent, Contractor	Continuous
		The negative impact on housing and service delivery provision pressures could be reduced by sourcing the majority of construction workers from local communities, thus reducing the need to bring new people into the local area. In this case, the District Municipality could be approached with a request to conduct a skills audit of the nearby communities, which will allow the contractor/s to identify people with suitable skills	Use of local labour sourced from the District to the greatest extent practical	Proponent, Contractor	Continuous
General	Numerous	Contractor/s are required to provide written method statements to the ECO/BRMO environmental manager, detailing how they intend to achieve compliance with the EMP in relation to the following aspects of construction camp management:	Written, ECO/BRMO approved method statements in place as required	Contractor, BRMO environmental manager and ECO	Once-off prior to commencement

Table 4-4: Construction Camp Establishment					
Activity / Structure / Infrastructure	Establishment of temporary construction camp facilities (Including administrative offices, ablution facilities, fuel storage, concrete/cement batching, vehicle workshops/wash bays and raw / construction material storage).				
Environmental Aspect	**Potential Impact/s**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		• Dust suppression within the contractors camp; • Provision of ablution / sanitary arrangements for their employees; • Black and Grey Water Management within the camp/s; • Storm water management within the construction camp/s; and • Site access management.			

Table 4-5: : Vegetation Clearance					
Activity / Structure / Infrastructure	Vegetation clearance, leading to ultimate establishment of construction camp/s, housing units and supporting ancillary infrastructure.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality through vehicle entrained dust generation	Cumulative dust deposition target thresholds, in terms of SANS 1292, 2009/11/17, must be met at the BRMO site boundary	Less than 600mg/m^2/day at the BRMO Mine boundary – 30 day average	Proponent, Contractor	Continuous
Ground water	Degraded groundwater quality through hydrocarbon contamination	Plant and vehicles used on site must be well maintained / serviced, and visually inspected (at least daily) by their respective operators for hydrocarbon (i.e. oil, fuel and hydraulic fluids) leaks.	Records on file of daily visual plant and vehicle inspections	Proponent, Contractor	Continuous
Biodiversity	Destruction of habitat leading to overall loss of biodiversity (Incl. relocation, removal and destruction of protected floral species)	Vegetation clearance must be limited to the smallest area practical to enable construction activities and the establishment of structures and infrastructure. These areas need to be clearly marked out (e.g. taped off) under the supervision / assistance of the ECO and BRMO environmental manager as vegetation clearance proceeds on site. Required to ensure that all vegetation clearance is restricted to designated areas to the greatest extent practical	No unnecessary clearance of indigenous vegetation. Vegetation clearance according to a final ECO and BRMO approved 'clearance layout'.	Proponent, Contractor, ECO	Continuous

Table 4-5: : Vegetation Clearance					
Activity / Structure / Infrastructure	Vegetation clearance, leading to ultimate establishment of construction camp/s, housing units and supporting ancillary infrastructure.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		No protected floral species may be removed, relocated or destroyed without the necessary permits for such having been obtained from the relevant competent authority	Copies of permits on file prior to proceeding with vegetation clearance	Proponent, Contractor	Once-off
		The removal, relocation or destruction of protected plant and tree species must be undertaken in compliance with all conditions stipulated in the above mentioned permits.	EMP appropriately updated to include specific conditions of permitting	Proponent, Contractor	Continuous
		Any *Ammocaris coranica, Harpogophytum procumbens, Babiana hypogaea* and *Boophane disticha*, or any other red data listed (RDL) plant species identified on site, need to be rescued and relocated under the guidance of a competent ecologist, or by parties trained to undertake such by a competent ecologist, as part of a species specific rescue and relocation plans formulated by a competent ecologist	Records kept of all RDL plant species rescued and relocated, as well as point of relocation thereof. Record of specialist ecologist appointment on file, as proof of involvement in rescue and relocation	Proponent, Contractor, Specialist Ecologist	Once-off, prior to commencing with broad-scale vegetation stripping.
		An indigenous tree nursery (particularly with respect to the growing of protected tree species to be destroyed) must be established by the BRMO in order to facilitate concurrent and closure rehabilitation.	The number of trees propagated and subsequently re-planted on site by completion of mine closure / rehabilitation, must at least equal the amount thereof removed during the construction phase	Proponent	Continuous
	Establishment of alien invasive floral species and associated negative impacts on biodiversity	All areas stripped of indigenous vegetation cover need to be regularly inspected for the potential establishment of alien invasive species, and appropriate control measures applied where these species are observed to have established (i.e. in accordance with the provisions of the BRMO 'alien invasive species management	Proof of training, in 'weed' identification, provided to mandated 'inspector/s. Inspection register maintained by the contractor/s, as well as	Proponent, Contractor	Weekly 'weed' inspections (Summer). Monthly 'weed' inspections (Winter) Problem species cleared within 5 calendar days of their identification.

Table 4-5: : Vegetation Clearance					
Activity / Structure / Infrastructure	Vegetation clearance, leading to ultimate establishment of construction camp/s, housing units and supporting ancillary infrastructure.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		plan').	documentation of any control measures applied (location, method & effectiveness at the very least)		
		A copy of the BRMO alien invasive species management plan, inclusive of quick 'weed identification' flash-card sets, to be supplied to the relevant contractor/s involved in vegetation stripping	Proof of contractor's receipt of the management plan	Proponent	Once-off
Soils	Loss of topsoil to vegetation stripping, thereby reducing remaining available extent thereof for rehabilitation efforts at mine closure	The degree of 'topsoil' lost to vegetation stripping needs to be kept to an absolute minimum by the relevant contractor/s.	Minimal loss of topsoil with 'stripped' vegetation.	Proponent, Contractor	Continuous
	Erosion losses from exposed soil surfaces	Any runnels, or erosion channels, developing during any construction, or on-going operational and maintenance period, shall be back-filled and consolidated immediately and the area restored to the proper condition. The contractor shall not allow erosion to develop on a large scale before effecting repairs and all erosion damage shall be repaired as soon as possible (Topsoil washed away shall be replaced).	No evidence on site of erosion channels. Topsoil has been appropriately replaced where it has been lost through surface storm water flows.	Proponent, Contractor	Continuous. Remedial action within 48 hours.
Noise	Negative impacts on ambient noise levels resulting from heavy vehicle operation during vegetation stripping	Vegetation stripping to only be undertaken between 7:00am and 5:00pm on week days and 8:00am to 13:00pm on Saturdays	No 'noisy' construction activities outside of stipulated work hours	Proponent, Contractor	Continuous
		In terms of noise impact for various increases over the ambient, the National Noise Regulations define an increase of 7dB as "disturbing". Noise levels during construction must, therefore, be kept within 7dB of the baseline data at sensitive receptors.	Records of regular (six monthly) noise monitoring during the construction phase, with appropriate comparison of measured data against baseline	Proponent, Contractor, Noise Specialist	Continuous. Quarterly monitoring of ambient levels

Table 4-5: : Vegetation Clearance					
Activity / Structure / Infrastructure	Vegetation clearance, leading to ultimate establishment of construction camp/s, housing units and supporting ancillary infrastructure.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
			data.		
Heritage Resources	Negative impacts on elements of cultural, or heritage, significance	Basic training needs to be provided to the relevant contractor/s, as well as their relevant vehicle / grader operator/s, in the identification of possibly encountered elements of cultural and heritage significance (e.g. archaeological sites, graves, etc.)	Proof of basic training by an appropriately qualified archaeological specialist	Proponent, Contractor, Archaeologist.	Once-off, prior to commencement of vegetation stripping
		If archaeological sites are exposed during vegetation stripping, it should immediately be reported to the Local and National Branches of the South African Heritage Resources Agency (SAHRA)	No unauthorised disturbances to elements of potential cultural, or heritage, significance	Proponent, Contractor	Continuous. Reporting of archaeological finds within 24hours
		Under no circumstances shall archaeological artefacts discovered on site during construction or operational activities be removed, destroyed or interfered with.	Compliance with the provisions of the National Heritage Resources Act (Act No. 25 of 1999)[HRA].	Proponent, Contractor	Continuous
Socio-economics	Wood harvesting 'off-set' in local communities	The wood from trees stripped during this phase of construction must be supplied to local community/ies as fire wood; unless otherwise directed in the respective 'protected tree removal/destruction permit/s'.	Recovery and use of feasible firewood stock to the greatest extent possible	Proponent, Contractor	Continuous
	Efficient reuse of all stripped vegetation	All stripped vegetation not suitable as fire wood must be chipped and utilised elsewhere on site as mulch / compost material	Recovery and use of all stripped vegetation to the greatest extent possible	Proponent, Contractor	Continuous

Table 4-6: : Topsoil Stripping					
Activity / Structure / Infrastructure	Topsoil stripping, leading to ultimate establishment of construction camp/s, housing units and associated supporting infrastructure				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality through vehicle entrained dust generation	Cumulative dust deposition target thresholds, in terms of SANS 1292, 2009/11/17, must be met at the BRMO site boundary	Less than 600mg/m^2/day at the BRMO Mine boundary – 30 day	Proponent, Contractor	Continuous

Table 4-6: : Topsoil Stripping					
Activity / Structure / Infrastructure	Topsoil stripping, leading to ultimate establishment of construction camp/s, housing units and associated supporting infrastructure				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
			average		
Ground water	Degraded groundwater quality through hydrocarbon contamination	Plant and vehicles used on site must be well maintained / serviced, and visually inspected (at least daily) by their respective operators for hydrocarbon (i.e. oil, fuel and hydraulic fluids) leaks.	Records on file of daily visual plant and vehicle inspections	Proponent, Contractor	Continuous
Biodiversity	Establishment of alien invasive floral species and associated negative impacts on biodiversity	All areas stripped of indigenous vegetation cover and topsoil need to be regularly inspected for the potential establishment of alien invasive species, and appropriate control measures applied where these species are observed to have established (i.e. in accordance with the provisions of the BRMO 'alien invasive species management plan').	Proof of training, in 'weed' identification, provided to mandated 'inspector/s. Inspection register maintained by the contractor/s, as well as documentation of any control measures applied (location, method & effectiveness at the very least)	Proponent, Contractor	Weekly (summer)/ monthly (winter)'weed' inspections. Problem species cleared within 5 calendar days of their identification.
		A copy of the BRMO alien invasive species management plan, inclusive of quick 'weed identification' flash-card sets, to be supplied to the relevant contractor/s involved in vegetation stripping	Proof of contractor's receipt of the management plan	Proponent	Once-off
Soils	Reduced effectiveness of rehabilitation efforts at mine closure, resulting from poor topsoil management practices	Topsoil to be stripped to a depth of at least 30cm from all development footprints and stockpiled for reuse in rehabilitation actions at mine closure	Photographic evidence of topsoil stripping, as well as data logging [source and estimated volumes(m^3)] of all new additions kept on file.	Proponent, Contractor	Continuous
		Vegetation stripping should not be conducted more than a week (7 calendar days) prior to topsoil stripping, in preparation of development, or mining	No areas left bare of vegetation for longer than a week following the 'stripping' thereof for development, or mining	Proponent, Contractor	Continuous. Seven (7) day window
		Topsoil stockpile heights must be optimised to ensure that a balance is struck between area of disturbance	Topsoil stockpile height optimisation	Proponent, Contractor	Continuous

Table 4-6: : Topsoil Stripping					
Activity / Structure / Infrastructure	Topsoil stripping, leading to ultimate establishment of construction camp/s, housing units and associated supporting infrastructure				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		from stockpiling and maintenance of seed bed and residual organic material therein			
		Topsoil stockpile areas must be securely fenced, sign posted as 'no-go' areas' and subsequently marked on the BRMO surface infrastructure plan	Appropriate access control in place for topsoil stockpiles	Proponent, Contractor	Once off fence/gate establishment. Continuous access control thereafter by environmental manager
		Topsoil and subsoil must only be utilised as required for rehabilitation within the mining area, and according to a topsoil reuse plan to be compiled by the BRMO Environmental Manager	Topsoil Reuse Plan available for inspection. No unauthorised use of topsoil in contravention of the aforementioned plan.	Proponent	6 months from the DMR's acceptance of this EMPR addendum. Implementation thereof subsequent to approval is an on-going task
		Stockpiles must be monitored for alien vegetation any existing alien vegetation must be removed and destroyed.	Records kept on file of at least monthly inspections	Proponent	Continuous
		A 'topsoil balance calculation' will be held by the BRMO, showing reasonable estimates of the topsoil volumes available in stockpiles against the volumes required for rehabilitation of affected development footprints for the project.	Topsoil balance calculation used to inform preparation of Topsoil Reuse Plan	Proponent	Once off, within 6 months of the DMR's acceptance of this revised EMPR
Noise	Negative impacts on ambient noise levels resulting from heavy vehicle operation during topsoil stripping	Topsoil stripping to only be undertaken between 7:00am and 5:00pm.on weekdays, and 8:00am to 13:oopm on Saturdays.	No 'noisy' construction activities outside of stipulated work hours	Proponent, Contractor	Continuous
Heritage Resources	Negative impacts on elements of cultural, or heritage, significance	Basic training needs to be provided to the relevant contractor/s, as well as their relevant vehicle / grader operator/s, in the identification of possibly encountered elements of cultural and heritage significance (e.g. archaeological sites, graves, etc.).	Proof of basic training by an appropriately qualified archaeological specialist	Proponent, Contractor, Archaeologist.	Once-off, prior to commencement of vegetation stripping
		If archaeological sites are exposed during topsoil stripping, it should immediately be reported to the	No unauthorised disturbances to elements	Proponent, Contractor	Continuous. Reporting of archaeological finds within

Table 4-6: : Topsoil Stripping					
Activity / Structure / Infrastructure	Topsoil stripping, leading to ultimate establishment of construction camp/s, housing units and associated supporting infrastructure				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		Local and National Branches of the South African Heritage Resources Agency (SAHRA),	of potential cultural, or heritage, significance		24hours
		Under no circumstances shall archaeological artefacts discovered on site during construction or operational activities be removed, destroyed or interfered with.	Compliance with the provisions of the National Heritage Resources Act (Act No. 25 of 1999)[HRA].	Proponent, Contractor	Continuous

Table 4-7: Civil- and Earthworks					
Activity / Structure / Infrastructure	Establishment of structural and infrastructural foundations / founding conditions and associated, operational, compacted working 'floors'				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Topography	Soil erosion resulting from the creation of steep, unnatural, slopes	No slopes with gradient > 3:1 should be established on site; unless otherwise protected from erosion by appropriate storm water management measures, or slope stabilisation / re-vegetation	No slopes > 3:1	Proponent, Contractor	Continuous
Air Quality	Degraded air quality through vehicle entrained dust generation	Cumulative dust deposition target thresholds, in terms of SANS 1292, 2009/11/17, must be met at the BRMO site boundary	Compliance with SANS 1929:2005 – Ambient Air Quality – Limits for Common Pollutant	Proponent, Contractor	Continuous
Ground water	Degraded groundwater quality through hydrocarbon contamination	Plant and vehicles used on site must be well maintained / serviced, and visually inspected (at least daily) by their respective operators for hydrocarbon (i.e. oil, fuel and hydraulic fluids) leaks.	Records on file of daily visual plant and vehicle inspections	Proponent, Contractor	Continuous
Biodiversity	Biodiversity loss through destruction of natural habitat	Civil- and earth works may only proceed where vegetation- and topsoil stripping have been effected in compliance with the provisions of the EMP	No extension of the development footprint beyond that approved in terms of this EMPR addendum	Proponent, Contractor	Continuous
Noise	Negative impacts on ambient	Civil- and earth works to only be undertaken between	No ' noisy' construction	Proponent, Contractor	Continuous

Table 4-7: Civil- and Earthworks					
Activity / Structure / Infrastructure	Establishment of structural and infrastructural foundations / founding conditions and associated, operational, compacted working 'floors'				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
	noise levels resulting from heavy vehicle operation during civil- and earthworks	7:00am and 5:00pm on weekdays, and 8:00am to 13:00pm on Saturdays	activities outside of stipulated work hours		
Heritage Resources	Negative impacts on elements of cultural, or heritage, significance	Basic training needs to be provided to the relevant contractor/s, as well as their relevant vehicle / grader operator/s, in the identification of possibly encountered elements of cultural and heritage significance (e.g. archaeological sites, graves, etc.).	Proof of basic training by an appropriately qualified archaeological specialist	Proponent, Contractor, Archaeologist.	Once-off, prior to commencement of vegetation stripping
		If archaeological sites are exposed during topsoil stripping, it should immediately be reported to the Local and National Branches of the South African Heritage Resources Agency (SAHRA),	No unauthorised disturbances to elements of potential cultural, or heritage, significance	Proponent, Contractor	Continuous. Reporting of archaeological finds within 24hours
		Under no circumstances shall archaeological artefacts discovered on site during construction or operational activities be removed, destroyed or interfered with.	Compliance with the provisions of the National Heritage Resources Act (Act No. 25 of 1999)[HRA].	Proponent, Contractor	Continuous

Table 4-8: Waste Generation and Management					
Activity / Structure / Infrastructure	Construction related waste (general and hazardous) generation and management				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality due to the burning of waste	Under no circumstances should waste ever be burnt, or buried, on site	Safe waste disposal / management certificates on record for all waste generated during the construction phase	Proponent, Contractor	Continuous
Ground water	Diminished ground water quality through poor waste management practices	Waste oil generated from vehicle workshops / drip trays must be immediately stored in sealable, water-tight, steel drums or containers within an impermeable bund wall with a capacity of at least 110% of the volume of	Waste oil storage area/s appropriately bunded. Safe disposal / management certificates	Proponent, Contractor	Once-off bund establishment. Continuous requirement for storage of waste oil.

Table 4-8: Waste Generation and Management					
Activity / Structure / Infrastructure	Construction related waste (general and hazardous) generation and management				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		the largest container / drum held therein – for subsequent removal from site for either recovery, or disposal thereof	on record for all oil removed from site		
		Waste oil storage areas may only be placed within relevant construction/contractor's camp/s	No waste oil storage outside of any dedicated contractor's camp/s	Proponent, Contractor	Continuous
Surface water	Surface storm water contamination through contact with waste material/s	Surface storm water run-off must not be able to flow through any waste storage areas. Nor should skips/containers, or waste storage areas, be positioned where surface water may pond or flow preferentially during rainfall events.	No contact between construction waste and surface water	Proponent, Contractor	Continuous
Soils	Soil contamination through contact with waste material/s	Waste must not be temporarily stored on bare soil surfaces; Except where: • The waste is regarded as being 'inert' (e.g. waste bricks, un-contaminated steel scrap, etc.), in terms of the definition provided for in the National Environmental Management: Waste Act (59 of 2008); • The waste will be removed from site within 30 days of the generation thereof; and • No component of the waste is susceptible to dispersal by wind	No contact between site soils and potential contaminants in construction waste/s	Proponent, Contractor	Continuous
		Construction waste generated on site by contractor/s must be gathered up daily and placed in skips/containers appropriate to the classification thereof (i.e. hazardous Vs. general waste)	No waste strewn over site over-night. No mixing of general and hazardous wastes	Proponent, Contractor	Daily, for the duration of the construction period
		Skips/containers must, therefore, be clearly marked for purpose	Waste skips clearly marked for applicable waste types to be discarded therein	Proponent, Contractor	Once-off
		Safe disposal / management certificates must be	Safe disposal /	Proponent, Contractor	Continuous, for every

Table 4-8: Waste Generation and Management					
Activity / Structure / Infrastructure	Construction related waste (general and hazardous) generation and management				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
		obtained for all waste removed from site	management certificates kept on record		incidence of waste removal from site
		Waste may only be taken to appropriately licensed / permitted waste management facilities	Proof of facility licensing kept on record	Proponent, Contractor	Continuous
		Waste skip/container collection and replenishment schedules must be developed and managed pro-actively by the contractor/s, in order to ensure that no skips/containers are left full and / or over-flowing for any extended period of time and that there is always appropriate temporary waste storage capacity on site	Temporary waste storage capacity available to the contractor/s	Proponent, Contractor	Continuous. No skip left full on site for more than a week.
	Unsustainable use of natural resources and unnecessary landfill airspace utilisation	Contractors will be required to provide a method statement specific to waste minimisation, reuse, recovery and recycling, as well as temporary storage and disposal; where such plans would need to be signed off by competent site environmental personnel / environmental control officer (ECO) prior to the start of construction activities. **Contractor Method Statement Required**.	Approved method statement/s on record	Proponent, Contractor	Once-off, prior to commencement

Table 4-9: Haul / Access Roads					
Activity / Structure / Infrastructure	Heavy and light vehicle movements on un-surfaced site haul / access roads. Vehicle access to, and over-nighting on, site.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality through vehicle entrained dust	Dust palliation with an effectiveness of at least 80% must be applied to all un-surfaced/gravel access and haul roads for the duration of the construction period	Compliance with SANS 1929:2005 – Ambient Air Quality – Limits for Common Pollutant	Proponent, Contractor	Continuous
		Palliatives must be applied and re-applied as necessary as per the manufacturer/supplier's recommendations	Compliance with SANS 1929:2005 – Ambient Air Quality – Limits for	Proponent, Contractor	Continuous

Table 4-9: Haul / Access Roads					
Activity / Structure / Infrastructure	Heavy and light vehicle movements on un-surfaced site haul / access roads. Vehicle access to, and over-nighting on, site.				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
			Common Pollutant		
		Vehicle speeds must be limited to 60 km/h on access roads unless these have bound paving, in which case sped regulations as per the relevant traffic regulations must apply. Vehicle speeds must be limited to 40 km/h on any exposed surfaces where palliatives or paving have not been applied.	Compliance with SANS 1929:2005 – Ambient Air Quality – Limits for Common Pollutant	Proponent, Contractor	Continuous
Biodiversity	Biodiversity loss through unnecessary habitat destruction	Access and haul roads may only be established, immediately adjacent to (within 10m), or directly between, the anticipated development footprints of the approved layout. All access and haul roads to be depicted on plan, subject to approval by ECO and BRMO environmental manager	No ad hoc, un-planned development of access / haul roads. All access and haul roads established to the satisfaction of the ECO and BRMO environmental manager	Proponent, Contractor, ECO	Continuous
		The hauling of materials and vehicle access to and from development sites must be strictly maintained to designated access/haul roads on site	No evidence of random, un-planned, road creation on site	Proponent, Contractor	Continuous
	Loss of biodiversity due to death / injury to indigenous site fauna	A speed limit of 60km/hr is applicable to all heavy and light vehicles used on site; where dust palliatives have been applied	No evidence of speeding vehicles on site	Proponent, Contractor	Continuous
Noise	Negative impacts on ambient noise levels resulting from heavy vehicle movements on site	Construction activities to be limited to between 7:00am and 5:00pm on weekdays, and 8:00am to 13:00pm on Saturdays	No 'noisy' construction activities outside of stipulated work hours	Proponent, Contractor	Continuous

Table 4-10: Raw / Construction Material Stockpiles and Storage	
Activity / Structure / Infrastructure	Storage of raw/construction materials on site during the construction phase

Environmental Aspect	Impact	Management Actions	Target	Responsible Party	Time-frame / Frequency
Biodiversity	Biodiversity loss through unnecessary habitat destruction	Raw / construction material storage may only take place within the development footprints of project structures and infrastructure, or designated construction camp/s	No storage of materials in 'green-field' areas	Proponent, Contractor	Continuous
Soils	Soil contamination through inappropriate storage of hazardous construction materials	Where daily quotas / stocks of hazardous materials are to be stored outside of the construction camp/s, the materials must be stored such that there is no contact between the material and site soils	No contact between site soils and hazardous construction materials	Proponent, Contractor	Continuous

4.7 OPERATIONAL PHASE

Table 4-11: Waste Generation and Management					
Activity / Structure / Infrastructure	Operational phase waste management				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Air Quality	Degraded air quality due to the burning of waste	Under no circumstances should waste ever be burnt, or buried, on site	Safe waste disposal / management certificates on record for all waste generated during the construction phase	Proponent, Contractor	Continuous
Ground water **Surface water** **Soils**	Degraded environmental quality due to inappropriate waste management practices	The applicability of the existing BRMO 'waste management procedure' - Env-S/UG-GN-0012 (Appendix 11) must be extended to include all proposed project elements and updated accordingly	Compliance with existing procedural requirements in respect of waste management	Proponent	Continuous

Table 4-12: Energy and Natural Resource Use Efficiency and Optimisation					
Activity / Structure / Infrastructure	Energy and Natural Resource Use Efficiency and Optimisation				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Energy efficiency	Positive: Off-set demand for electricity from the national grid	The proponent should install solar geysers for each of the housing units to off-set the demand for power from the national grid.	Solar geysers established. Establishment of sustainable developments.	Proponent	Once-off installation, with maintenance thereafter at suppliers recommended intervals.
Water use efficiency	Positive: Off-set demand from the VG pipeline.	All showers in the dwelling units should be fitted with water efficient shower heads	Required shower heads fitted	Proponent	Once-off
	Inefficient water use through excessive evaporation	The watering of gardens, or any other soft landscaping at the development must not take place between 8:00am and 17:00pm daily	No watering inside of the specified time periods	Proponent	Continuous.

Table 4-13: Biodiversity					
Activity / Structure / Infrastructure	Alien invasive control and soft landscaping				
Environmental Aspect	**Impact**	**Management Actions**	**Target**	**Responsible Party**	**Time-frame / Frequency**
Alien invasive species	Loss of biodiversity through the establishment and propagation of alien invasive floral species	The potential presence of alien invasive species on, and adjacent to the housing development must be monitored and appropriately managed, in accordance	No evidence of alien invasive species occurrence within the	Proponent	Continuous

		with the BRMO alien invasive species management plan (Appendix 5).	development footprint. Records kept of any remediation effected at the site (i.e. problematic species, nature of remedial efforts, date and party who effected remedial solution)		
		The use of herbicides on site must be undertaken according to the BRMO environmental procedure for the use of herbicides (Env-S/UG-GN-003- Appendix 7).	Compliance with applicable operational procedure	Proponent	Continuous
		Only indigenous floral species representative of the Kathu Bushveld vegetation type may be used for landscaping purposes within the development	No evidence of the panting of exotic, or inappropriate (i.e. other than Kathu Bushveld species) floral species	Proponent, specialist ecologist/Landscaper	Continuous
	Lowering of regional biodiversity as a result of mining and activities supportive thereof.	The BRMO must manage their potential impacts on site biodiversity through the implementation of the BRMO Biodiversity Action Plan (BAP).	Compliance with the operational management provisions of the BRMO BAP.	Proponent	Continuous

5. ENVIRONMENTAL MONITORING PLAN

5.1 DUST FALLOUT

Because of the potential impact the haul road PM_{10} entrainment has on ambient air quality, it is required that the Proponent implements a palliative abatement method on unpaved road surfaces, with a minimum abatement efficiency of 80%. The monitoring of the effectiveness thereof will be needed, and it is proposed that this be done at least at the locations indicated in Figure 5-1 and Table 5-1). The locations were chosen so that while they will still be able to collect dust from the surroundings it will not result in the over-estimation of ambient dust emissions by being placed too close to any haul roads and product stockpile areas.

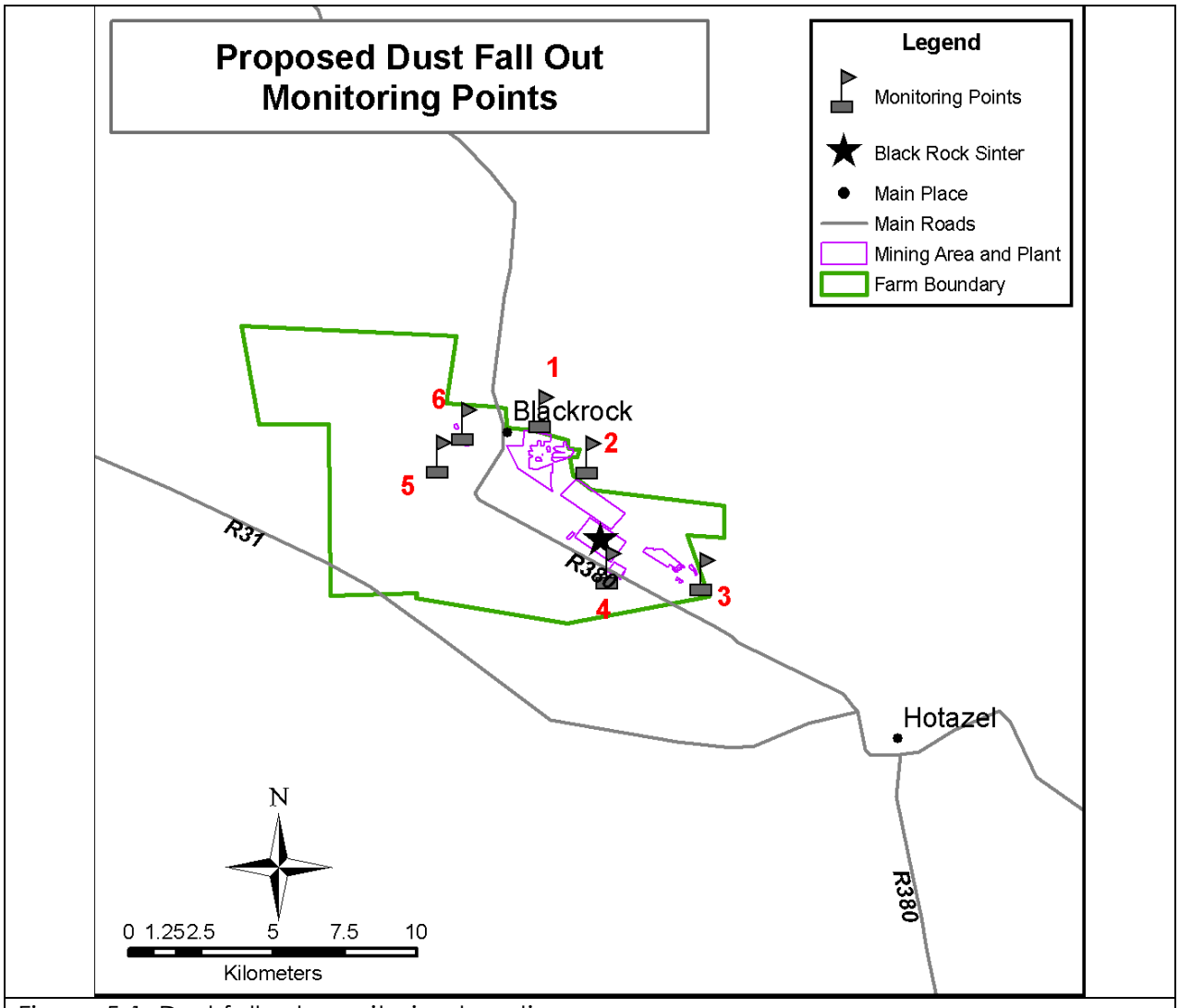

Figure 5-1: Dust fallout monitoring locations

Table 5-1: Co-ordinates of the dust emissions monitoring

Name	No.	Latitude	Longitude
North boundary point	1	-27.1225	22.8649
East boundary point	2	-27.1368	22.87949
Far East boundary point	3	-27.1735	22.9153
South boundary	4	-27.171301	22.88858
Mokala Guest Lodge	5	-27.1367	22.8328

Black Rock School	6	-27.1265	22.8406

Monitoring must be undertaken as per the requirements of ASTM D1739: Standard Test Method for 'Collection and Measurement of Dustfall'. Monthly monitoring must be undertaken, with quarterly reports relating thereto being issued to mine management, such that any necessary remedial actions can be timeously actioned.

6. ENVIRONMENTAL REHABILITATION

This rehabilitation plan provides details as to how site rehabilitation should be undertaken, with step by step break-down of disturbed areas to be rehabilitated, when those areas should be rehabilitated, as well as a description of the actual rehabilitation measures to be implemented. The decommissioning and rehabilitation of the housing facility would hinge on the closure of the BRMO itself; unless an alternative use for the housing can be agreed upon with the local authority and the DMR. These rehabilitation provisions are written under the auspices that the housing will be demolished at the end of life of mine and the disturbed footprint rehabilitated; where the provisions are commensurate with the rehabilitation requirements of the greater BRMO.

6.1 PRINCIPLES OF REHABILITATION

The following principles should be followed during the planning, implementation and post-implementation phases of the rehabilitation process:

- Define and agree upon end-goals for the rehabilitation process, such as land-use, rehabilitation objectives, areas to be rehabilitated, etc.;
- Prevent and continually manage the propagation and establishment of alien and invasive species;
- As far as is practical, implement concurrent rehabilitation in order to limit degradation of soil biota;
- Limit the footprint area of the disturbing activity in order to minimise environmental damage;
- Rehabilitation earthworks should aim to reshape the disturbed areas to represent the area prior to disturbance and to present a safe, functional and sustainable environment;
- Visual impacts of rehabilitated areas must be minimised by recreating natural landforms and ensuring that reshaped areas are visually suited to surrounding landscapes;
- Natural landforms such as drainage lines, undulating areas and ridges, which have been damaged during activities, must be restored.
- Implement erosion control measures to prevent the loss of topsoil during and after construction activities;
- Rip and aerate all compacted soils in order to allow for plant establishment and growth;
- Re-vegetate all disturbed areas with suitable floral cover and methods;
- After completion of activities ensure that the site is safe for use by the intended land users and remove all activity equipment; and
- Implement a monitoring plan to determine the efficacy of the rehabilitation exercise (This should be a long-term monitoring program).

6.2 REHABILITATION OBJECTIVES

Before any rehabilitation measures are implemented, it is of vital importance to define goals and objectives for the rehabilitation procedures. These objectives include:

- Defining an end-use for the area in question and returning the area to as-close-as-possible to the pre-mining environment;
- Ascertain whether the proposed end-use is compatible with the land capability of the area;
- Resources allocated to rehabilitation procedures must be sufficient to ensure effective rehabilitation;

- Contractors entrusted with rehabilitation operations must be suitably qualified and experienced;
- Planning of rehabilitation should ideally be implemented as part of the planning and pre-construction phase of any proposed project;
- Continual record-keeping must be implemented in order to ensure effective and responsible rehabilitation; and
- Monitoring and after-care must be implemented in order to ensure efficacy of rehabilitation.

6.2.1 LAND-USE OBJECTIVES

The remote and arid nature of the site, in combination with the low average annual rainfall (approximately 325mm/annum) of the region and poor agricultural potential of the site soils (i.e. 'poor' in respect of planted crop production), limits the range of potentially feasible end land-use alternatives available to the Assmang BRMO. To this end, the end land-use for the BRMO mine site is proposed as extensive grazing land; where according to the draft JTGDM EMF, stocking rates in the Northern Cape are 14 - 30ha/LSU. The Agricultural Research Council's Institute for Soil, Climate and Water (ARC-ISCW), put this figure at closer to 20-25ha / LSU for the region in question.

It is proposed, therefore, that the most feasible end land-use of the aforementioned option would be as follows; where closure of the BRMO would be conditional to –

The rehabilitated land should be capable of sustainably supporting an extensive livestock production system of at least 25ha / large stock unit (LSU).

The proposed end land-use is commensurate with pre-mining land use, and typical of the surrounding, non-mining, land uses in the area; where it would be the choice of any party who ultimately wishes to purchase the subject land (as would be the case with any farm purchased in the area) to further invest in establishing any land use other than that defined as part of these closure objectives for the BRMO.

6.2.2 ECOLOGICAL OBJECTIVES

Apart from ensuring that mine rehabilitation at the BRMO yields outcomes supportive of sustainable economic activity(ies), a further critical objective of mine rehabilitation is to achieve a stable, climax state, representative of the pre-mining vegetation types; where the ecological system functioning of the plant community(ies) is tolerant of the prevailing environmental conditions of the region.

The 'ecological' objective of mine rehabilitation at the BRMO is thus to -

Ultimately ensure that efforts by the BRMO to re-establish Kathu Bushveld (Figure 6-1) over disturbed development footprints yields stable, climax state, floral communities with ecosystem functioning and biological diversity at least resembling pre-development conditions to the extent that reasonable and feasible rehabilitation efforts allow.

6.2.3 GENERAL OBJECTIVES

Apart from the land use and 'ecological' objectives stated in the preceding sections, the closure and rehabilitation of the BRMO's operations would need to see the subject areas made safe, to the extent that –

The rehabilitated areas should not pose any significant direct, indirect or residual risks to either human health and livelihoods, or environmental quality, over the short-, medium- or long-term post closure and rehabilitation thereof.

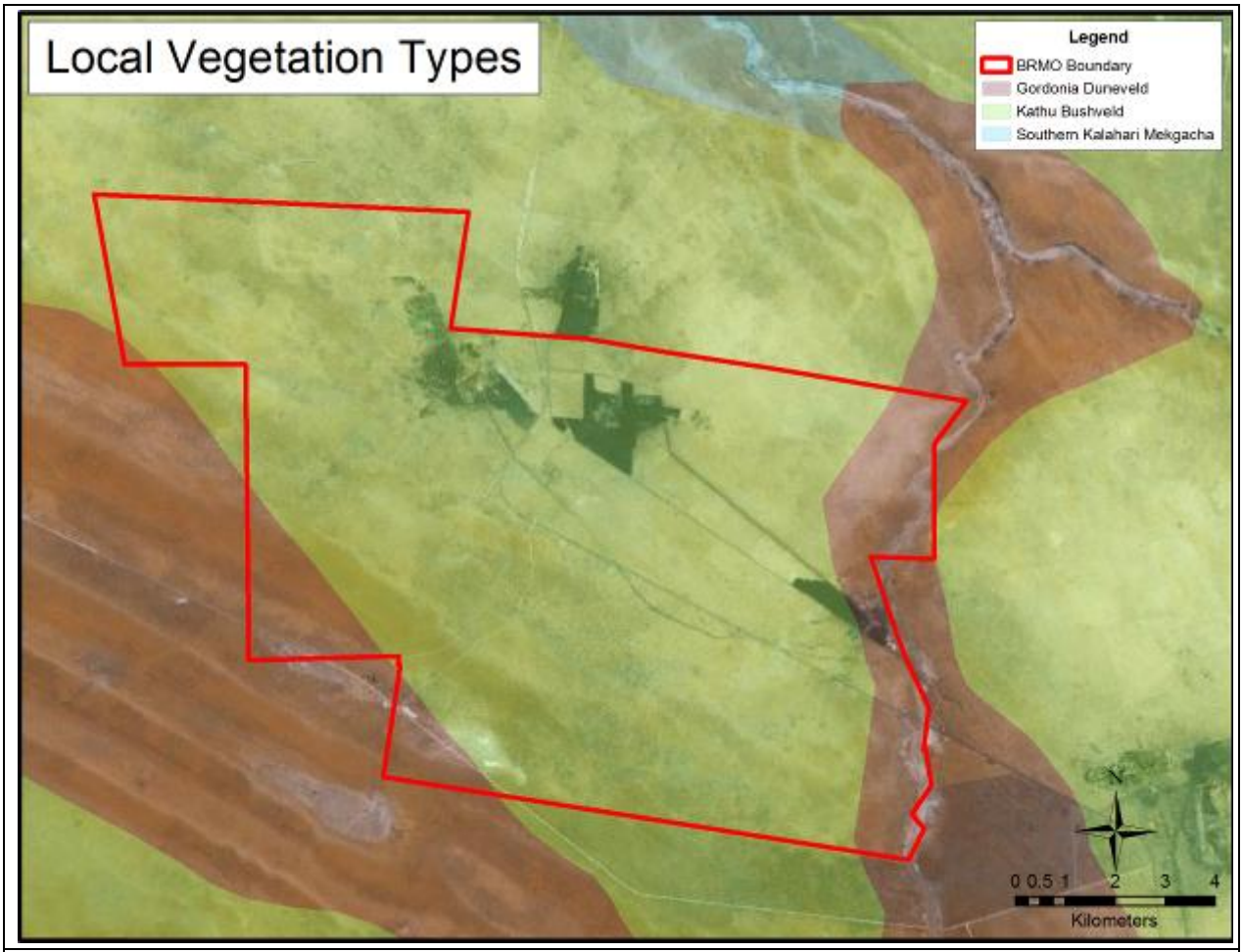

Figure 6-1: Target vegetation types for final phase BRMO surface rehabilitation

6.2.4 EXTENT OF REQUIRED 'GENERAL SURFACE REHABILITATION'

The relevant extent of required 'general surface rehabilitation' relevant to the project is as per the approved development layout (Appendix 1). The requisite requirements for 'general surface rehabilitation' are discussed in Section 6.3 to follow.

6.3 GENERAL SURFACE REHABILITATION

The 'general surface rehabilitation' of the development footprint to meet the stated end land-use and ecological objectives, must comply with the following broad sequentially implemented phases of rehabilitation:

Phase 1: Removal of all surface structures and infrastructure, as well as buried service infrastructure that may act to impede subsequent phases of rehabilitation;
Phase 2: Preparation and amelioration of structural and infrastructural development footprints for further rehabilitation;
Phase 3: Replacement of stockpiled topsoil to a depth of at least 30cm;
Phase 4: Initial hydro-seeding of prepared areas to establish basal cover for subsequent of rehabilitation;

Phase 5: Initial maintenance and monitoring of basal cover;
Phase 6: Establishment of Kathu Bushveld once sufficient basal cover is achieved; and
Phase 7: On-going monitoring and maintenance

Table 6-1 to **Error! Reference source not found.** that follow provide further detail as to the actions that need to be taken by the BRMO for each of the respective phases of surface rehabilitation.

Table 6-1: Requirements for General Surface Rehabilitation				
No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
PHASE 1: Removal of Surface Structures and Infrastructure				
1.1	All surface structures, infrastructure and 'hard surfaces' (*inter alia*, redundant surfaced roads, parking and paved areas) are to be demolished and removed from the disturbed development footprint; unless an alternative/continued use for any such items is agreed upon, in writing, with the Department of Mineral Resources (DMR) and the local authority. (Refer Section 8.4.1)	Development footprint cleared of all housing units and related structures and infrastructure.	Assmang, contractor	Once-off
1.2	The foundations of removed structures and infrastructure are to be removed to a depth of at least 0.5m below ground level.	No remaining sub-surface structures that may impede further phases of rehabilitation, or the ultimate root penetration of re-introduced plant species.	Assmang, contractor	Once-off
1.3	Care should be taken in implementing 1.1 and 1.2above to ensure nominal losses of underlying soils.	No evidence of significant sub-surface soil loss	Assmang, contractor	On-going
1.4	On-going alien and invasive floral species control, in accordance with the provisions of the *BRMO Alien and Invasive Species Control Programme* (attached), is required through all phases of rehabilitation.	No establishment and propagation of 'undesirable' plant species over rehabilitation sites.	Assmang, contractor	On-going. Weekly inspections; unless otherwise expressly stated for subsequent phases of rehabilitation
PHASE 2: Preparation of underlying soils for further phases of rehabilitation				
2.1	Exposed, compacted, soil surfaces must be ripped to a depth of at least 0.5m to allow for adequate aeration and plant root penetration.	No topsoil replacement to compacted underlying soil horizons.	Assmang, contractor	Once-off

Table 6-1: Requirements for General Surface Rehabilitation				
No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
2.2	The pre-development site topography should be reasonably restored through shaping, such that the topography of rehabilitated areas will ultimately be commensurate with that of adjacent, non-disturbed areas.	No evidence of significant alteration to 'natural', pre-development, surface drainage and topographical regime.	Assmang, contractor	On-going
2.3	A 'post-rehabilitation' surface contour plan should be developed by the BRMO in consultation with a specialist surface water hydrologist, such that would then inform implementation of 2.3 above.	Post-rehabilitation contour plan on record. Said plan mitigates potentially significant impacts on surface hydrology.	Assmang, Specialist hydrologist	Once-off, within 12 months of EMP approval
2.4	Care should be taken in choosing a method/machinery to implement 2.2 above, such that ripped soils are not re-compacted through efforts to appropriately shape the disturbed sites.	No topsoil replacement to compacted underlying soil horizons.	Assmang, contractor	Once-off
2.5	Vehicular access to rehabilitation sites from this phase of rehabilitation onward should be limited to vehicles/machinery expressly required for the sound implementation of this plan.	No *ad hoc*, unauthorised, vehicular movements over rehabilitation sites.	Assmang, contractor	On-going
PHASE 3: Topsoil / growth substrate replacement/preparation				
3.1	As far as available stockpile volumes allow, topsoil should be replaced to a consistent depth of at least 30cm across areas prepared in terms of phase 2.	Topsoil replacement implemented prior to further efforts to re-introduce basal cover. Even surface, free from surface ponding of water.	Assmang, contractor	Once-off
3.2	Topsoil should be screened, as necessary, to remove any foreign objects, rocks, etc., prior to the replacement thereof.	Replacement of topsoil that is fit for purpose, and which does not impede Assmang from achieving the stated end-use objectives for the site.	Assmang, contractor	On-going
3.3	Topsoil should at least meet the following physical and chemical profile before the replacement thereof is	Replacement of topsoil that is fit for purpose, and which does not	Assmang, contractor, soil	Once-off

<table>
<tr><th colspan="5">Table 6-1: Requirements for General Surface Rehabilitation</th></tr>
<tr><th>No.</th><th>Management/Monitoring Measures</th><th>Target</th><th>Responsible party(ies)</th><th>* Time-frames</th></tr>
<tr><td></td><td>implemented as part of rehabilitation:

<table><tr><th colspan="2">Topsoil Analytical Data for BRMO Reference Soil</th></tr><tr><td>Depth (cm)</td><td>0-20</td></tr><tr><td>pH (H_20)</td><td>7.3</td></tr><tr><td>Clay %</td><td>1.5</td></tr><tr><td>Silt%</td><td>0.2</td></tr><tr><td>Very fine sand%</td><td>16.4</td></tr><tr><td>Fine sand</td><td>60.2</td></tr><tr><td>Medium sand</td><td>15.5</td></tr><tr><td>Texture</td><td>Sand</td></tr><tr><td>Exch. Ca ($mgkg^{-1}$)</td><td>106</td></tr><tr><td>Exch. Mg ($mgkg^{-1}$)</td><td>51</td></tr><tr><td>Exch. K ($mgkg^{-1}$)</td><td>31</td></tr><tr><td>Exch. Na ($mgkg^{-1}$)</td><td>0.2</td></tr><tr><td>P (Bray 1)</td><td>2.8</td></tr></table></td><td>impede Assmang from achieving the stated end-use objectives for the site.</td><td>scientist</td><td></td></tr>
<tr><td>3.4</td><td>Any areas with slope >3° should be inspected weekly for signs of topsoil erosion following the replacement thereof, and appropriate action taken to curb any problematic areas.</td><td>Records of weekly ‘erosion inspections’. No topsoil erosion following replacement.</td><td>Assmang, contractor</td><td>Monitor weekly, address erosion within 48 hours</td></tr>
<tr><td>3.5</td><td>Care should be taken during topsoil replacement to minimise the extent to which vehicle movement over replaced topsoil may act to compact these surfaces.</td><td>No significant compaction of soil surfaces prior to commencement of re-seeding (phase 4)</td><td>Assmang, contractor</td><td>On-going</td></tr>
<tr><td colspan="5">PHASE 4: Re-seeding for basal cover establishment</td></tr>
<tr><td>4.1</td><td>A grass mixture of endemic grasses known to be non-invasive within the area, such as, inter alia, Aristida meridionalis, Centropodia glauca, Stipagrostis ciliata, Eragrostis lehmanniana and Schmidtia pappophoroides, should be utilised in the re-seeding process for the re-introduction of basal cover over rehabilitation sites.</td><td>Establishment of basal cover commensurate with the indigenous floral communities of the pre-mining site, such that would also allow Assmang to meet the stated land-use objectives for the site.</td><td>Assmang, contractor</td><td>Once-off</td></tr>
</table>

Table 6-1: Requirements for General Surface Rehabilitation				
No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
4.2	The BRMO should investigate the commercial availability of seed stocks of the aforementioned grass species; and if not commercially available, Assmang must implement a seed harvesting programme from undisturbed areas of the BRMO surface rights area (in conjunction with a competent specialist).	Sufficient available seed stock on hand to effect rehabilitation that meets the stated land-use objective for the site.	Assmang, specialist	Proof of commercial availability within 3 months of the EMP approval, or seed harvesting programme commencement within 12 months.
4.3	Hydro-seeding, or any other suitable means of re-introducing basal cover, should be planned and implemented in conjunction with the professional inputs and services of a competent contractor, with experience in such undertakings (proven track record in the Northern Cape preferable).	Optimal establishment of basal cover that will that Assmang achieves the stated end-use objectives for the site.	Assmang	Once-off appointment with on-going management thereafter
4.4	Re-seeding should commence within 30 days of topsoil replacement, and areas should be free of alien and invasive plants.	Records kept of topsoil replacement and re-seeding dates for all rehabilitation sites.	Assmang, contractor	Within 30 days of topsoil replacement
4.5	The potential requirements for the irrigation and fertilisation of seeded areas, is to be done according to the recommendations and specifications of the specialist contractor appointed for this work.	Optimised efficacy of efforts to establish appropriate basal cover over rehabilitated areas.	Assmang, contractor	Once-off
4.6	No grazing on rehabilitated areas is to occur within three years of phase 4 completion.	• Documented records of dates upon which re-seeding was effected; • Establishment of robust basal cover prior to introducing grazing herbivores; and • Assmang to meet stated end land-use objectives for the site	Assmang	3 years from re-seeding

Table 6-1: Requirements for General Surface Rehabilitation				
No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
PHASE 5: Intermediary monitoring and maintenance of basal cover				
5.1	Weekly monitoring should take place in order to ascertain the efficacy of the seeding, and to repair any areas where gullies or rills are forming. Appropriate interventions to be adopted where basal cover establishment fails.	Documented records of weekly inspections. Basal cover establishment commensurate with adjacent undisturbed areas over the BRMO surface rights areas (i.e. % cover relative to exposed soil surfaces).	Assmang, contractor	Weekly monitoring until adequate basal cover establishment has been confirmed by ecological specialist
5.2	Regular application of fertiliser, under the guidance of a suitably qualified soil scientist, should take place in order to ensure efficient establishment of vegetation cover until such time as sufficient organic matter is being produced by the established grasses to allow for self-sustaining growth.	Basal cover establishment commensurate with adjacent undisturbed areas over the BRMO surface rights areas (i.e. % cover relative to exposed soil surfaces).	Assmang, soil scientist	On-going, as per specialist recommendations
5.3	If re-seeding for basal cover establishment was not effective during 1st application, a second application of hydro-seed mixture may have to be applied in certain areas. The application of hydro-seed should be at the discretion of the specialist contractor.	Basal cover establishment commensurate with adjacent undisturbed areas over the BRMO surface rights areas (i.e. % cover relative to exposed soil surfaces).	Assmang, contractor	As necessary, per specialist recommendations
PHASE 6: Establishment of Kathu Bushveld				
6.1	Once sufficient basal cover has been established, the introduction of species representative of the applicable vegetation types over the site may commence.	Establishment of stable, climax state, plant communities on rehabilitated areas.	Assmang, contractor	On-going
6.2	Introduction of these species should commence through the stages of natural succession (i.e. Pioneer species (grasses, herbaceous species), Secondary species (grasses, small shrubs, and small trees) and Climax state (larger shrubs, large trees).	Establishment of stable, climax-state, plant communities on rehabilitated areas.	Assmang, contractor	On-going
6.3	The BRMO indigenous tree and plant nursery (as per the BRMO Indigenous Nursery Implementation Plan) should be retained	Functional indigenous nursery on-site until all necessary phase 6	Assmang	On-going.

Table 6-1: Requirements for General Surface Rehabilitation				
No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
	on-site for as long as it is necessary to propagate species for active re-introduction thereof to rehabilitation sites.	undertakings are completed over the BRMO surface rights area.		
6.4	The potential requirements for the irrigation and fertilisation of re-introduced floral species, is to be done according to the recommendations and specifications of the specialist contractor appointed for this work.	Effective establishment and growth of introduced floral species.	Assmang, contractor	On-going.
	PHASE 7: On-going monitoring, maintenance and aftercare			
7.1	Monitoring and maintenance (as necessary) of phase 6 implementation is to be effected for at least five years following the completion of active species re-introduction to the site.	• At least 90%, sustainable, establishment of re-introduced plants/trees; and • 'Ecological' objectives for site closure met.	Assmang	On-going, Monthly inspections for at least two years; every 6 months thereafter if efforts to rehabilitate are proving effective.
	GENERAL PROVISIONS			
8.1	External, independent, 'BRMO Rehabilitation' compliance audits must be undertaken by a competent auditor for all areas where rehabilitation is being implemented at the BRMO. Audit to at least document compliance with this plan.	Full compliance with the provisions for BRMO site rehabilitation.	Assmang, External Auditor	Every 6 months for as long as any rehabilitation (concurrent and/or closure) is being undertaken at the BRMO
8.2	The BRMO should undertake monthly internal compliance audits for all areas where rehabilitation is being implemented at the BRMO. Audit to at least document compliance with this plan, as well as any other relevant provisions of the EMP revision approval by the DMR.	Full compliance with the provisions for BRMO site rehabilitation.	Assmang	Monthly
8.3	Assmang should comply with all relevant enviro-legal provisions concerning protected floral species, in executing	Full legal compliance for the duration of rehabilitation efforts.	Assmang	On-going

Table 6-1: Requirements for General Surface Rehabilitation				
No.	Management/Monitoring Measures	Target	Responsible party(ies)	* Time-frames
	any relevant provision of this plan.			

* All required actions to be implemented and completed within reasonable, practical, time-frames; unless time-frames otherwise expressly stated.

7. PROCEDURES FOR ENVIRONMENTAL RELATED EMERGENCIES AND REMEDIATION

An effective, comprehensive, well-considered and tested environmental emergency preparedness and response plan has the potential to save lives, prevent unnecessary damage to the company and other property, as well as to manage environmental risk in the event of a large chemical spill, oil spill, fuel spill or explosion.

The MPRDA requires in the Regulations Section 51(b) iii that the mine implement procedures to environmental related emergencies and remediation [Refer to the Black Rock Mine (BRMO) Emergency Preparedness and Response Plan included in Appendix 2].

Some specific legal requirements were identified for the emergency response activities in the mining industry. A number of SABS standards apply, such as the SANS10232 - the minimum requirements for emergency responses. Legislation requires that relevant government departments are kept informed of incidents and accidents that occur within the mining area in terms of the following acts:

- Regulation 51 of Regulations under the MPRDA - PROCEDURE FOR ENVIRONMENTAL RELATED EMERGENCY AND REMEDIATION;
- Mine Health & Safety Act (Act 29 of 1996) - MANNER OF REPORTING AND KEEPING OF INFORMATION REGARDING INCIDENTS & EMERGENCIES; and
- Occupational Health & Safety Act (Act 85 of 1993) - EMPLOYEE REQUIREMENTS TO REPORT INCIDENTS WHERE ACTIVITY HAS OCCURRED.

7.1 OBJECTIVES OF AN ENVIRONMENTAL EMERGENCY RESPONSE PLAN

Environmental emergencies occur over the short-term and require an immediate response. A mine, as part of its management tools, especially if it is ISO 9000 and ISO 14001 compliant, should have an Emergency Response Plan. If one does not exist then one should be compiled and disseminated to all employees and contractors and in the event of an emergency, the emergency response plan should be consulted.

This plan should be placed around the mine where it will be easily viewed. The plan should contain a list of procedures, evacuation routes and a list of emergency contact numbers. It is advisable that the mine tests the emergency response plan in order to identify any areas for improvement.

If the emergency has the potential to affect surrounding communities, they should be alerted *via* alarm signals or contacted in person. The surrounding community will be informed, prior to mining taking place, of the potential dangers and emergencies that exist, and the actions to be taken in such emergencies.

Communication is vital in an emergency and thus communication devices, such as mobile phones, two-way radios or telephones, must be placed around the mine. A checklist of emergency response units must be consulted and the relevant units notified.

The checklist includes:

- Fire department;
- Police;

- Emergency health services, such as ambulances, paramedic teams, poisons centres;
- Hospitals, both local and further afield, for specialist care;
- Public health authorities;
- Environmental agencies, especially those responsible for air, water and waste issues;
- Other industrial facilities in the vicinity with emergency response facilities;
- Public works and highways departments; and
- Public information authorities and media organisations.

7.2 EMERGENCIES, PROCEDURES AND REMEDIAL ACTION

The relevant provisions of the BRMO's existing emergency preparedness and response plan must be made relevant to the proposed housing development (Appendix 2).

8. ENVIRONMENTAL AWARENESS PLAN

8.1 INTRODUCTION

An environmental awareness plan must:

- Outline how employees will be informed of environmental risks; and
- State how employees will be able to prevent, reduce or remediate risks.

8.1.1 SCOPE

This environmental awareness plan sets out the mine's training procedures and objectives regarding environmental awareness. It is a stand-alone procedure, which serves to improve awareness, training and competency in the environmental field. It contains no detail on the actual training initiatives but rather serves to ensure that a responsible person is appointed to deal with and increase environmental awareness on the mine.

8.1.2 OBJECTIVES

The objectives as defined by ISO14001 are as follows:

Competence, Training and Awareness:

1. The organisation shall ensure that any person(s) performing tasks for it or on its behalf that have the potential to cause a significant environmental impact(s) identified by the organisation is (are) competent on the basis of appropriate education, training or experience, and shall retain associated records.

2. The organisation shall identify training needs associated with its environmental aspects and its environmental management system. It shall provide training or take other action to meet these needs, and shall retain associated records.

3. The organisation shall establish, implement and maintain a procedure(s) to make persons working for it or on its behalf aware of:

- *The importance of conformity with the environmental policy and procedures and with the requirements of the environmental management system.*
- *The significant environmental aspects and related actual or potential impacts associated with their work, and the environmental benefits of improved personal performance.*
- *Their roles and responsibilities in achieving conformity with the requirements of the environmental management system.*
- *The potential consequences of departure from specified procedures*.

8.1.3 REVISION

The responsible person will revise these environmental awareness procedures from time to time. The date of commencement of the revised procedure will always be indicated to prevent confusion.

8.2 ENVIRONMENTAL RISKS AND PRIORITIES

8.2.1 OBJECTIVES

The following requirements of ISO14001 have bearing:

1. The organisation shall establish, implement and maintain a procedure(s) to identify potential emergency situations and potential accidents that can have an impact(s) on the environment and how it will respond to them.

2. The organisation shall respond to actual emergency situations and accidents and prevent of mitigate associated adverse environmental impacts.

3. The organisation shall periodically review and, where necessary, revise its emergency preparedness and response procedures, in particular, after the occurrence of accidents or emergency situations.

4. The organisation shall also periodically test such procedures where practicable.

8.2.2 IDENTIFYING ENVIRONMENTAL RISKS

Environmental risks must be identified and procedures must be set in place to deal with risks, which could include:

- Fires;
- Spills of hazardous substances, including explosions;
- Leaks or breaks of pipes or vessels, including dam overflows;
- Accidents, especially during adverse weather;
- Slow environmental degradation related to continuous poor housekeeping;
- Damage to heritage or environment; and
- Social issues, either complaints about poor environmental management, or direct employment type issues.

Many of these environmental risks have been identified in the Basic Assessment Report associated with the development of this EMP and therefore the risk assessment exercise will not be repeated here. Once the mitigation measures have been read in the EMP chapter, it will be clear what training will assist with the prevention or reduction of each environmental risk.

8.3 INCREASING ENVIRONMENTAL AWARENESS

8.3.1 TRAINING NEEDS

These shall typically be identified by:

- Management or staff through performance appraisal;
- At time of recruitment;
- In-task observation of performance;
- Additions to scope of work; and
- Changes to working procedures.

Training programmes and environmental awareness programmes should typically include:

- Environmental legislation and the BRMO EMS;
- Resource conservation, including recycling and cleaner production methods;
- Pollution prevention, including emergency procedures;
- General good house-keeping, storage and handling of chemicals;
- Spill prevention, clean-up and remediation;
- Ecological protection and nature conservation, including alien vegetation, protected trees; and
- Administrative procedures, such as reporting, data collection and input, sampling, etc.

The level of detail on these topics will depend upon the exposure of that person to the natural environment and the nature of their job. Contractors that are employed at BRMO must, prior to starting any work, complete the contractor's package. This package requires the contractor to perform SHERQ procedures, which include BRMO's SHERQ Policy, existing operational procedures and Incident Reporting. The contractor is required to brief and train all its employees on the BRMO SHERQ procedures prior to commencing with work. Training records must be available and auditable for auditing purposes.

Several different types of training programme can be developed, as follows:

- Induction training: for all new employees, aimed to acquaint the employee with the company, its rules and their new job; no employee may start work until they have completed the induction training;
- On-the-Job training: offered as needs be, but particularly as part of mentoring junior staff; to be largely conducted by supervisors and other senior staff;
- Internal training: may be similar to On-the-Job training, for topics such as machinery operation, but will be conducted as a discrete training event; other courses may also be offered such as First Aid. Outside service providers may be used, but training will take place on site;
- External training: can cover any topic, including leadership, life skills, management, etc. and should be aligned with the National Skills Strategy of the Department of Labour and the Mining Qualifications Authority;
- Educational assistance: this will encourage staff to study further, by possibly paying tuition and towards study materials, or allowing study leave; some payback system may be used for staff who fail, in order to provide motivation to pass and excel;
- Once training needs have been established it is up to the supervisor to notify the training department of the requirements. The training department will then identify pertinent and relevant courses (if not already done so by employee/supervisor) and schedule training accordingly. Identified and agreed training needs shall be included in budgets and processed as described below. Course attendance (other than at the internal induction courses) shall be scheduled on the basis of the scale of environmental risk; and
- Training expenses, including conferences and symposia should be checked and approved by the mine management. The training department shall complete a course authorisation form and ensure that the procedures are followed regarding course bookings, confirmations and payments. Planning of training for job specific training (done through training needs analysis) will be coordinated between the Training Superintendent and the relevant section heads. This will result in a training schedule for job specific training on the mine.

8.3.2 EMS TRAINING

All employees, current and new, and contractors will undergo induction, a part of which is environmental awareness training and includes the environmental policy of the Mine. All personnel performing tasks, which can cause significant or major environmental impacts, shall be competent on the basis of training, education and/or experience. This applies to, but is not limited to, supervisor level and above - i.e. operators, artisans.

Type

Awareness training should typically include the potential consequences of departure from specified operating procedures as well as significant environmental impacts, actual or potential, of their work activities. Training should be appropriate to the actual activity of individual employees.

Evaluation

Evaluation of awareness and competency training (implementation of training in the work place) can be carried out by the environmental officers, section managers and staff in the training department. Senior management if required can also supplement the evaluation.

Records

The following records should typically be maintained by the Training, or designated such, Department when relevant:

- Personnel qualifications;
- Training needs;
- Certificates;
- Licences;
- Training programmes/courses attended;
- Staff induction; and
- Performance appraisals (confidential).

8.4 ENVIRONMENTAL NON-COMPLIANCE

Non-conformance is a term used for the ISO14001 EMS, whilst non-compliance typically relates to environmental law. Either way, these situations do occur and need to be dealt with suitably.

8.4.1 RESPONSE TO ENVIRONMENTAL NON-COMPLIANCE

ISO14001 states that:

> "The organisation shall establish, implement and maintain a procedure(s) for dealing with actual and potential non-conformity(ies) and for taking corrective action and preventative action".

All employees and contractors must report non-compliances according to the EMS, which generally involves:

- Reporting to the supervisor of that area;
- Investigating the cause of the incident;
- Recording the incident;
- Reporting to authorities, if necessary;
- Ensuring remediation is done;
- Identifying corrective actions;
- Follow-up on corrective actions; and
- Drafting progress reports and keeping all records.

The BRMO have existing, well established and trialled, '*competence, training and awareness'* procedure (EP02-2) which they will continue to implement in respect of environmental awareness training requirements at their operations (Appendix 13).

9. CONCLUSION

This EMP and associated Environmental Impact Assessment has been compiled in terms of the provisions of the National Environmental Management Act (Act No. 107 of 1998)[NEMA] and its associated 2010 EIA Regulations. The EMP provides for management and mitigation measures relevant to all phases of the project life cycle. It is the EAP's opinion the implementation of the EMP will reduce the potential significance of identified impacts to within acceptable levels.

10. UNDERTAKING

I, _____

the undersigned, and duly authorised thereto by Assmang Black Rock Mine Operations, have studied and understand the contents of this document in its entirety and hereby duly undertake to adhere to the conditions as set out therein.

Signed at _____

this _____ day of _____, 2013

Applicant's name:

Designation:

APPENDIX 1: DEVELOPMENT LAYOUT PLAN

APPENDIX 2: BRMO EMERGENCY PREPAREDNESS AND RESPONSE PLAN

APPENDIX 3: CV OF EAP

CURRICULUM VITAE — Bradley Thorpe

Full Name:	Bradley Kevin Thorpe
Date of Birth:	27 March 1980
Nationality:	South African
Identity Number:	8003275043087
Sex:	Male
Marital Status:	Married
Language:	English, Afrikaans

QUALIFICATIONS & PROFESSIONAL MEMBERSHIP

- Bachelor of Science – Animal Sciences: University of Pretoria, 2002;
- Bachelor of Science (Honours) in Wildlife Management: University of the Pretoria, 2003;
- Master of Science – Environmental Management: University of Johannesburg, in progress;
- Member: Institute of Waste Management, South Africa (IWMSA); and
- Member: International Association of Impact Assessors (IAIA), South Africa branch.

KEY EXPERIENCE

Six (6) years experience in Integrated Environmental Management (Strategic planning, legislation, Waste Management, EIA's, EMP's, monitoring, auditing, pollution abatement, rehabilitation etc.), including:

- **Integrated environmental management for the establishment, expansion, upgrade, rehabilitation and optimisation of light and heavy industrial processes** including the metallurgical, paper, mining and power generation industries
- **Integrated environmental management studies for the establishment, operation, auditing, closure and rehabilitation** of general waste landfills and transfer stations, industrial/hazardous waste landfills, incinerators, and hazardous effluent dams
- **Mining / prospecting permit and licence applications,** in terms of the Mineral and Petroleum Resources Development Act (MPRDA) –as amended, 2002
- **Environmental impact assessments, environmental management plans and public participation programmes** for small, medium and large linear and site specific infrastructure and land developments
- **Environmental management plans (EMP)** for the construction, operational and decommissioning/closure phases of infrastructure and land developments, waste management facilities and heavy industrial processes
- **Environmental advisory services,** including policy and procedures development, legal enforcement and compliance management, strategic planning, enviro-legal procedures and peer reviews
- **Specialist training,** including training of Provincial Environmental Authorities / EIA administrators in the review and administration of EIA's and Basic Assessments.
- **Project management** of numerous environmental and strategic projects

EMPLOYMENT HISTORY & PROJECT EXPERIENCE

EScience Associates (Pty) Ltd. January 2010 - Current
Senior Environmental Project Manager

Key Projects:

Waste Management:
- Interwaste: Scoping and EIA process for the establishment of an integrated waste management/treatment and transfer facility, Germiston, Gauteng (current);
- Reclamation Group (Reclam): Development of industry norm and standards for the operation of scrap metal recovery and processing facilities;
- Department of Environmental Affairs & Tourism (DEAT): Development of a Revised Hazardous Waste Classification System for South Africa;
- ClinX Waste Management: Scoping and EIA process relating to Waste License application for proposed Healthcare Risk Waste Incinerator, Wadeville, Gauteng;
- SE Solutions, on behalf of Reclamation Group: Specialist Waste Impact Assessment for a proposed ferrous scrap metal shredder facility in Waltloo, Pretoria, Gauteng; and
- Rand Water, Panfontein Water Treatment Residue Disposal Facility: Environmental risk assessment, rehabilitation planning and associated determination of closure and rehabilitation costs, Vereeniging, Gauteng (current).

I*ndustry*:
- ArcelorMittal, Vanderbijlpark Works: EIA and Environmental Management Plan for decommissioning of coke oven effluent maturation ponds, Vanderbijlpark, Gauteng;
- Assmang Chrome: Environmental Control Officer (ECO) for implementation and operational phases of ferromanganese production switch ('swing capacity') at Assmang Machadodorp-Ferroalloy Works, Machadodorp, Mpumalanga; and
- Assmang Chrome: Development of an Integrated Water and Waste Management Plan for the Machadodorp-Ferroalloy Works, Machadodorp, Mpumalanga.

Mining:
- Assmang Black Rock Mine Operations (BRMO): EIA and EMPR addendum for Sinter Plant and Mine Expansion, Hotazel, Northern Cape (current);
- Assmang Black Rock Mining Operations (BRMO): Development and subsequent implementation of the BRMO Environmental Management Master Plan, Hotazel, Northern Cape (inclusive of total revision to the Mine's EMPR);
- Assmang Chrome, Machadodorp: Waste Licensing EIA process for the proposed establishment of a proposed Reverse Osmosis Plant at Assmang, Machadadorp operations, Machadodorp, Mpumalanga; and
- Assmang Chrome, Dwarsriver Mine: Waste Licensing EIA process for the proposed establishment of a proposed Reverse Osmosis Plant at Assmang, as well as total revision to EMPR, Dwarsriver Mine, Steelpoort valley, Limpopo.

Specialist Training Course Development & Presentation:
- 2010: Training of Government Officials in the Review of EIAs and applications for environmental authorisation - Responsible for training of Government Officials responsible for EIA Review at the Gauteng, Eastern Cape, Western Cape and KZN Provincial Environmental Authorities.

COURSES

- Practical Training and Capacity Building Workshop on the Globally Harmonised System of Classification and Labelling of Chemicals (GHS): Presented by Orange House Partnership, with assistance from UNITAR (March 2011). Certificate received;
- Introduction to Integrated Waste Management: Centre for Environmental Management, Potchefstroom University (April 2009). Certificate received;
- Waste Reduction and Management: Melrose Advanced Training, Glenhove Conference Centre (September 2008);
- Integrated Environmental Management and Reporting: SEF internal training offered by Andrew Woghiren / Reuben Heydenrych (July 2008); and
- EIA Report Writing: Strategic Environmental Focus (2007).

APPENDIX 4: LIST OF POTENTIAL DUST PALLIATIVES

Road Palliation Options (Efficiencies from Bashian and Strauss, 2002)				
Type (efficiency %)	***Mechanism***	***Advantages***	***Limitations***	***Environmental considerations***
Freshwater (87%)	Moisture wets particles, increasing their mass and binding them together.	Usually readily available, low material cost, easy to apply.	BRMO within a water scarce area. Frequent light applications may be necessary during hot, dry, weather; potentially labour intensive. Over application may result in loss of traction, erosion, or points of road failure.	Minimal environmental impact provided water is not scarce. If applied excessively, may result in erosion and sediment runoff. Supply may be limited in some areas.
Calcium chloride	Deliquescent and hygroscopic at a relative humidity equal to or greater than 29 % (25°C).	Reduces evaporation rate of surface moisture 3.4 times; increases compacted density of road material.	Effectiveness in arid and semi-arid regions may be limited due to low relative humidity; very corrosive to aluminium alloys; slightly corrosive to steel. Solubility results in leaching during heavy precipitation. Releases heat when mixed in water.	Repeated applications and long-term use may harm vegetation, and contamination of groundwater.
Magnesium chloride (98%)	Deliquescent and hygroscopic at a relative humidity equal to or greater than 29 % (25°C).	Reduces evaporation rate of surface moisture 3.1 times; increases compacted density of road material, more so than $CaCl_2$.	Effectiveness in arid and semi-arid regions may be limited due to low relative humidity; very corrosive to steel, though inhibitors can be added. Solubility results in leaching during heavy precipitation.	Repeated applications and long-term use may harm vegetation, and contamination of groundwater.
Lignin derivatives (99%)	Act as adhesives, binding soil particles together.	Greatly increases dry strength of soil; not humidity-dependent; imparts some plasticity to road surfaces; lowers freezing point of road surface and base.	High solubility results in leaching during heavy precipitation; corrosive to aluminium alloys due to acidity ($CaC0_3$ added ingredient, can neutralize acidity). Proper aggregate mix (4-8% fines) important to performance. Becomes slippery when wet, brittle when dry.	Lignin products have a high BOD in aquatic systems. Spills or runoff into surface or groundwater may create low dissolved oxygen conditions or increases in groundwater concentrations of iron, sulphur com pounds, and other pollutants.
Tree Resin Emulsions	Act as adhesives, binding soil particles together.	Low solubility after curing minimizes leaching and provides degree of surface waterproofing. Imparts some plasticity to road surfaces. High bonding strength; non-corrosive.	Require proper weather and time to cure. No residual effectiveness after re-blading. Equipment requires prompt clean up avoiding curing of resin in hoses and pipes.	

Road Palliation Options (Efficiencies from Bashian and Strauss, 2002)				
Type (efficiency %)	***Mechanism***	***Advantages***	***Limitations***	***Environmental considerations***
Synthetic Polymer Emulsions	Bind soil particles together by forming a polymerizing matrix, function similar to adhesives.	Applicable to a range of emission sources; function well in sandy soil conditions. Some types allow seeded vegetation to grow through the polymer matrix.	Require proper weather conditions and time to cure; may be subject to UV (sunlight) degradation; application equipment requires timely cleaning; no residual effectiveness after re-blading.	
Bituments, Tars, and Resins	Asphalt and resinous products are adhesive, binding soil particles together. Petroleum oil products coat soil particles, increasing their mass.	Water insoluble when dry; provide a degree of surface waterproofing. Good residual effectiveness.	Surface crusting, fracturing and potholing may develop; long-term application may cause road to become too hard for re-blading; won't lower freezing point; petroleum oil products lack adhesive characteristics.	Use of used oils is prohibited. See MTCA discussion on page 6. Some petroleum-based products may contain carcinogenic polycyclic aromatic hydrocarbons (PAHs).
Geo-textiles	Provide and maintain drainage; improve load supporting properties; prevent upward migration of sub-grade fines; separate road layer materials.	Flexible, durable, water per me able, and resists soil chemicals; reduces amount of aggregate required during initial construction; lower maintenance.	High material cost; material degrades in sunlight, if exposed.	

APPENDIX 5: BRMO ALIEN INVASIVE SPECIES MANAGEMENT PROGRAMME

APPENDIX 6: BRMO SALVAGE YARD – ENVIRONMENTAL OPERATIONAL PROCEDURE (ENV-S/UG-GN-005)

APPENDIX 7: BRMO ENVIRONMENTAL OPERATIONAL PROCEDURE FOR THE USE OF HERBICIDES AND PESTICIDES (ENV-S/UG-GN-003)

APPENDIX 8: BRMO BUND WALL PROCEDURE (ENV-S/UG-GN-002)

APPENDIX 9: BRMO WASTE OIL ENVIRONMENTAL PROCEDURE (ENV-S/UG-GN-001)

11. APPENDIX 10: BRMO SPILL MANAGEMENT ENVIRONMENTAL PROCEDURE (ENV-S/UG-GN-016)

12. APPENDIX 11: BRMO WASTE MANAGEMENT ENVIRONMENTAL PROCEDURE (ENV-S/UG-GN-0012)

APPENDIX 1: DEVELOPMENT LAYOUT PLAN

APPENDIX 2: BRMO EMERGENCY PREPAREDNESS AND RESPONSE PLAN

ASSMANG LIMITED

EMERGENCY PREPAREDNESS AND RESPONSE

PROCEDURE

BLACK ROCK

DOCUMENT REF : 02-07-01

MANAGEMENT REPRESENTATIVE	SENIOR GENERAL MANAGER	ISSUE STAMP / REF.
		14/04/2008

PROCEDURE REVISIONS

NO	CLAUSE (S) AMENDED	PAGES RE-ISSUED	REVISION DETAILS
1.	Not Applicable	1 - 11	Assmang Iron and Manganese logo substituted by Manganese logo
2.	Not Applicable	1 - 11	General Mine Manger W.S. Grobbelaar changed to General Mine Manager Manganese A.J. Nel
3.	Not Applicable	1 - 11	General Mine Manager Manganese A.J. Nel changed to Senior General Manager A.P. Hamman
4.	No 1 below	2 - 15	Revised text to be in red. Change to correct contact numbers
5.			
6.			
7.			
8.			
9.			
10.			

NOTES:

1. Revised areas to have the revision number opposite them. Revised text to be in red. (Except in the case of a complete revision of entire document).

2. This Procedure to Be Completely Re-Issued after a maximum of 10 revisions.

3. Title Sheet and Revision Sheet to be re-issued with every revision.

LIST OF CONTENTS

1. OBJECTIVE

To provide guidance to deal with emergencies efficiently and to:

- Ensure the safety of all personnel
- Recover to normal operation as soon as possible
- Co-ordinate orderly evacuation
- Minimize damage to equipment and production loss
- Minimize damage to the environment

2. SCOPE

This procedure is applicable to all Assmang Mine personnel, visitors and contractors permanently or temporarily on site.

3. DEFINITIONS

3.1 Emergency Control Centre

This location will be a suitable room from where the emergency co-ordinator can control the emergency by telephone.

3.2 Emergency Co-ordinator

After hours, it will be the nearest most senior person in charge of the area most affected by an emergency. During office hours it will be the ISO Co-ordinator or the most senior person in charge of the area most affected by an emergency.

3.3 Fire Emergency Team

This will be Mine personnel on each shift or Proto team, trained to do the first line fire fighting.

3.4 Fire Department

This will be the surface fire-fighting department. They will
take charge of all fire fighting on surface on their arrival at an emergency.

3.5 Area co-ordinator

This will be a person selected to take charge of evacuation process at each department/Unit.

3.6 Emergency assembly point

This will be an identified place where all personnel must assemble for roll call after evacuation.

- Black Rock - Emergency assembly points as identified per MSMS at each office.
- Nchwaning - Emergency assembly points as identified per MSMS at each office.
- Gloria - Emergency assembly points as identified per MSMS at each office.

4. POTENTIAL EMERGENCIES

4.1 Fires

4.2 Spillage of potentially contaminated water (Surface Pipelines).

4.3 Diesel Spill

4.4 Petrol Spill

4.5 Leakage of underground or surface oil storage tank

4.6 Explosives truck (overturning)

5. ACTIONS TO BE TAKEN

5.1 Fires

5.1.1 All fires are to be reported to the control room.

5.1.2 Procedure as per fire manual to be followed.

5.2 Spillage of potentially contaminated water

5.2.1 The person detecting the emergency notifies control room.

a) Notify the nearest most senior official

b) Notify the safety and environmental departments

c) Mobilise possible equipment that can be used to contain spillage

ASSMANG LIMITED

5.3 IN CASE OF : DIESEL TANK FAILURE

STEPS

If possible stop the source of spillage and switch of all sources of ignition.

Evacuate area.

Demarcate affected area with red and white barrier tape.

Display no smoking open flame signs.

Initiate steps to prevent spilt diesel from entering drain water systems.

Contain spillage to smallest possible area.

Notify fire brigade or emergency services of the incident.

Initiate plan of action to clean up contaminated area.

Return to workplace after area has been declared safe.

Rehabilitate contaminated area to its original form.

In case of water pollution notifies DWAF.

ASSMANG LIMITED

5.4 IN CASE OF: PETROL TANK FAILURE

STEPS

If possible stop the source of spillage and switch of all sources of ignition.

Evacuate area.

Demarcate affected area with red and white barrier tape.

Display no smoking open flame signs.

Initiate steps to prevent spilt petrol from entering drain water systems.

Contain spillage to smallest possible area.

Notify fire brigade or emergency services of the incident.

Initiate plan of action to clean up contaminated area.

Return to workplace after area has been declared safe.

Rehabilitate contaminated area to its original form.

In case of water pollution notifies DWAF.

ASSMANG LIMITED

5.5 IN CASE OF: OIL STORAGE TANKS FAILURE

STEPS

If possible stop the source of spillage and switch of all sources of ignition.

Evacuate area.

Demarcate affected area with red and white barrier tape.

Display no smoking open flame signs if on surface.

Initiate steps to prevent spilt oil from entering drain water systems.

Contain spillage to smallest possible area.

Notify Manager or emergency services of the incident.

Initiate plan of action to clean up contaminated area.

Return to workplace after area has been declared safe.

Rehabilitate contaminated area to its original form.

ASSMANG LIMITED

5.6 IN CASE OF: FLAMMABLE STORES FAILURE

STEPS

If possible stop the source of spillage and switch of all sources of ignition.

Evacuate area.

Demarcate affected area with red and white barrier tape.

Display no smoking and open flame signs if on surface.

Initiate steps to prevent spilt substance from entering drain water systems.

Contain spillage to smallest possible area.

Notify Manager or emergency services of the incident.

Initiate plan of action to clean up contaminated area.

Return to workplace after area has been declared safe.

Rehabilitate contaminated area to its original form.

ASSMANG LIMITED

5.7 IN CASE OF: EXPLOSIVE TRUCK

STEPS

Demarcate affected area with red and white barrier tape.

Display no smoking and open flame signs.

Contain spillage to smallest possible area.

Notify Manager brigade or emergency services of the incident.

Initiate plan of action to clean up contaminated area.

Rehabilitate contaminated area to its original form.

ASSMANG LIMITED

6. MANAGEMENT TEAM CONTACT NUMBERS

S. LETABA	Tel:	(053) 751 5299
Senior General Manager	Fax:	(053) 751 5252
	Home:	(053) 751 1688
	Cell:	(082) 498 1452
J.J.P NEL	Tel:	(053) 751 5229
Mine Manager	Fax:	(053) 751 5251
	Home:	(053) 712 0774
	Cell:	(083) 701 8008
D. MANS	Tel	(053) 751 5405
Engineering Manager	Fax	(053) 751 5404
	Cell:	(083) 809 0540

7. OTHER CONTACT NUMBERS

SAFETY DEPARTMENT	**053 751 5419**
ENVIRONMENTAL DEPARTMENT	**053 751 5227**
SECURITY DEPARTMENT	**053 751 5209**
SAPD	**053 7791 0222**

EMERGENCY TELEPHONE NUMBERS

AMBULANCE	**053 751 5218**
FIRE BRIGADE	**053 751 5214**

DR HTE BOHNEN

All hours emergency number	**(082) 859 7617**

DR J MOSTERT

All hours emergency number	**(083) 269 5977**

APPENDIX 3: CV OF EAP

CURRICULUM VITAE — Bradley Thorpe

Full Name:	Bradley Kevin Thorpe
Date of Birth:	27 March 1980
Nationality:	South African
Identity Number:	8003275043087
Sex:	Male
Marital Status:	Married
Language:	English, Afrikaans

QUALIFICATIONS & PROFESSIONAL MEMBERSHIP

- Bachelor of Science – Animal Sciences: University of Pretoria, 2002;
- Bachelor of Science (Honours) in Wildlife Management: University of the Pretoria, 2003;
- Master of Science – Environmental Management: University of Johannesburg, in progress;
- Member: Institute of Waste Management, South Africa (IWMSA); and
- Member: International Association of Impact Assessors (IAIA), South Africa branch.

KEY EXPERIENCE

Six (6) years experience in Integrated Environmental Management (Strategic planning, legislation, Waste Management, EIA's, EMP's, monitoring, auditing, pollution abatement, rehabilitation etc.), including:

- **Integrated environmental management for the establishment, expansion, upgrade, rehabilitation and optimisation of light and heavy industrial processes** including the metallurgical, paper, mining and power generation industries
- **Integrated environmental management studies for the establishment, operation, auditing, closure and rehabilitation** of general waste landfills and transfer stations, industrial/hazardous waste landfills, incinerators, and hazardous effluent dams
- **Mining / prospecting permit and licence applications,** in terms of the Mineral and Petroleum Resources Development Act (MPRDA) –as amended, 2002
- **Environmental impact assessments, environmental management plans and public participation programmes** for small, medium and large linear and site specific infrastructure and land developments
- **Environmental management plans (EMP)** for the construction, operational and decommissioning/closure phases of infrastructure and land developments, waste management facilities and heavy industrial processes
- **Environmental advisory services,** including policy and procedures development, legal enforcement and compliance management, strategic planning, enviro-legal procedures and peer reviews
- **Specialist training,** including training of Provincial Environmental Authorities / EIA administrators in the review and administration of EIA's and Basic Assessments.
- **Project management** of numerous environmental and strategic projects

EMPLOYMENT HISTORY & PROJECT EXPERIENCE

EScience Associates (Pty) Ltd. January 2010 - Current
Senior Environmental Project Manager

Key Projects:

Waste Management:
- Interwaste: Scoping and EIA process for the establishment of an integrated waste management/treatment and transfer facility, Germiston, Gauteng (current);
- Reclamation Group (Reclam): Development of industry norm and standards for the operation of scrap metal recovery and processing facilities;
- Department of Environmental Affairs & Tourism (DEAT): Development of a Revised Hazardous Waste Classification System for South Africa;
- ClinX Waste Management: Scoping and EIA process relating to Waste License application for proposed Healthcare Risk Waste Incinerator, Wadeville, Gauteng;
- SE Solutions, on behalf of Reclamation Group: Specialist Waste Impact Assessment for a proposed ferrous scrap metal shredder facility in Waltloo, Pretoria, Gauteng; and
- Rand Water, Panfontein Water Treatment Residue Disposal Facility: Environmental risk assessment, rehabilitation planning and associated determination of closure and rehabilitation costs, Vereeniging, Gauteng (current).

I*ndustry*:
- ArcelorMittal, Vanderbijlpark Works: EIA and Environmental Management Plan for decommissioning of coke oven effluent maturation ponds, Vanderbijlpark, Gauteng;
- Assmang Chrome: Environmental Control Officer (ECO) for implementation and operational phases of ferromanganese production switch ('swing capacity') at Assmang Machadodorp-Ferroalloy Works, Machadodorp, Mpumalanga; and
- Assmang Chrome: Development of an Integrated Water and Waste Management Plan for the Machadodorp-Ferroalloy Works, Machadodorp, Mpumalanga.

Mining:
- Assmang Black Rock Mine Operations (BRMO): EIA and EMPR addendum for Sinter Plant and Mine Expansion, Hotazel, Northern Cape (current);
- Assmang Black Rock Mining Operations (BRMO): Development and subsequent implementation of the BRMO Environmental Management Master Plan, Hotazel, Northern Cape (inclusive of total revision to the Mine's EMPR);
- Assmang Chrome, Machadodorp: Waste Licensing EIA process for the proposed establishment of a proposed Reverse Osmosis Plant at Assmang, Machadadorp operations, Machadodorp, Mpumalanga; and
- Assmang Chrome, Dwarsriver Mine: Waste Licensing EIA process for the proposed establishment of a proposed Reverse Osmosis Plant at Assmang, as well as total revision to EMPR, Dwarsriver Mine, Steelpoort valley, Limpopo.

Specialist Training Course Development & Presentation:
- 2010: Training of Government Officials in the Review of EIAs and applications for environmental authorisation - Responsible for training of Government Officials responsible for EIA Review at the Gauteng, Eastern Cape, Western Cape and KZN Provincial Environmental Authorities.

COURSES

- Practical Training and Capacity Building Workshop on the Globally Harmonised System of Classification and Labelling of Chemicals (GHS): Presented by Orange House Partnership, with assistance from UNITAR (March 2011). Certificate received;
- Introduction to Integrated Waste Management: Centre for Environmental Management, Potchefstroom University (April 2009). Certificate received;
- Waste Reduction and Management: Melrose Advanced Training, Glenhove Conference Centre (September 2008);
- Integrated Environmental Management and Reporting: SEF internal training offered by Andrew Woghiren / Reuben Heydenrych (July 2008); and
- EIA Report Writing: Strategic Environmental Focus (2007).

APPENDIX 4: LIST OF POTENTIAL DUST PALLIATIVES

Road Palliation Options (Efficiencies from Bashian and Strauss, 2002)				
Type (efficiency %)	***Mechanism***	***Advantages***	***Limitations***	***Environmental considerations***
Freshwater (87%)	Moisture wets particles, increasing their mass and binding them together.	Usually readily available, low material cost, easy to apply.	BRMO within a water scarce area. Frequent light applications may be necessary during hot, dry, weather; potentially labour intensive. Over application may result in loss of traction, erosion, or points of road failure.	Minimal environmental impact provided water is not scarce. If applied excessively, may result in erosion and sediment runoff. Supply may be limited in some areas.
Calcium chloride	Deliquescent and hygroscopic at a relative humidity equal to or greater than 29 % (25°C).	Reduces evaporation rate of surface moisture 3.4 times; increases compacted density of road material.	Effectiveness in arid and semi-arid regions may be limited due to low relative humidity; very corrosive to aluminium alloys; slightly corrosive to steel. Solubility results in leaching during heavy precipitation. Releases heat when mixed in water.	Repeated applications and long-term use may harm vegetation, and contamination of groundwater.
Magnesium chloride (98%)	Deliquescent and hygroscopic at a relative humidity equal to or greater than 29 % (25°C).	Reduces evaporation rate of surface moisture 3.1 times; increases compacted density of road material, more so than $CaCl_2$.	Effectiveness in arid and semi-arid regions may be limited due to low relative humidity; very corrosive to steel, though inhibitors can be added. Solubility results in leaching during heavy precipitation.	Repeated applications and long-term use may harm vegetation, and contamination of groundwater.
Lignin derivatives (99%)	Act as adhesives, binding soil particles together.	Greatly increases dry strength of soil; not humidity-dependent; imparts some plasticity to road surfaces; lowers freezing point of road surface and base.	High solubility results in leaching during heavy precipitation; corrosive to aluminium alloys due to acidity ($CaC0_3$ added ingredient, can neutralize acidity). Proper aggregate mix (4-8% fines) important to performance. Becomes slippery when wet, brittle when dry.	Lignin products have a high BOD in aquatic systems. Spills or runoff into surface or groundwater may create low dissolved oxygen conditions or increases in groundwater concentrations of iron, sulphur com pounds, and other pollutants.
Tree Resin Emulsions	Act as adhesives, binding soil particles together.	Low solubility after curing minimizes leaching and provides degree of surface waterproofing. Imparts some plasticity to road surfaces. High bonding strength; non-corrosive.	Require proper weather and time to cure. No residual effectiveness after re-blading. Equipment requires prompt clean up avoiding curing of resin in hoses and pipes.	

Road Palliation Options (Efficiencies from Bashian and Strauss, 2002)				
Type (efficiency %)	***Mechanism***	***Advantages***	***Limitations***	***Environmental considerations***
Synthetic Polymer Emulsions	Bind soil particles together by forming a polymerizing matrix, function similar to adhesives.	Applicable to a range of emission sources; function well in sandy soil conditions. Some types allow seeded vegetation to grow through the polymer matrix.	Require proper weather conditions and time to cure; may be subject to UV (sunlight) degradation; application equipment requires timely cleaning; no residual effectiveness after re-blading.	
Bituments, Tars, and Resins	Asphalt and resinous products are adhesive, binding soil particles together. Petroleum oil products coat soil particles, increasing their mass.	Water insoluble when dry; provide a degree of surface waterproofing. Good residual effectiveness.	Surface crusting, fracturing and potholing may develop; long-term application may cause road to become too hard for re-blading; won't lower freezing point; petroleum oil products lack adhesive characteristics.	Use of used oils is prohibited. See MTCA discussion on page 6. Some petroleum-based products may contain carcinogenic polycyclic aromatic hydrocarbons (PAHs).
Geo-textiles	Provide and maintain drainage; improve load supporting properties; prevent upward migration of sub-grade fines; separate road layer materials.	Flexible, durable, water per me able, and resists soil chemicals; reduces amount of aggregate required during initial construction; lower maintenance.	High material cost; material degrades in sunlight, if exposed.	

APPENDIX 5: BRMO ALIEN INVASIVE SPECIES MANAGEMENT PROGRAMME

ALIEN VEGETATION CONTROL PLAN FOR THE ASSMANG MANGANESE BLACK ROCK MINE

PREPARED FOR

Environmental Science Associates

Prepared by:	Scientific Aquatic Services
Report Authors:	Stephen van Staden (Pr. Sci. Nat) Natasha van de Haar (Pr. Sci. Nat)
Report Reference:	SAS 211022
Date:	May 2011

Scientific Aquatic Services CC
CK Reg No 2003/078943/23
Vat Reg. No. 4020234273
347 Highland Rd
Kensington
2094
Tel: 011 616 7893
Fax: 011 615 4106
E-mail: admin@sasenvironmental.co.za

Contents

Table of Figures

List of Tables

Glossary of Terms & Acronyms

Alien vegetation – Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally.

Biomass – The total mass of living material in a specific area.

Biome – A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.

Bush encroachment – A state where undesirable woody elements gain dominance within grassland, leading to depletion of the grass component. Typically due to disturbances and transformations as a consequence of veld mismanagement (overgrazing, incorrect burning, etc.).

Decreaser grass – Grass abundant in veld in good condition, which decreases when veld is under- or over-utilized.

°*C* – Degrees Celsius.

Endangered – Organisms in danger of extinction if causal factors continue to operate.

Endemic species – Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.

Exotic vegetation – Vegetation species that originate from outside of the borders of the biome. Usually international in origin.

Ex situ conservation – Where a plant (or community) cannot be allowed to remain in its original habitat and is removed and cultivated to allow for its ongoing survival.

Extrinsic – Factors that have their origin outside of the system.

ha – Hectares.

Indigenous vegetation – Vegetation occurring naturally within a defined area.

Increaser 1 grass – Grass species that increase in density when veld is under-utilized.

Increaser 2 grass – Grass species that increase in density in over-utilized, trampled or disturbed veld.

Increaser 3 grass – Grass species that increase in density in over and under-utilized veld.

In situ conservation – Where a plant (or community) is allowed to remain in its natural habitat with an allocated buffer zone to allow for its ongoing survival.

Karoid vegetation – A shrub-type vegetation that dominates in grasslands that have seen historical disturbances. Mainly due to over-grazing and mismanaged burning regimes. The shrubby vegetation eventually becomes dominant and out-competes the grassy layer.

m – Metres.

mm – Millimetres.

MAMSL – Metres above mean sea level.

MAP – Mean annual precipitation.

MAPE – Mean annual potential for evaporation.

MASMS – Mean annual soil moisture stress.

MAT – Mean annual temperature.

PES – Present Ecological State.

POC – Probability of occurrence.

Pre - emergence herbicide – Is applied to the soil before the weeds emerge. Uptake is usually by growing coleoptiles (shoot) or by the developing roots.

Post - emergence herbicide – Applied after emergence of the weeds and usually have high degree of leaf uptake. To a large degree this term is used to describe products applied to mature plants.

PRECIS – Pretoria Computer Information Systems.

Pioneer species – A plant species that is stimulated to grow after a disturbance has taken place. This is the first step in natural veld succession after a disturbance has taken place.

QDS – Quarter degree square (1:50,000 topographical mapping references).

SANBI – South African National Biodiversity Institute.

Veld retrogression – The ongoing and worsening ecological integrity state of a veld

1 INTRODUCTION

Alien invaders are plants that are of exotic origin and are invading previously pristine areas or ecological niches (Bromilow, 2001). Not all weeds are exotic in origin but, as these exotic plant species have very limited natural "check" mechanisms within the natural environment, they are often the most opportunistic and aggressively growing species within the ecosystem. Therefore, they are often the most dominant and noticeable within an area. Disturbances of the ground through trampling, excavations or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area. Under natural conditions, these pioneer species are overtaken by sub-climax and climax species through natural veld succession. This process, however, takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition as would have been present prior to the disturbance. There are many species of indigenous pioneer plants, but very few indigenous species can out-compete their more aggressively growing exotic counterparts.

Alien vegetation invasion causes degradation of the ecological integrity of an area, causing (Bromilow, 2001):

- A decline in species diversity;
- Local extinction of indigenous species;
- Ecological imbalance;
- Decreased productivity of grazing pastures and
- Increased agricultural input costs.

All floral species that can be regarded as problem plants within a certain area are not necessarily included within the categories as stipulated by the Conservation of Agricultural Resources Act, 1983 (CARA). It is however important to note that each study area is unique and each floral species encountered should be considered with regards to extent and dominance. If any species are identified within the study area which can be regarded as a threat to natural vegetation, or its dominance is as a result of anthropogenic activity, an appropriate mitigation plan should be developed. According to DWAF all alien invasive eradication programs should consist of three phases (www.dwaf.gov.za):

1 Initial control: drastic reduction of existing population.
2 Follow-up control: control of seedlings.
3 Maintenance control: sustain low alien plant numbers with annual control.

Presently dominant alien floral species can be divided into three categories as stipulated by CARA (see section below). The definitions of category 1, 2 and 3 plants as well as the

definition of bush encroachment as given by the Agricultural Research Council (www.arc.agric.za) are stipulated below.

- **Category 1** These are prohibited plants that will no longer be tolerated, neither in rural nor urban areas, except with the written permission of the executive officer or in an approved biocontrol reserve. These plants may no longer be planted or propagated, and all trade in their seeds, cuttings or other propagative material is prohibited. They may not be transported or be allowed to disperse.

Plant species were included in this list for one or more of the following reasons: they might pose a serious health risk to humans or livestock, cause serious financial losses to land users, be able to invade undisturbed environments and transform or degrade natural plant communities, use more water than the plant communities they replace or be particularly difficult to control. Most of the plants in this category produce copious numbers of seeds, are wind or bird dispersed or have highly efficient means of vegetative reproduction. Whereas some of these plants were introduced inadvertently, have no obvious function to fulfil in South Africa and are generally regarded as undesirable, many of them are popular garden or landscaping plants. What they all have in common, however, is the fact that their harmfulness outweighs any useful properties they might have. Care was taken not to include a plant in this category if part of the population of South Africa would suffer because of its absence. The ornamentals in this category ought to be reasonably easy to replace with less invasive substitutes (Agricultural Research Council; www.arc.agric.za).

- **Category 2** These are plants with the proven potential of becoming invasive, but which nevertheless have certain beneficial properties that warrant their continued presence in certain circumstances. CARA makes provision for Category 2 plants to be retained in special areas demarcated for that purpose, but those occurring outside demarcated areas have to be controlled. The exception is that Category 2 plants may also be retained or cultivated in biological control reserves, where the plants will serve as host plants for the breeding of biological control agents. The growing of Category 2 plants in a demarcated area qualifies as a water use, and is subject to the requirements of section 21 of the National Water Act, 1998 (Act No. 36 of 1998).

An area can only demarcated for the growing of Category 2 plants by the Executive Officer of the department of Water and Environmental Affairs. The land user needs to obtain a water use license; the plants have to primarily serve a commercial or utility purpose, such as a woodlot, shelter belt, building material, animal fodder, soil stabilisation, medicinal or own consumption; the conditions under which they are cultivated, have to be controlled; all

reasonable steps have to be taken to curtail the spreading of seeds or vegetatively reproducing material outside the demarcated area, and all specimens outside the demarcated area have to be controlled. The Executive Officer of the department of Water and Environmental Affairs. has the power to impose additional conditions to ensure the adequate control of Category 2 plants in demarcated areas. Seed or other propagative material of Category 2 plants may only be sold to, and acquired by, land users of areas demarcated for the growing of that species, or for the establishment of a biocontrol reserve. Category 2 plants may not occur within 30 m from the 1:50 year flood line of watercourses or wetlands, unless authorisation has been obtained in terms of the National Water Act. The Executive Officer of the department of Water and Environmental Affairs has the power to grant exemption from some of the above requirements (Agricultural Research Council; www.arc.agric.za).

- **Category 3** These plants are undesirable because they have the proven potential of becoming invasive, but most of them are nevertheless popular ornamentals or shade trees that will take a long time to replace. A few of them were placed into this category instead of into category 1 because they do not cause problems in all situations. In terms of Regulation 15 of CARA, Category 3 plants will not be allowed to occur anywhere except in biological control reserves, unless they were already in existence when these regulations went into effect. The conditions on which these already existing plants may be retained are that they do not grow within 30 m from the 1:50 year flood line of watercourses or wetlands, that all reasonable steps are taken to keep the plant from spreading, and that the Executive Officer of the department of Water and Environmental Affairs has the power to impose additional conditions or even prohibit the growing of Category 3 plants in any area where he has reason to believe that these plants will pose a threat to the agricultural resources. Propagative material of these plants, such as seeds or cuttings, may no longer be planted, propagated, imported, bought, sold or traded in any way. It will, however, be legal to trade in the wood of Category 3 plants, or in other products that do not have the potential to grow or multiply. The Executive Officer of the department of Water and Environmental Affairs will have the power to grant exemption from some of the above requirements (Agricultural Research Council; www.arc.agric.za).

- **Bush encroachment** Declared indicators of bush encroachment concern only landowners in rural areas and are covered in Regulation 16 of CARA. Bush

encroachment is a condition where specific individual plant species are closer to each other than three times the mean crown diameter. Plants in this group are not alien plants, but indigenous plants that tend to become abnormally abundant when the area is degraded by e.g. overgrazing or injudicious fires (Agricultural Research Council; www.arc.agric.za).

2 LEGISLATION

The Conservation of Agricultural Resources Act (CARA) and the National Environmental Management: Biodiversity Act (NEMBA), and their Regulations, gives significant powers to hold land-owners accountable for invasions of alien plants on their land.

The present Legislation forms part of the Conservation of Agricultural Resources Act, 1983 (CARA). Regulations 15 and 16 under this Act are of specific concern to problem plants. In the past CARA classified problem plants in two groups namely declared weeds and plant invaders. As a result of accelerating deterioration of the country's natural resources as well as heightened public awareness with regards to environmental affairs, this Act was amended in 2001. Thereafter problem plants are dealt with in four Categories:

Regulation 15

- Declared weeds (Category 1)
- Plant invaders (Category 2 and 3).

Regulation 16

- Indicators of bush encroachment.

3 ASSUMPTIONS AND LIMITATIONS OF THE STUDY

The following assumptions and limitations are applicable to this report:

- The assessment is confined to the subject property and does not include the neighbouring and adjacent properties.
- Sampling by its nature, means that not all individuals are assessed and identified. Some species on the subject property may therefore been missed during the assessment.

4 METHODOLOGY

The alien vegetation study and assessment of the study area will include the following:

- Literature study of both the regional and localised area which will include relevant geology, soil types and species likely to be encountered in the area.
- A site visit will take place for the consultants to obtain an understanding of the site and to observe the various alien vegetation types and their locations and extent.
- Further assessment of the alien vegetation stands will include:
    - Dominance by biomass.
    - Dominance by recruitment.
    - Assessment of spatial significance.

- Reports will include:
    - Mapping of alien communities.
    - Legal overview and obligations.
    - Alien species inventory.
    - Control methods.
    - Management methods.
    - Discussions of priority species.
    - Discussions on priority areas.

5 RESULTS OF INVESTIGATION

5.1 Surrounding properties/land uses

Four mining entities form part of the Black Rock surface rights area namely Black Rock, Gloria, Nchwaning II and Nchwaning III. Black Rock, Gloria, and Nchwaning II and III Mines are situated in the Northern Cape Province approximately 80km north-west of the town of Kuruman. Black Rock, Nchwaning II and III are situated 16km north-west of Hotazel and Gloria Mine is situated 12km north-west of Hotazel. As depicted in the figure below the Black Rock Mine is bordered by the Belgravia Game Farm to the west which also falls under management of the mine. The Gloria and Nchwaning III mines are located east of the Black Rock Mine and Nchwaning II is located within the Black Rock Mine footprint area. All the above mentioned mining facilities are presently still in use, with the exception of the Black Rock koppie operations which ceased in 1992. Two decommissioned mine sites are located to the south of the Black Rock surface rights area, located on the farms Perth 276 and Devon 277. The mining footprint within the farm Perth 276 constitutes approximately 160ha of the total farm surface area and Devon 277 approximately 105ha.

Historically the subject property was utilised primarily for livestock grazing. Some portions within the surface rights area are presently rented to farmers which currently still use the open veld for grazing of cattle. The portion of the Balgravia farm presently managed as a game farm was historically also utilized for grazing however from the time of the establishment of the game farm this area has seen little anthropogenic activity and has largely returned to a more natural ecological state. Land in the immediate vicinity of the Black Rock Mine not used for mining purposes is used for extensive livestock farming.

5.2 Site descriptions

A site visit was undertaken during March 2011 to obtain an understanding of the site and to observe the various alien vegetation communities, their locations and extent. After an initial reconnaissance drive around, more thorough investigations of the study area were undertaken on foot to identify the dominant alien vegetation species.

Current mining activity, game farming with specific reference to the Belgravia game farm as well as cattle grazing are the dominant land uses encountered during the assessment. As a result of these anthropogenic activities, less natural vegetation than what is expected occurs within the surface rights area.

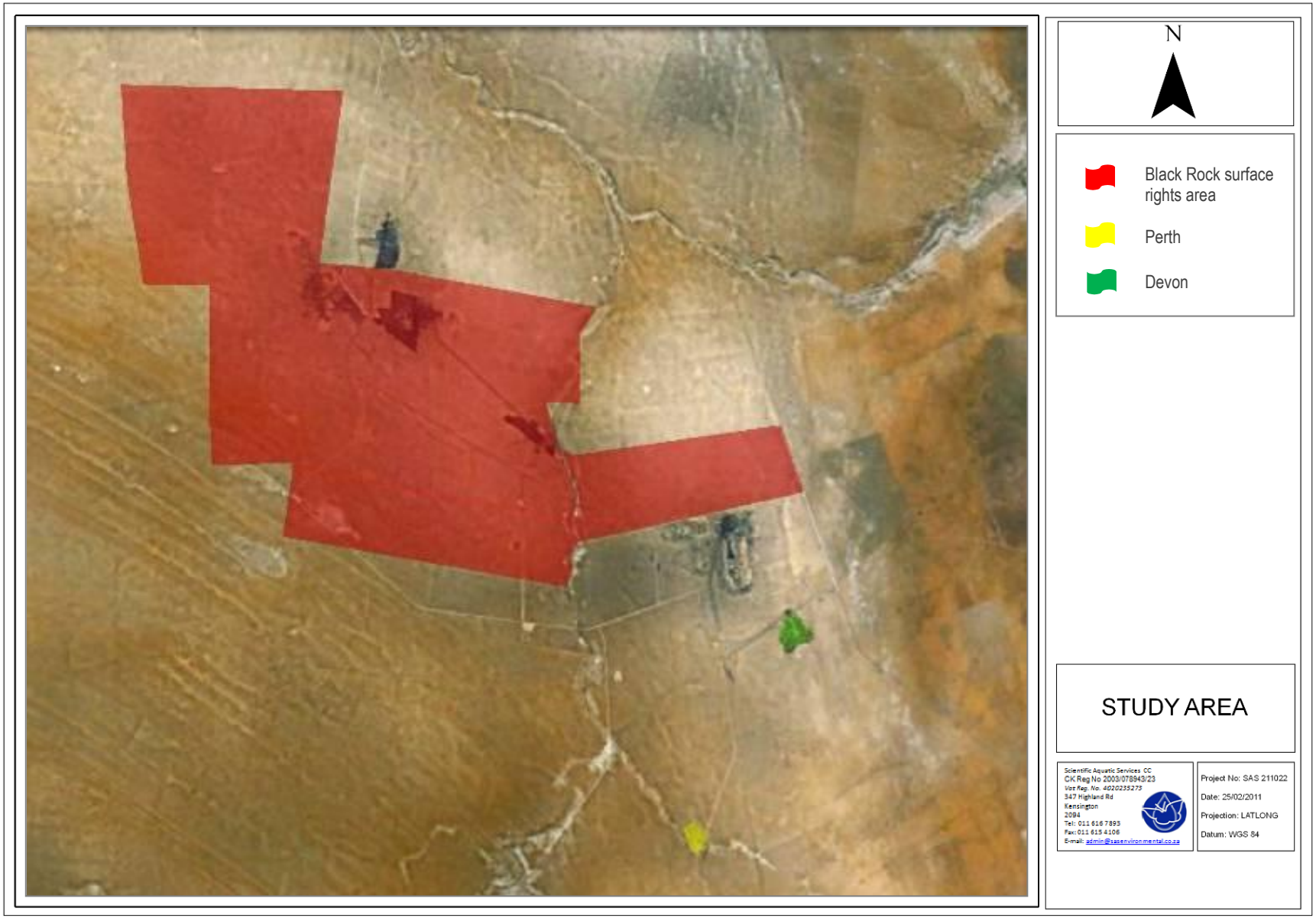

Figure 1: Aerial photograph depicting locality of the subject property within the larger area.

5.3 Regional floral life context

5.3.1 Biome and bioregion

Biomes are broad ecological units that represent major life zones extending over large natural areas (Rutherford 1997). This assessment site falls within the *Savanna biome* (Figure 2) (Rutherford & Westfall, 1994). Biomes are further divided into bioregions, which are spatial terrestrial units possessing similar biotic and physical features, and processes at a regional scale. The majority of the assessment site is situated within the *Eastern Kalahari Bushveld Bioregion* however some smaller portions are located within the *Kalahari Duneveld Bioregion* (Figure 3) (Musina & Rutherford, 2006).

.

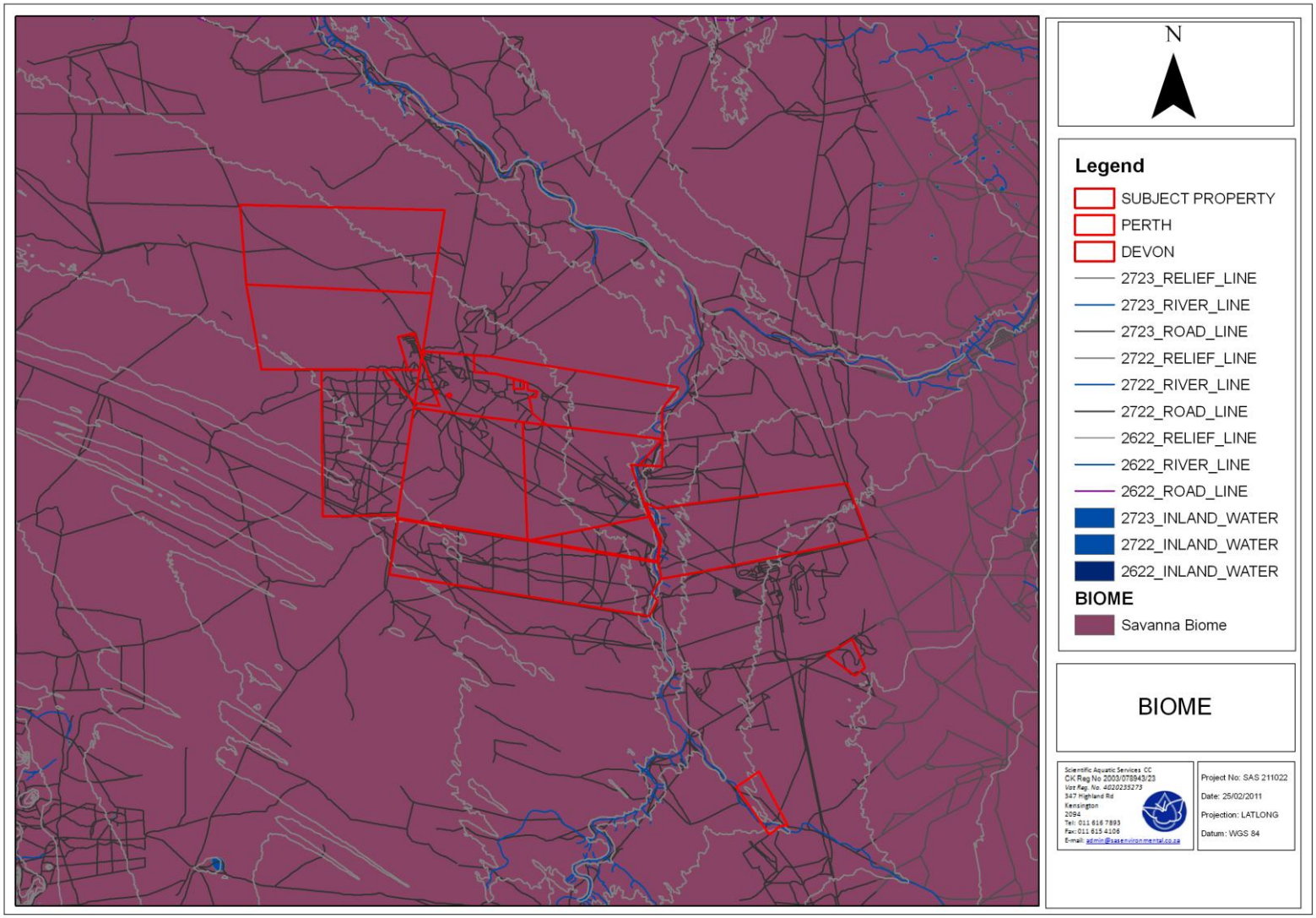

Figure 2: Biomes associated with the study area *(Mucina & Rutherford, 2006)*.

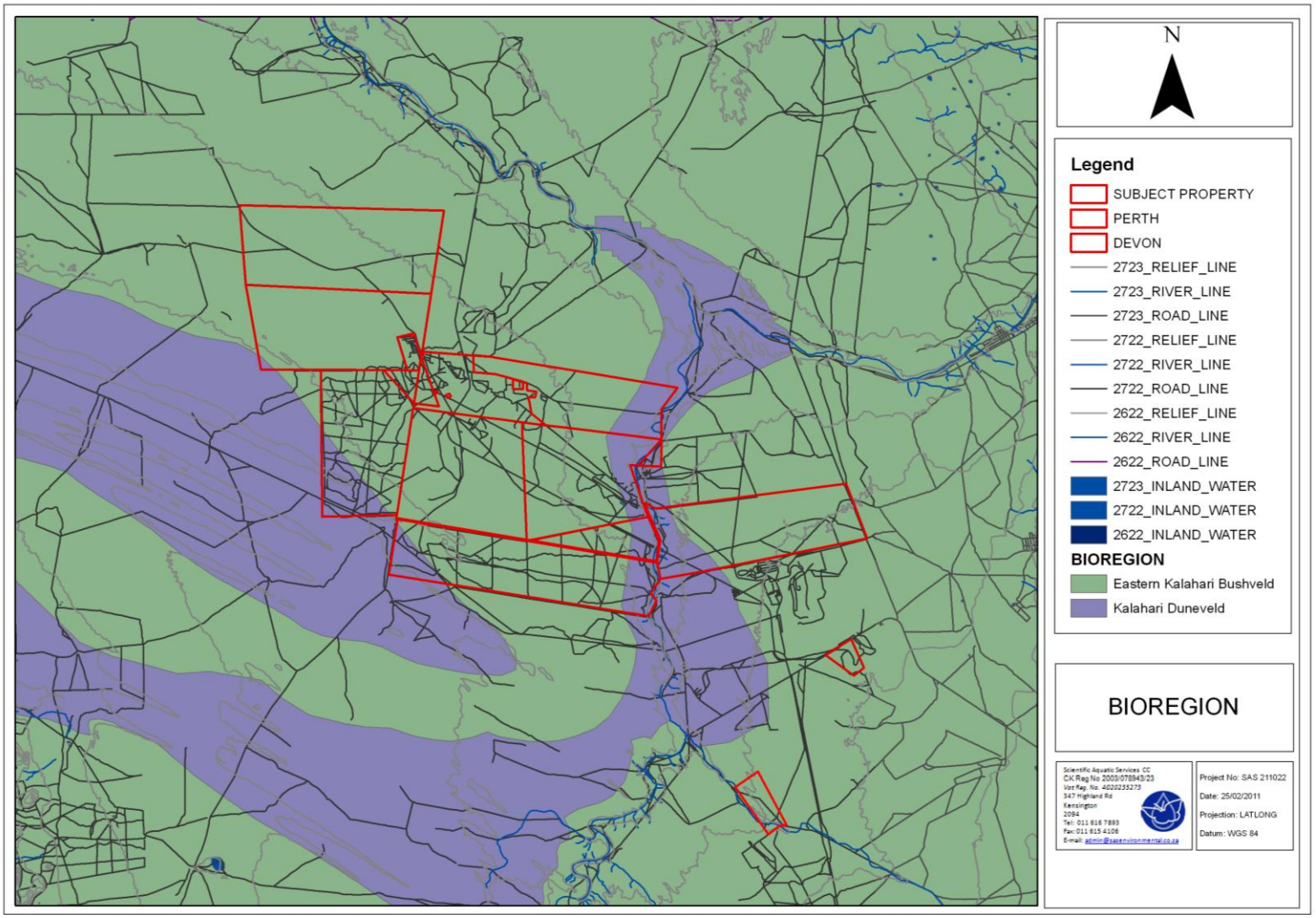

Figure 3: Bioregions associated with the study area *(Mucina & Rutherford, 2006)*.

5.3.2 Vegetation type

While biomes and bioregions are valuable as they describe broad ecological patterns, they provide limited information on the actual species that are expected to be found in an area. Knowing which vegetation type an area belongs to provides an indication of the floral composition that would be found if the assessment site was in a pristine condition. When the boundary of the assessment site is superimposed on the vegetation types of the surrounding area, it is evident that the subject property falls within the *Kalahari Thornveld and Shrub Bushveld* veld type; Figure 4 (Acock's, 1990) and *Kathu Bushveld* vegetation type and partly in the *Gordonia Duneveld* vegetation type; Figure 5 (Musina & Rutherford, 2006).

These species are what one would expect to find in the natural state of the vegetation types, not necessarily for the study area. Factors such as veld mismanagement in the form of incorrect burning regimes, cultivation and infrastructure development, bush encroachment, historical ploughing, landscaping, exotic vegetation encroachment and other forms of transformation all lead to a generally transformed veld where there is no, or little, representation of the floral species associated with the expected vegetation types.

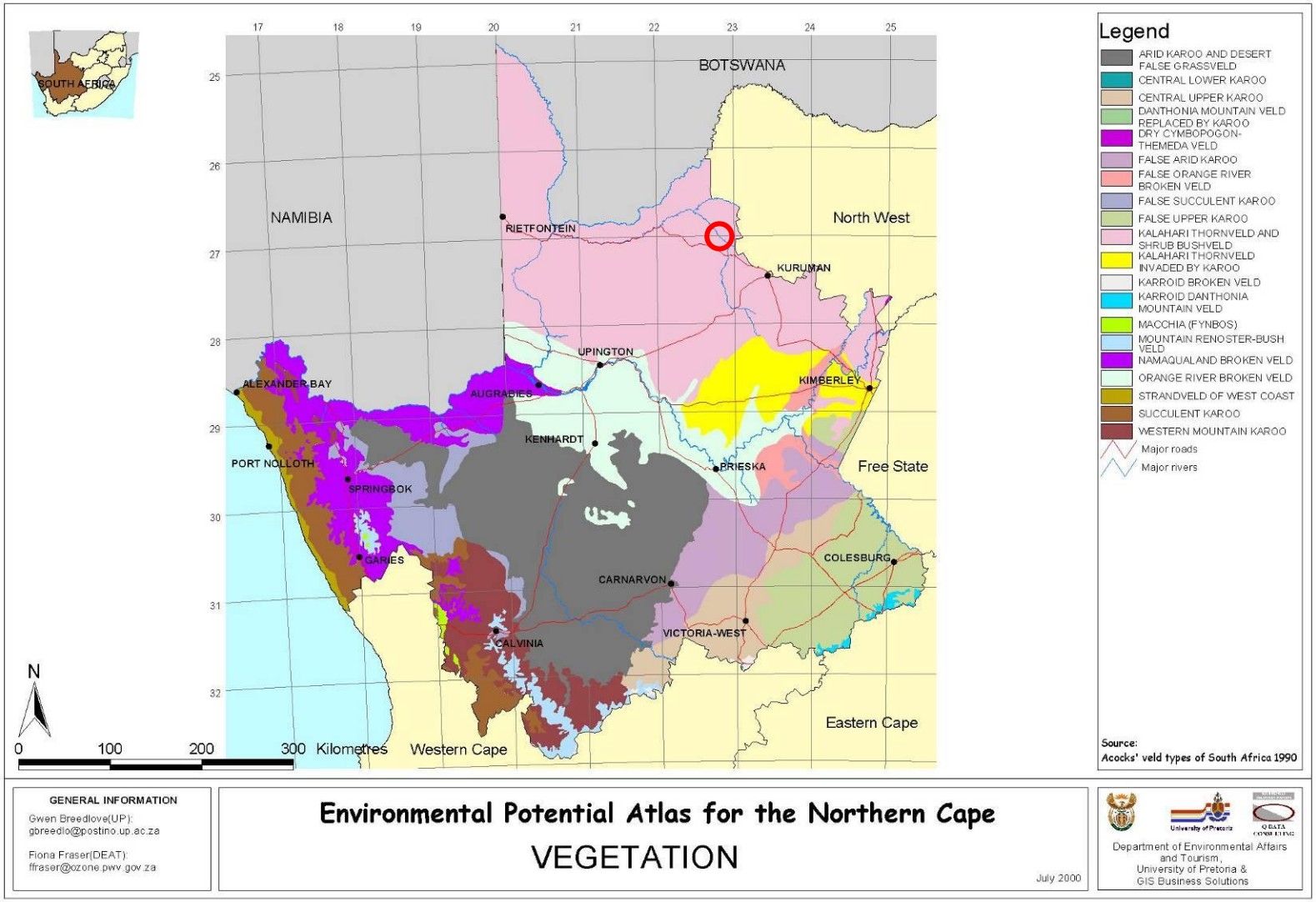

Figure 4: Veld types of the Northern Cape (www.environment.gov.za) subject property is depicted in red.

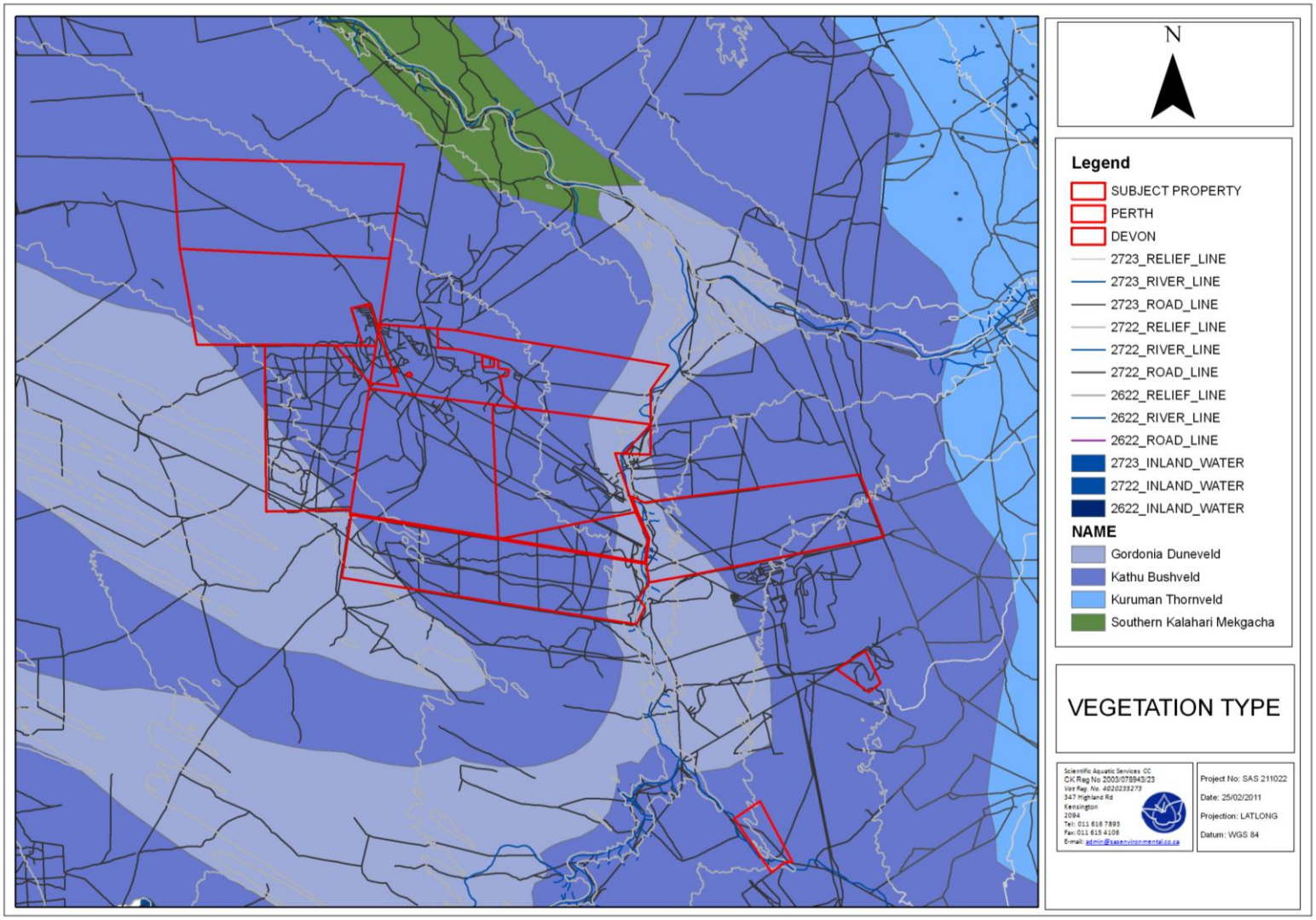

Figure 5: The boundary of the assessment site and the vegetation types of the surroundings areas.

5.3.3 Geology and soils

5.3.3.1 Kathu Bushveld

Aeolian red sand and surface calcrete, deep (>1.2m) sandy soils of Hutton and Clovelly soil forms. Land types mainly Ah and Ae, with some Ag (Mucina & Rutherford, 2006).

5.3.3.2 Gordonia Duneveld

Aeolian sand, underlay by calcrete of the kalahari group, deep, loose, sandy soils of the namib soil form on the flat plains. Land types mainly Ah, and Af with little Ae (Mucina & Rutherford, 2006).

5.3.4 Climate

5.3.4.1 Kathu Bushveld

Summer and autumn rainfall with very dry winters. MAP about 220-380mm. Frost frequently in winter. Mean monthly maximum and minimum temperatures for Sishen 37.0°C and -2.2°C for December and July, respectively (Mucina & Rutherford, 2006).

5.3.4.2 Gordonia Duneveld

Summer and autumn rainfall with very dry winters. MAP about 180-280mm. Frost frequent in winter (Mucina & Rutherford, 2006).

5.3.5 Conservation

5.3.5.1 Kathu Bushveld

Least concern with a target of 16%. None conserved in statutory conservation areas. More than 1% already transformed, including the manganese ore mining locality at Sishen, one of the biggest open-cast mines in the world. Erosion is very low (Mucina & Rutherford, 2006).

5.3.5.2 Gordonia Duneveld

Least threatened with a target of 16%. Some 14% statutorily conserved in the Kgalagadi Transfrontier Park. Very little transformed. Generally low erosion, but some areas with spectacular destabilisation of normally vegetated dues (through local overstocking) favoured by Photographers. Erosion is normally very low (Mucina & Rutherford, 2006).

6 FLORAL ALIEN & INVADER COMMUNITIES

The study area can be broadly divided into four alien floral communities. These communities were identified using to dominance by biomass and recruitment of individual species identified. Definitions given below:

- Recruitment - the arrival/establishment of new individuals into the floral community.
- Biomass - the combined weight of a specific species within the alien floral community.

After the initial site assessment as well as determination of recruitment and biomass, areas with uniform vegetation characteristics were mapped and grouped together. An aerial photograph depicting the locations of these alien communities are conceptually presented in the figure below and discussed in detail in the sections that follow.

It is recommended that species listed as category 1 be considered first priority followed by category 2 and 3 invaders. During the assessment of the study area very low alien and weed species diversity were noted (see table below). It is however evident within the region that grass species known to thrive in disturbed places, is the species noted to quickly establish if areas are disturbed. As a result the natural species diversity declines and grass species known to thrive in disturbed places dominates instead of shrub/forb weed species. An exception to this is overgrazed areas where it was noted that *Acacia mellifera* is the species to quickly establish. The establishment of *A. mellifera* ultimately leads to bush encroachment with little or no establishment of grass species.

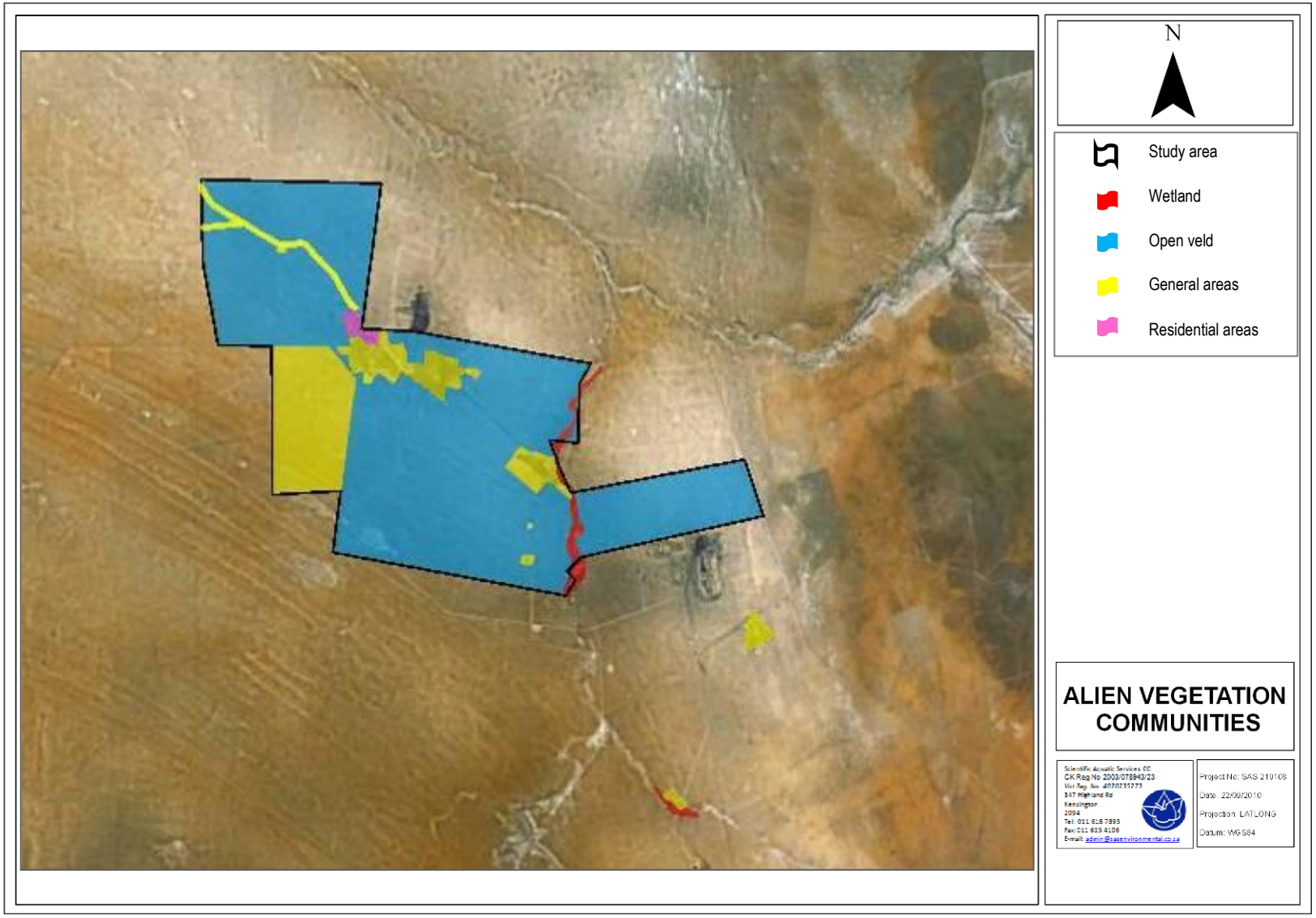

Figure 6: Conceptual mapping of alien floral communities within the study area

6.1 Community 1-Riparian zones and artificial wetland features

Figure 7: Ga Magara River habitat.

Areas included within community 1 are habitat associated with the Ga Magara River as well as the Witleegte River near Perth. This community has remained largely free from alien and invasive species (see figure above); however, invader grass known to thrive in disturbed places such as *Aristida congesta* subsp *congesta* and *Setaria verticillata* was noted. The dominant exotic species identified within community 1 during the time of the assessment was *Prosopis glandulosa,* listed as a category 2 invader. Evidence was encountered during the assessment of *Prosopis glandulosa* eradication within these habitat units. Individuals of this species were also noted along the banks of the open cast quarries located within the decommissioned Perth and Devon mines. It is deemed important that individuals of this species also be eradicated within these areas to prevent increase in the community size. It is however important to note that both these quarries presently hold water and creates habitat for various faunal wetland inhabitants and therefore eradication methods should be done in such a way to prevent to the loss of habitat of the wetland faunal species.

The Conservation of Agricultural Resources Act concerning category 2 invader species specify that category 2 plants may not occur within 30 m from the 1:50 year flood line of watercourses or wetlands, unless authorisation has been obtained in terms of the National Water Act. Therefore it is deemed important that eradication of this species continue in conjunction with rehabilitation of the decommissioned areas as well as previously disturbed areas within the Ga Magara River. All the appropriate eradication measures are stipulated within Appendix A. However, management of these species within riparian areas will prove to be difficult and therefore proper planning should coincide with the management to limit any further damage to the riparian features.

Other invasive floral species identified within the community include *Acacia mellifera, Acacia hebeclada* and *Setaria verticillata.* Management of these species should form a part of all river rehabilitation plans, because they have the potential to proliferate as a result of disturbance, which in turn will prevent establishment of natural climax vegetation.

Recommendations for mitigation of Prosopis glandulosa[1]:

- The eradication methods are stipulated within appendix A. It is deemed that the cut-stump method will be the most effective with the least harm to the wetland, riparian and drainage line habitats. Due to the overall sensitivity of wetland systems, the herbicide chosen should specifically cater for wetland and riverine habitats.
- The plant is known to re-sprout if eradication was not effective; therefore, ongoing monitoring after eradication is necessary.
- All action plans pertaining to wetlands as stipulated within the BAP, should be adhered too. Therefore, the area disturbed during the removal of trees should be kept as small as possible, with no vehicles allowed within wetland zones and all work should be done manually in these areas.

[1] Bromilow, C. Problem plants of South Africa, 2001

Table 1: Summary of alien community 1: Riparian zone.

	Species	Common name	Category if applicable
Dominance by biomass	*Prosopis glandulosa*	Mesquite	2
	Acacia mellifera	Black Thorn	Bush encroachment indicator
	Acacia hebeclada	Candle-pod thorn	Bush encroachment indicator
	Setaria verticillata	Sticky bristle grass	N/A
Dominance by recruitment	*Prosopis glandulosa*	Mesquite	2
	Acacia mellifera	Black Thorn	Bush encroachment indicator
	Acacia hebeclada	Candle-pod thorn	Bush encroachment indicator
	Setaria verticillata	Sticky bristle grass	N/A

6.2 Community 2 – Open veld

Figure 8: *Acacia mellifera* encroachment.

All areas presently utilised for cattle grazing were included within this community. Significant amounts of *Acacia mellifera* which formed impenetrable thickets in some areas within the subject property was considered the dominant invasive species within the community, which ultimately resulted in a significant decrease in natural floral species diversity and abundance within these areas. Smaller areas were also noted within the open veld habitat unit with the potential of extensive *Acacia hebeclada* encroachment in the future.

Although *Acacia mellifera* is considered an indicator species of the *Gordonia Duneveld* vegetation type this species is known to become invasive in previously disturbed areas. Both *Acacia mellifera* and *Acacia hebeclada* are listed within the CARA, (regulation 16) as declared indicators of bush encroachment. This regulation states that a land user of an area in which natural vegetation occurs and which contains communities of indicator plants should follow practices to prevent the deterioration of natural resources and to combat bush encroachment where it occurs. Bush encroachment is a result of a process known as plant succession that entails transformation of a grass-dominated ecosystem to a tree or shrub-dominated ecosystem. The key difference is that bush encroachers are mainly indigenous woody plants. Bush encroachment also poses problems for those who graze cattle on their land, as valuable grazing is lost[2]. Although the tree is known to be grazed by goats the tree is too spiny for cattle and the fallen leaves too small and therefore does not hold any grazing potential.

Eradication and control of *Acacia mellifera* should be planned according to post as well as future land use. To prevent unnecessary expenditure within areas earmarked as future mining expansion areas. No eradication within these areas are deemed necessary, however

[2] http://www.hartebeestfonteinconservancy.org.za/index.php?option=com_content&view=article&id=140:bush-encroachment&catid=43:projects&Itemid=59

the spread of these trees should be monitored. It is also recommended that a combined effort between farmers currently renting the areas within the Black Rock surface rights area and Black Rock Mining operations be established to eradicate extensive *A. mellifera* stands.

Recommendations for mitigation of Acacia mellifera within open veld areas:

- *A. mellifera* is killed by stumping and cutting, with the use of Bromacil and Tebuthiuron, or other herbicides as recommended by chemical agencies.
- Repeated burning exerts a good deal of control, however it is doubtful that burning will be efficient within the subject property mainly due to very little grass cover left in the majority of the highly infected areas. Burning may also result in destruction of seedlings of protected tree species found within the subject property such as *Acacia erioloba* and *Acacia haematoxylon.*
- Ongoing monitoring is essential within areas rehabilitated, which is earmarked for cattle grazing in the future. A sufficient grass layer should be established prior to the introduction of grazing as to prevent proliferation of *A. mellifera*. Future land use should be managed in such a way as to prevent overgrazing which will lead to *A. mellifera* encroachment.
- Regular inspection after eradication is deemed necessary to ensure the eradication method is effective.
- Protected tree species (*Acacia erioloba, Acacia heamatoxylon* and *Boscia albitrunca*) were identified close to areas with *Acacia mellifera* encroachment therefore care should be taken with the identification of the trees.
- Where total removal of *A. mellifera* communities has taken place, reseeding with indigenous grass is required. It is important to use pioneer species such as *Centropodia glauca, Stipagrostis ciliata, Eragrostis lehmanniana* and *Schmidtia pappophoroides,* which are expected within the vegetation type, that will establish quickly and lead to a natural vegetation community in the future.

Cuscuta campestris is listed as a Category 1 invader, therefore all individuals within the Black Rock Mine surface rights area should be eradicate. One other floral species considered invasive at the time of the assessment namely *Verbesina encelioides* was identified. Although *V. encelioides* is not listed within the CARA act it is deemed important that individuals be eradicated and controlled to prevent spread to surrounding areas. Two other species namely *Melinis repens* and *Ziziphus mucronata* also not listed within CARA were identified. Both species have the potential to become invasive if not controlled, therefore these species are not considered priority at present but needs to be monitored to prevent excessive propagation in the future.

Table 2: Summary of alien community 2: Open veld.

	Species	Common name	Category if applicable
Dominance by biomass	*Acacia mellifera*	Black Thorn	Bush encroachment indicator
	Acacia hebeclada	Candle-pod thorn	Bush encroachment indicator
	Melinis repens	Natal red top	N/A
	Verbesina encelioides	Wild sunflower	N/A
	Cuscuta campestris	Dodder	1
	Ziziphus mucronata	Buffalo thorn	N/A
Dominance by recruitment	*Acacia mellifera*	Black Thorn	Bush encroachment indicator
	Acacia hebeclada	Candle-pod thorn	Bush encroachment indicator
	Melinis repens	Natal red top	N/A
	Verbesina encelioides	Wild sunflower	N/A
	Cuscuta campestris	Dodder	1
	Ziziphus mucronata	Buffalo thorn	N/A

6.3 Community 3 – Residential areas

Figure 9: *Melia azedarach* trees within residential areas.

Due to urban development within the Black Rock village and areas such as the hostel and office buildings various exotic species were introduced within urban gardens. Category 3 species identified within these areas include *Melia azedarach, Morus nigra* and *Schinus molle*. Although these species are considered exotics they still offer habitat for faunal species known to reside close to human activity and also form part of established gardens. It is therefore not deemed necessary to remove larger trees, however all exotic seedlings should be removed to prevent spread of these species into open veld areas. It is recommended that a replacement process of large exotic tree species with indigenous species be done over 5 year period.

Nerium oleander is listed as a Category 1 species and should therefore be eradicated regardless of size. The only Category 2 species identified at the time of the assessment was *Agave americana*. It is recommended that the majority of *Agave americana* individuals be eradicated; exception can be made of larger individuals within established gardens; provided that all seedlings are removed.

Table 3: Summary of alien community 3: Residential areas.

	Species	Common name	Category if applicable
Dominance by biomass	*Melia azedarach*	Syringa	3
	Morus nigra	Black mulberry	3
	Schinus molle	Pepper tree	3
	Nerium oleander	Oleander	1
	Agave americana	Sisal	2

	Species	Common name	Category if applicable
	Verbesina encelioides	Wild sunflower	N/A
Dominance by recruitment	*Melia azedarach*	Syringa	3
	Verbesina encelioides	Wild sunflower	N/A
	Morus nigra	Black mulberry	3
	Nerium oleander	Oleander	1
	Agave americana	Sisal	2
	Schinus molle	Pepper tree	3

6.4 Community 4 – General areas

Figure 10: Disturbed areas dominated by one grass species namely *Schmidtia kalihariensis* with *Verbesina encelioides* encroachment visible.

All remaining areas within the Black Rock Mine surface rights area are included within this community and species listed within this community were encountered throughout these areas, with only *Verbesina encelioides* noted as significantly invasive in some areas. Although not listed as an invader within the CARA act, this weed is adapted to arid sandy soil conditions and therefore eradication and future management is needed to prevent it from spreading to nearby open veld habitat.

Opuntia ficus-indica, Spartium junceum, Lantana camara and *Cuscuta campestris* are species identified within this community and listed as Category 1 species. All individuals of these species should be eradicated and controlled. *Eucalyptus* sp. was the only Category 2 species identified within this community. Category 2 plants may not occur within 30 meters from the 1:50 year flood line of watercourses or wetlands, unless authorisation has been obtained in terms of the National Water Act. *Melia azedarach, Schinus molle* and *Ipomoea indica* are Category 3 species identified. It is recommended that these species be removed and replaced with species representative of the relevant vegetation type such as *Acacia erioloba, Boscia albitrunca* and *Acacia haematoxylon.* The remainder of the species were not considered a significant threat to natural vegetation, however it is deemed important that they be appropriately monitored to ensure they do not proliferate excessively.

Table 4: Summary of alien community 4: General areas.

	Species	Common name	Category if applicable
Dominance by biomass	*Eucalyptus sp.*	Gum trees	2
	Melia azedarach	Syringa	3
	Schinus molle	Pepper tree	3
	Opuntia ficus-indica	Sweet prickly pear	1
	Cortaderia selloana	Pampas grass	1
	Verbesina encelioides	Wild sunflower	N/A
	Pennisetum setaceum	Fountain grass	1
	Sesamum triphyllum	Wild sesame	N/A
	Spartium junceum	Spanish broom	1
	Lantana camara	Lantana	1
	Cuscuta campestris	Dodder	1
	Ipomoea indica	Morning glory	3
	Melinis repens	Natal red top	N/A
Dominance by recruitment	*Verbesina encelioides*	Wild sunflower	N/A
	Pennisetum setaceum	Fountain grass	1
	Sesamum triphyllum	Wild sesame	N/A
	Eucalyptus sp.	Gum trees	2
	Melia azedarach	Syringa	3
	Lantana camara	Lantana	1
	Ipomoea indica	Morning glory	3
	Cortaderia selloana	Pampas grass	1
	Melinis repens	Natal red top	N/A
	Spartium junceum	Spanish broom	1
	Cuscuta campestris	Dodder	1
	Schinus molle	Pepper tree	3
	Opuntia ficus-indica	Sweet prickly pear	1

7 CONTROL METHODS

After identification of the different alien floral communities within the study area, control methods specifically pertaining to each floral community could be ascertained (listed in Appendix A). The control methods can be divided into four basic methods of weed control, listed below (definitions compiled by using Bromilow, 2001 and www.dwaf.gov.za).

1. Physical/manual (chopping and slashing; digging and bulldozing; cultivation or hoeing).

2. Cultural (crop rotation; the use of catch crops; winter ploughing; irrigation management; fire).

3. Biological (insects and diseases).

4. Chemical (herbicides).

It should be noted that the category of each species as indicated within the CARA, 2001 legislation is indicated within the control methods table and where the species is not considered in one of the categories, but control methods is deemed necessary, it is indicated with N/A.

- **Ring barking**: Bark must be removed from the bottom of the stem to a height of 0.75-1.0 m. All bark must be removed to below ground level for good results. Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out. Bush knives or hatchets should be used for debarking.
- **Frill:** Using an axe or bush knife. Make angled cuts downward into the cambium layer through the bark in a ring. Ensure to affect the cuts around the entire stem and apply herbicide into the cuts.
- **Cut stump treatment**: Stems should be cut as low as possible. Herbicides are applied in diesel or water as recommended for the herbicide. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label
- **Stem injection**: Punch downward slanting holes into the main stem using a sharpened metal spike. Space holes around entire circumference of lower stems. Inject the herbicide directly into the plant – ensuring to inject around the stem. Follow label recommendations - For invasive cactus species.

General guidelines to take into consideration during alien and invasive control strategies [3]:

- Do not leave herbicide mixed and "ready-to-use" - use it all on the day that it is mixed.
- Use a crop oil with the herbicide; this assists the herbicide to "cling" to the leaves; where applicable it is noted within Appendix A.
- To prevent confusion use a dye in the sprayer so that field workers can see individuals already sprayed; where applicable it is noted within Appendix A.
- Do not spray in the heat of the day. The plant protects itself from water loss, and this reduces the take-up of the herbicide.
- Use all herbicides in the recommended dosages.
- Do not use herbicide in a watercourse. If the use of an herbicide is deemed necessary, the herbicide chosen should specifically cater for wetland habitat.
- If it is a flowering plant, remove flower heads before seeds are dispersed. Care should be taken not to disperse seeds while picking and transporting of flowers. It is recommended that all flower heads be placed directly into a plastic bag where after suitably discarded off.

8 DISPOSAL OF PLANT MATERIAL

- Care should be taken that all alien/weed vegetation is removed prior to seed production. This typically occurs in the early summer.
- All plant material removed should be taken to an area isolated from surrounding natural areas with a bunded surface. This should be designated as a burning area and burning should only be allowed within this area. The plant material should be burnt at the highest temperature possible to ensure alien floral seeds are destroyed. After which all ash should be taken to a registered landfill site.
- All plant material should be covered with a sail during transportation by road to prevent any blow-off from the vehicle.
- The landfill site as well as the place were burning is carried out and the immediate surrounding areas should be monitored for any species that may germinate.
- It is not recommended that any plant material be disposed of within a landfill site or buried prior to burning. This is mainly due to the possible presence of seeds which will germinate and result in the further spread of the problem species.

[3] http://rnc.za.net/index.php?option=com_content&view=article&id=49:guide-to-invader-species-weeds&catid=7:conservation&Itemid=21

- It is not recommended that any species be chipped and used as mulch as there may be seeds present within the mulch that will spread to areas beyond the present alien/weed floral communities.
- Wood from large trees can be made available to the public for firewood.

9 MANAGEMENT OBJECTIVES

The following objectives and principles should be followed to ensure adequate management.

- Priority invasive species within each community identified during the assessment should be addressed first. These include *Prosopis glandulosa* for Community 1; *Acacia mellifera* for Community 2; *Nerium oleander* for community 3 and *Vebesina encelioides* as well as all Category 1 species for community 4. Followed by other species as listed within the various communities.
- After initial control methods the relevant areas should be assessed at quarterly intervals after initial treatment to control any species that may sprout. Thereafter an annual assessment of the alien vegetation stands should take place after the spring flush of each year but prior to seed formation. The annual assessment should include:
    - Determination of effectiveness of mitigation measures within each community.
    - Determination of dominance by biomass and recruitment within each alien vegetation community. To identify any dominant species that may become a threat to the natural vegetation.
- Where total removal of alien communities has taken place, reseeding with indigenous grass is required with special mention of areas where *Acacia mellifera* eradication is deemed necessary. It is important to use pioneer species, which are expected within the vegetation type, that will establish quickly and lead to a natural vegetation community in the future.
- Liaison with surrounding stakeholders, and the local municipality to control surrounding nodes of seed production.
- Re-assessment of the area to determine success of the action and any follow-up measures required.
- Where extensive rehabilitation is needed and areas prone to erosion have been left bare as a result of alien removal a rehabilitation plan should be compiled and implemented.
- Various plant species of concern (*Acacia erioloba, Acacia haematoxylon, Ammocaris coranica, Boophone disticha, Babiana hypogaea* and *Harpagophytum procumbens)* were noted throughout the Black Rock surface rights area. Therefore extra care should be taken with the identification of species before removal of alien or invasive species as well as keeping impact from eradication methods as well as footprint areas to a minimum.

10 REFERENCES

Agricultural Research Council (www.arc.agric.za)

Bromilow, C. (2001). Revised Edition, First Impression. *Problem Plants of South Africa.* Briza Publications, Pretoria, RSA.

Department of Water Affairs and Forestry (www.dwaf.co.za)

Mucina, L. & Rutherford, M. C. (Eds). (2006). *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria, RSA.

Rutherford, M. C. & Westfall, R. H. (1994). *Biomes of Southern Africa: An Objective Categorization.* National Botanical Institute, Pretoria, RSA.

APPENDIX A

Table 5: Control methods as given by Bromilow, 2001 and T.Bold, WfW, Nat.Off.CT retrieved from www.dwaf.gov.za.

Species	Category if applicable	Eradication method
Ipomoea indica	3	Not very susceptible to herbicides. Removal by hand recommended before seed production.
Lantana camara	1	**Foliar spray - Fluroxypyr / picloram**; 80 / 80 g/L ME Plenum 160 ME (L7702); 150ml / 10 Litres water and 0.5% Wetter & Dye **Foliar spray - Glyphosate (ammonium)**; 680 g/kg WG Roundup Max 680 WG; (L6790); 160gr / 10 Litres water and 0.1% Dye **Foliar spray - Glyphosate (isopropylamine)**; 240 g/L SL Tumbleweed 240 SL; (L4781); 300ml / 10 Litres water and 0.1% Dye **Foliar spray - Glyphosate (isopropylamine)**; 360 g/L SL Glyph 360 SL (L4767), Mamba 360 SL (L4817), Roundup 360 SL (L407), 300ml / 10 Litres water and 0.1% Wetter & Dye **Foliar spray - Glyphosate (isopropylamine)**; 450 g/L SL RoundUp Turbo 450 SL (L7166); 240ml / 10 Litres water and 0.1% Dye **Foliar spray - Glyphosate (isopropylamine);** 480 g/L SL Mamba Max 480 SL (L7714); 220ml / 10 Litres water and 0.1% Dye **Foliar spray - Glyphosate (potassium)**; 500 g/L SL Touchdown Forte Hitech 500 SL adjuvant incl.(L7305); 200ml / 10 Litres water and 0.1% Dye **Foliar spray - Glyphosate (sodium)**; 500 g/kg WG Kilo 500 WSG (L7431); 220gr / 10 Litres water and 0.5% Wetter & Dye **Foliar spray - Imazapyr;** 100 g/L SL Chopper 100 SL (L3444), Hatchet 100 SL (L7409); 200ml / 10 Litres Water **Foliar spray - Picloram** (potassium salt) 240 g/L SL; Access 240 SL (L4920), Browser 240 SL (L7357); 100ml / 10 Litres Water and 0.5% Wetter & Dye
Melia azedarach	3	Seedlings need to be hand pulled no herbicide recommended. Adults can be eradicated by the cut stump method or frilling using the herbicides indicated below. • **Clopyralid / triclopyr**; (-amine salt); 90 / 270 g/L SL; Confront 360 SL (L7314); 300ml / 10 Litres water and 0.5% Wetter & Dye • **Fluroxypyr / picloram**; 80 / 80 g/L ME Plenum 160 ME (L7702); 150ml / 10 Litres water and 0.5% Wetter & Dye • **Imazapyr** 100 g/L SL Chopper 100 SL (L3444), Hatchet 100 SL (L7409); 300ml / 10 Litres Water • **Picloram** (potassium salt) 240 g/L SL; Access 240 SL (L4920); 200ml / 10 Litres Water and 0.5% Wetter & Dye • **Triclopyr** (-amine salt); 360 g/L SL Timbrel 360 SL

Species	Category if applicable	Eradication method
		(L4917); 300ml / 10 Litres Water and 0.5% Wetter & Dye
Opuntia ficus indica	1	Injection by any of the following: • **Glyphosate (Ammonium);** 680 g/kg WG **;** Roundup Max 680 WG; (L6790) 3,300ml / 10 Litres water and 0.1% Dye • **Glyphosate (ammonium**); 680 g/kg WG Roundup Max 680 WG (L6790); 3,300ml / 10 Litres water and 0.1% Dye • **Glyphosate (ammonium**); 680 g/kg WG Roundup Max 680 WG (L6790;) 1,800ml / 10 Litres water and 0.1% Dye • **Glyphosate (ammonium);** 680 g/kg WG Roundup Max 680 WG (L6790); 2,200ml / 10 Litres water and 0.1% Dye • **Glyphosate (ammonium**); 680 g/kg WG Roundup Max 680 WG (L6790) 1,000ml / 2 Litres water
Cuscuta campestris	1	Cut and burn infected plants.
Pinus pinaster	2	Mature trees can be frilled: • glyphosate (sodium) 500 g/kg WG Kilo 500 WSG (L7431) Seedlings can be uprooted.
Asclepias fruticosa	N/A	Controlled by physical means when still young. No herbicide registrations.
Melinis repens	N/A	Pre-immergence herbicides
Eucalyptus camaldulensis	2	Seedlings can be hand pulled. Cut stump method can be applied to mature trees: • fluroxypyr / picloram 80 / 80 g/L ME Plenum 160 ME (L7702)
Prosopis spp.	2	Seedlings can be hand pulled. **Foliar spray:** clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL Confront 360 SL (L7314) 150ml / 10 Litres water and 0.5% Wetter & Dye **Foliar spray:** glyphosate (potassium) 500 g/L SL Touchdown Forte Hitech 500 SL adjuvant incl.(L7305) 500ml / 10 Litres water and 0.1% Dye **Cut stump/frilled with:** clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL Confront 360 SL (L7314) 400ml / 10 Litres water and 0.5% Wetter & Dye **Cut stump/frilled with**: triclopyr (butoxy ethyl ester) 240 g/L EC Ranger 240 EC adjuvant incl. (L6179) 800ml / 10 Litres water and 0.1% Dye **Cut stump/frilled with:** triclopyr (butoxy ethyl ester) 480 g/L EC Garlon 480 EC (L4916) 400ml / 10 Litres water and 0.5% Wetter & Dye **Cut stump/frilled with:** triclopyr (-amine salt) 360 g/L SL Lumberjack

Species	Category if applicable	Eradication method
		360 SL (L7295), Timbrel 360 SL (L4917) 500ml / 10 Litres Water and 2% Wetter & Dye
Agave americana & sisalana	2	**Direct inject:** MSMA 720g/L SL MSMA 720 SL (L7279) 2 ml / plant undiluted
Spartium junceum	1	The entire plant needs to be physically removed.
Pennisetum setaceum	1	Isolated plants can be removed manually. Industrial herbicides can be used for large stands.
Sesamum triphyllum	N/A	Preferably plants need to be controlled when still seedlings when they can be removed manually. Isoksaflutool is registered for the control of this species.
Verbesina encelioides	N/A	Mechanical control methods such as removal of flower heads or of the entire plant with taproot, mowing, etc. are suggested. Repetition of efforts is needed.
Morus nigra	3	Seedlings can be hand pulled. Cut stump treated with an herbicide.
Schinus molle	3	Cut stump treated with Triklopir - registered for the control of this species.
Nerium oleander	1	Chemical control is deemed the most effective. Cut stump method with suitable herbicide.
Cortaderia selloana	1	This invader is very difficult to control. Burning does not aid in eradication. Systemic herbicide is deemed the most effective, however follow-up treatment is necessary.

APPENDIX B

Table 6: Photographs of all identified alien and invader species.

Scientific name	Common name	Photograph
Melia azedarach	Syringa/Maksering	
Lantana camara	Common lantana/Lantana	
Pennisetum setaceum	Fountain grass/Pronkgras	
Melinis repens	Natal Red-top Natalse rooipluim	
Cuscuta campestris	Dodder	

v

Scientific name	Common name	Photograph
Pinus pinaster	Cluster pine Trosden	
Spartium junceum	Spanish broom	 en.wikipedia.org
Sesamum triphyllum	Wild sesame	 zimbabweflora.co.zw
Verbesina encelioides	Wild sunflower	
Morus nigra	Black mulberry	 trees-online.co.uk

Scientific name	Common name	Photograph
Eucalyptus camaldulensis	Red River gum	
Schinus molle	Pepper tree	 biologie.uni-regensburg.de
Prosopis glandulosa	Mesquite	 laspilitas.com
Agave americana	Sisal	 ag.arizona.edu
Opuntia ficus-indica	Sweet prickly pear	 digilander.libero.it

Scientific name	Common name	Photograph
Nerium oleander	Oleander	 en.wikipedia.org
Ipomoea indica	Morning glory	 st-andrews.ac.uk
Cortaderia selloana	Pampas grass	 en.wikipedia.org

APPENDIX 6: BRMO SALVAGE YARD – ENVIRONMENTAL OPERATIONAL PROCEDURE (ENV-S/UG-GN-005)

Salvage Yard – Environmental Operational Procedure

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Ensure that the Salvage Yard at Black Rock Mine Operations is controlled and operated in a manner that is not detrimental to the environment.

2. Related Documents and Forms

2.1. Occupational Health, Safety and Environmental Policy

2.2. SANS ISO 14001: 2004 (4.4.6)

2.3. Hazardous Substances Act, 1973 (Act No. 15 of 1973)

2.4. Environmental Conservation Act, 1989 (Act No. 73 of 1989)

2.5. DWAF Minimum Requirements for Waste Disposal by Landfill

2.6. DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste

2.7. DWAF Minimum Requirements for Monitoring at Waste Management Facilities

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

2.9. National Water Act (Act 36 of 1998)

2.10. Access Control Forms

2.11. Waste Manifests

2.12. Safe Disposal Certificate

2.13. Waste Monitoring Reports

2.14. Environmental Incident/Non-conformance Reports

2.15. PROCEDURE: Salvage Yard - GEN-S-GN-002

2.16. Salvage Commercial Forms as per Salvage Procedure

3. General

3.1. This procedure is applicable to the Black Rock Mine Operations Salvage Yard, which includes the area designated for temporary storage of hazardous waste. This procedure applies to the management, sorting, stacking and piling of recyclable materials as well as the separation of Hazardous and Non Hazardous waste

3.2. The responsibility for the implementation and compliance to this procedure lies with the following all the sections and individuals utilizing the Salvage Yard.

3.3. DEFINITIONS

- **Hazardous Waste:** is waste which can, even in low concentrations, have a significant adverse effect on public health and/or the environment. This is on account of its' inherent chemical and physical characteristics such as toxicity, ignitibility, corrosiveness, carcinogenic, and other properties.
- **General Waste:** is the generic term for waste that, because of its composition and characteristics, does not pose a significant threat to public health or the environment if properly managed.
- **Recyclable Material:** is material that maybe offered on tender to interested parties, which is deemed not to be hazardous.

4. Description of Procedure

4.1. The different sections will deliver recyclable/salvageable material and hazardous waste to the Salvage Yard during normal working hours.

4.2. As access to the Salvage Yard is strictly controlled, a register is to be completed upon entry.

4.3. The Salvage Yard Supervisor/designate will indicate the area where hazardous waste or recyclable/salvageable material is to be off-loaded.

4.4. The Salvage Yard Supervisor/designate will report all non-compliances and incidents of environmental nature to the Environmental Management Section.

4.5. The Salvage Yard Supervisor/designate will ensure that the non-hazardous waste is separated into recyclable material and waste that must leave the mine. The recyclable material must be stacked neatly so that the tender process may follow.

4.6. The Salvage Yard Supervisor/designate will label all the hazardous waste, indicating the date of receipt, type and volume.

4.7. The Salvage Yard Supervisor/designate will ensure that the hazardous waste is sent to a H:H registered waste disposal site within a period of 90-days.

4.8. The Salvage Yard Supervisor/designate will inform the Environmental Officer when the hazardous waste is due for off-site disposal, the Environmental Officer will contact the outsourced Waste Contractor, and have the hazardous waste removed and disposed at a registered H:H Waste disposal facility, and ensure that the Waste Manifest and Certificate of Safe Disposal are received by the mine.

APPENDIX 7: BRMO ENVIRONMENTAL OPERATIONAL PROCEDURE FOR THE USE OF HERBICIDES AND PESTICIDES (ENV-S/UG-GN-003)

The Use of Herbicides and Pesticides

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Ensure safe handling, application and disposal of pesticides at Black Rock Mine Operations.

2. Related Documents and Forms

2.1. Department of Water Affairs Working for Water Policy on the use of herbicides for the control of alien vegetation

2.2. Conservation of Agricultural Resources Act, CARA 1983 (Act 43 of 1983)

2.3. National Environmental Management Act (Act 107 of 1998)

2.4. PROCEDURE: Waste Management – ISO-14001-WastD-01-1-2

2.5. PROCEDURE: Hazardous Substances Handling – Env-S/UG-GN-004

2.6. Black Rock Emergency Telephone List

2.7. Black Rock Emergency Telephone Numbers and Addresses

3. General

3.1. This procedure applies to all areas on the mine, including mine perimeter and plant areas, where pesticides are applied.

3.2. It is the responsibility of the Environmental Specialist/Designate to ensure adherence to this procedure where pesticides are used, handled, stored and/or disposed of.

3.3. DEFINITIONS

Pesticides: Pesticides is a collective term for Herbicides, Insecticides, Fungicides, etc.

Herbicides: Herbicides is a chemical mixture, which contains an active ingredient to eradicate weeds.

4. Description of Procedure

4.1. Selection of pesticides to be used

- Determine the type of pest or weeds that needs to be controlled, and the specific pesticide to be used for control.
- The pesticide must be registered under Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No.36 of 1947).
- Obtain a Material Safety Data Sheet for the pesticide.

4.2. Operator Safety

- All measures must be taken to ensure operators safety and label recommendations regarding safety are strictly observed. The following gives the toxicity rating according to the label colour band:
  - Green Acute hazard unlikely in normal
  - Blue Slightly hazard – caution
  - Yellow Moderately hazardous – harmful
  - Red Toxic to very toxic

4.3. Operators Training

- Basic pesticide awareness
- Safe handling of concentrates and spray mixtures, toxicity of the pesticides, protective clothing and safe disposal
- Application techniques to prevent waste
- Care of equipment – cleaning and disposal of washings.

4.4. Personal Protective Equipment (PPE)

- Always read the product label to determine what specific protective equipment is required for handling and application of a product.
- The minimum requirements when handling pesticides are:
  - Adequate eye protection, goggles or a full-face shield.
  - Rubber gloves and boots
  - Aprons to protect working clothes
  - Head protection
  - Respirator or face-mask

4.5. Environmental Safety

- Only pesticides with least environmental impact should be used.
- Precaution should be taken to ensure that these products are safely stored, handled, applied and disposed.

- During the application, damage to indigenous or other desirable vegetation product should be observed.
- Care must be taken to prevent contamination of water bodies.

4.6. Handling

- Strict precautions should be applied when handling pesticides and the personnel handling the product must be fully aware of the precautions observed.

4.7. Spillages

- Absorbent materials must be available during the process to handle accidental spillages.
- In case of spillage, the spill must be contained immediately with absorbent.
- The contaminated material should then be disposed of as hazardous waste
- Concentrates and mixtures should never be decanted into or be mixed in drinking bottles or other food containers.
- All containers into which pesticides are decanted must be clearly marked and a copy of the original label secured to the container.

4.8. Disposal

- Pesticides empty containers should be treated as hazardous waste and correctly and safely disposed (see waste management procedure)
- All contaminated material must be paled in a sealable container marked with the following words e.g. “Pesticide/Toxic”.
- Contaminated soil must be dug up and placed into a suitable container and sealed.
- The container must be stored in a designated area, along with all other hazardous waste (See: Waste Management Procedure)

APPENDIX 8: BRMO BUND WALL PROCEDURE (ENV-S/UG-GN-002)

Bund Walls

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Ensure that all bund walls are constructed to a specific standard in order to prevent pollution of soil and water resources.

2. Related Documents and Forms

2.1. National Environmental Management: Waste Act (Act 59 of 2008)

2.2. Mineral and Petroleum Resources Development Act (Act 28 of 2002)

2.3. National Environmental Management Act (Act 107 of 1998)

2.4. National Water Act, 1998 (Act 36, 1998)

2.5. Hazardous Substances Act, 1973 (Act 15, 1973)

2.6. Hazardous Chemical Substances Regulations, 1995

3. General

3.1. This procedure applies to all areas on the mine, where bund walls may be deemed necessary

3.2. It is the responsibility of the Section Supervisors to ensure adherence to this procedure in their area(s) of responsibility.

3.3. DEFINITIONS

- Environment: the surroundings in which the mine operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation.

- Environmental Aspects: components of the mine's activities or products or services that can interact with the environment.
- Environmental Impact: any change to the environment, whether adverse or beneficial, wholly or partially resulting from the mines environmental aspects.
- Environmental Management Systems(EMS): the part of the overall management system that includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy.

3.4. SPECIFICATIONS FOR BUND WALLS

All Bund walls will have the following specifications:

- The bund walls must be able to contain at least the volume of the largest container and an additional 10% of the largest container in the bunded area.
- The total capacity of the bund wall must be displayed on the bund wall or on the fence if the bunded area is fenced.
- It must be constructed from cast concrete with pinning steel, or from bricks (plastered inside) or made from an impermeable material.
- It must have a draining valve at the lowest point of the bunded area; the draining valve must be closed and if lockable, be locked at all times.
- An emergency container and pump must be readily available at a commonly-known location.
- Where practical/ necessary, the bund wall must have protective barriers to prevent vehicles from colliding with the walls and damaging it.
- No pipes or cables should run through the bund walls, except drainage pipes. As far as possible, all flanges, pipe fittings, valves and pumps etc. of the tank and the dispensing system should be situated well within the bund wall.
- Storage areas that must be accessible with forklifts must be constructed in such a way that a ramp will allow access and still contain spillage.
- Only galvanized steel pipes may be used for drainage. No rubber, plastic or PVC pipes will be allowed.

4. *Description of Procedure*

4.1. Demarcation of Bund Walls

Responsible Person:

- Calculate the volume of the bund wall.
- Prepare a conspicuous display mechanism i.e. a metal/ plastic plate, laminated sheet or painted on the bund wall
- Attach the display mechanism in such a manner that the integrity of the bund wall will not be jeopardised.
- Ensure that only the volume of liquid that the bund wall is designed for is kept in the bund wall.

4.2. Cleaning of Bunded Areas

Responsible Persons:

- Pumps or drains contaminated water from bunded areas into a container.
- Cleans the contaminated area with the appropriated absorbent in the case of spillage.

- Disposes contaminated water at a wash bay where an oil separator is functional.
- Salvage and recycles any oil / fuel spilled inside the bund wall as far as possible.
- Disposes any absorbent material or polluted soil as hazardous waste.
- Empties drip trays regularly and stores them inside the bunded area.
- Ensures that no chemical, oil or fuel is present in the water before releases rain water from the bund wall.
- Ensures that the valves on the bund walls are closed/locked at all times.

4.3. Inspection of Bund Walls

Responsible Person:

- Checks on permeability, cracks and pollution of adjacent areas during regular inspection of bund walls.
- Schedules inspections on Maximo.
- All newly constructed bund walls are to be inspected and signed off in terms of the integrity and capacity of the installation by the responsible Engineer.

APPENDIX 9: BRMO WASTE OIL ENVIRONMENTAL PROCEDURE (ENV-S/UG-GN-001)

Old Oil Management

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Provide guidelines for correct handling and disposal of used oil at Black Rock Mine Operations.
- Identify the roles and responsibilities for the transportation and maintenance of the used oil disposal facilities.
- Prevent the pollution of land and water with oil.

2. Related Documents and Forms

2.1. National Environmental Management Act

2.2. National Environmental Management: Waste Act

2.3. Hazardous Substances Act

2.4. SANS 10131:2004 Standard

2.5. ARM Corporate Standard on Waste Management

2.6. FORM: Old Oil Management

2.7. PROCEDURE: Non-conformance, Corrective and Preventative Actions – ISO-14001-PRO-03-2

2.8. PROCEDURE: Waste Management – ISO-14001-WasteD-01-1-2

2.9. PROCEDURE: Bund Wall – Env-S/UG-GN-002

3. General

3.1. Used oil may only be disposed of in the following manner:-

3.1.1. Used oil "in transit" will be conveyed in the following containers:

Surface

- In 210 litre drums between the collection point and the Workshops.
- In containers carried from the Shaft to the old oil storage tank at Nchwaning 2.

Underground

- In used oil containers such as 210litre drums between the collection points and Surface.

NOTE: All lubricant containers and storage areas for lubricants must comply with the following standards:

- Storage areas must be bunded according to the SANS specification to contain 110 % of the volume of the storage capacity of containers and must be impervious to fuel and oil.
- The storage area must not present a fire hazard to other facilities or structures.
- Oil drums must not leak and caps must be securely fitted.
- Measures must be taken to prevent the overfilling of containers.

3.2. RESPONSIBILITY

3.2.1. Areas for Maintenance and Persons Responsible

Underground Workshops

- The Engineering Foreman of each Underground Workshop must ensure that the oil separators and the sumps of oily water separators are always in good working order and that all used oil is pumped to the designated used oil containers.

4. Description of Procedure

4.1. Surface

4.1.1. Used oil disposal on Surface

- All the used oil on surface is to be drained into a container and emptied into 210 litre drums posted at various locations and clearly marked for this purpose.
- All the used oil collected at the oil traps and sumps is to be pumped into 210 litre drums marked for this purpose.
- When these drums are full, the responsible Artisan is to ensure that they are taken to the old oil bay at Nchwaning 2 and placed at the designated storage area to be pumped out.
- Empty drums must replace the full drums that are removed from the oil disposal points.
- All personnel must be familiar with the old/used oil disposal system and must know where the disposal points are situated.
- Empty drums that are not in use may be stored at the hazardous storage area at the Salvage Yard.

4.2. Underground

4.2.1. Used oil removal procedures for Underground Workshops

- No oil shall be allowed to run into any water drain. The responsible Foreman and Artisans are to ensure that all oil drained from machines during maintenance is to be

disposed of into 210 litre drums which eventually report to surface. Oil spillage occurring during machine repairs and breakdowns in service bays must be absorbed with fibre and the workshop floor cleaned with a biological degreaser where possible. Under no circumstances must oil be deposited on the footwall or poured into the drains or water passes underground. Any vessel that contains old oil must be sealed so that accidental spillage cannot occur if the container is disturbed.

- Old oil must be taken to the old oil storage tank at Nchwaning 2.
- At this facility oil must then be transferred into the used oil storage tank. Spillage must be caught in a drip tray.

4.3. Transformer Oil

4.3.1. As a standard, no PCB containing insulating oil is to be used in transformers and as a rule, should not contain PCBs. If transformer oil has to be disposed of, a sample will be taken for PCB testing. If the results indicate that the oil is PCB free it will be taken for testing. If the results indicate that the oil is PCB free it will be taken in 210litre drums to a designated area at the Nchwaning2 where it will be pumped into the used oil storage.

4.3.2. If the transformer oil contains PCBs, i.e. if the levels exceed 50 ppm it cannot be disposed of through the old oil system. PCB contaminated oil must be securely contained in labeled 210litre drums and taken by the Electrical Foreman to the hazardous waste storage area at the Salvage Yard. The Environmental Officer must be informed so that arrangements can be made for its safe, off-site disposal.

4.4. Oil Disposal Facility Procedure

4.4.1. Old oil must be sent to an old oil facility at Nchwaning 2.

4.4.2. The oil must then be transferred from the used oil storage tank into the used oil cassette. Spillage must be caught in a drip tray.

4.5. Oil Spill Clean-up Procedure

4.5.1. All spills must be reported to the Environmental Management Section. The method used to clean up an oil spill depends on the type of surface that has been contaminated. The main objective is to prevent the spreading of the oil, recovery of oil where possible, clean up and if necessary rehabilitation of the area.

4.5.2. Personnel handling oil must use gloves and eye protection. Personnel must have training in spill management.

4.5.3. Method used to contain and clean up oil spills on a concrete surface.

- Absorbent Booms should be used to contain a large spill and excess oil must be pumped or scooped up into old oil containers. Loose Fibre should be used on any concrete floor where a small-uncontained spill has occurred. The used fibre or booms should be stored in a 210 litre drum marked for this purpose and reused where possible. Avoid the use of chemicals to absorb/emulsify oil.
- The used fibre and fibre booms, together with oily rags may be disposed of in a drum marked for this purpose and sent to the Salvage Yard. Do not mix oil-contaminated fibre or other oil contaminated materials with any other wastes.
- Concrete floors should be washed with a Biological Degreaser to remove the oil stains.

4.6. Clean-up of Oil Spills on Land

4.6.1. Spills on land should be contained as quickly as possible with earth walls or absorbent booms. Excess oil can be deflected onto plastic sheeting to minimise infiltration into the ground. Contaminated soil should be removed and placed in 210litre drums and removed to the designated area at the Salvage Yard.

4.6.2. On site bioremediation can be carried out in an approved manner. Bioremediation Powders are powders containing microbes, and are used to bio-remediate contaminated soil.

4.7. Records

4.7.1. Records of used oil disposal must to be kept by Materials Manager and by each Section that makes use of the old oil disposal system.

14. APPENDIX 10: BRMO SPILL MANAGEMENT ENVIRONMENTAL PROCEDURE (ENV-S/UG-GN-016)

Spill Management

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Ensure that spills are handled in an appropriate manner in order to minimise the environmental impact and rectify the damage done to the environment.

2. Related Documents and Forms

2.1. SHE Incident/Accident Reporting Booklet

2.2. Black Rock Mine Operations' Occupational Health, Safety & Environmental Policy

2.3. Hazardous Substances Act, 1973 (Act No. 36 of 1973).

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

2.5. PROCEDURE: Hazardous Substances Handling Procedure - PRO-SHERQ-Env-S/UG-GN-004

2.6. PROCEDURE: Non-conformance, Corrective and Preventative Actions – ISO14001-PRO-03-2

2.7. PROCEDURE: Waste Management - PRO-SHERQ-Env-S/UG-GN-0012

3. General

3.1. This procedure applies to all areas Black Rock Mine Operations which are considered to have been disturbed by the mining activities.

3.2. RESPONSIBILITY

- It is the responsibility of all employees working at Black Rock Mine Operations to handle spills that may cause environmental impacts in accordance with this procedure and report via the prescribed incidents/non-conformance form or Electronic Management System.

- It is the responsibility of all supervisors to ensure that remedial steps are taken to rectify the damage caused to the environment in their area of responsibility and to report back on the Electronic Management System.
- The supervisors responsible in that area must in conjunction with the Environmental Specialist formulate sustainable solutions to prevent re-occurrences of such incidents.
- It is the responsibility of the Environmental Specialist to evaluate the success of the remedial action taken on significant spills and to record the results on the Electronic Management System.

3.3. DEFINITIONS

Environment: the surroundings in which the mine operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation.

Environmental aspects: components of the mine's activities or products or services that can interact with the environment.

Environmental impact: any change to the environment, whether adverse or beneficial, wholly or partially resulting from the mines environmental aspects.

Environmental Management System (EMS): the part of the overall management system that includes the organisation structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy.

4. Description of Procedure

4.1. All spillages must be reported and attended to.

4.2. Should a spill occur, the person responsible/ discovering the spill should take the necessary step to contain the spill in order to minimise the area that will be affected.

4.3. Once contained, the spill should be cleaned up in a manner appropriate to the spill, if uncertain refer to the Safety Data Sheet for the fluid spilled.

4.4. Spills on an impermeable surface can be mopped up with a suitable absorbent material e.g. organic fibre; reusable absorbent pads or any other suitable absorbent material. If a reusable absorbent material is used this should be stored in a drum kept for this purpose until its life is exhausted. Once the absorbent material has reached the end of its life it should be disposed of in the hazardous waste bins and not discarded with general waste. It is important that the used absorbent is placed in a box/packet/container before placed into the hazardous waste drum.

4.5. Should an oil, fuel or lubricant spill occur on a permeable surface (i.e. ground/soil) the area is to be remediated on site by the person responsible for the spill. If is not practical to remediate the site, as much of the contaminated soil as possible must be lifted and removed to the Salvage Yard hazardous waste temporary storage for disposal. The site of the spill should be treated with suitable bioremediation product in accordance with the manufacturer's instructions. The principle of "polluter pays" will be adopted with regard to the clean-up and disposal costs incurred.

4.6. Should any other spill occur the spill must be cleaned up and the polluted waste and/or soil deposited in a hazardous waste bin or suitable container clearly labeled with contents. This container must be sent to the hazardous waste transfer site for correct disposal according to the substance spilled.

4.7. Oil spills which occur on water may be contained with fibre booms and mopped up with a suitable product (e.g. absorbent cushions) that float on top of the water and absorbs the oil. The used fibre booms and pillows should be disposed of at demarcated contamination site.

4.8. If harmful substances, other than oil, fuel or lubricant, are spilled into water the contaminated water must be contained and pumped to where it can either rectify or disposed correctly.

4.9. Spill kits are provided in the various sections of the mine to assist with the cleaning of spillages.

4.10. The re-filling of spill kits is the responsibility of the employee who uses the kit.

4.11. Purchase Requisitions must be completed and the absorbent must then be fetched from stores.

4.12. Each section/department is responsible for the care of their spill kits.

15. APPENDIX 11: BRMO WASTE MANAGEMENT ENVIRONMENTAL PROCEDURE (ENV-S/UG-GN-0012)

Waste Management

Table of Contents

1. Purpose

The purpose of this procedure is to:

- Establish minimum control measures to be implemented to ensure waste management complies with the applicable environmental laws from inception of the waste stream to final disposal. The procedure provides for control measures for the handling, storage and disposal of waste on and off site, as well as for the operation of the general waste landfill site.

2. Related Documents and Forms

2.1. Occupational Health and Safety Act (Act No. 85 of 1993, as amended)

2.2. National Water Act (Act No. 36 of 1998, as amended)

2.3. Minerals Petroleum Resources Development Act, (Act 28 of 2002)

2.4. Mine Health and Safety Act (Act 29 of 1996)

2.5. National Environmental Management Act (Act 107 of 1998)

2.6. National Environmental Management: Waste Act (Act 59 of 2008)

2.7. The Constitution (Act 108 of 1996)

2.8. Environment Conservation Act Transitional Provisions (Repealed, but mine has a s.20 permit)

2.9. Assmang Black Rock Mine Operations Occupational Health, Safety and Environmental Policy

2.10. FORM: Landfill Site Register

2.11. FORM: Old Oil Management

2.12. PROCEDURE: Old Oil Management – Env-S/UG-GN-0001

2.13. PROCEDURE: Safe handling and processing of products containing Asbestos – Env--S/UG-GN-0011

2.14. PROCEDURE: Disposal of Empty Containers and Storage of Full Containers – Env-S/UG-GN-0013

2.15. Department of Water Affairs & Forestry, 1994. Waste Management Series. Minimum Requirements for the Handling and Disposal of Hazardous Waste.

2.16. Department of Water Affairs & Forestry, 1994. Waste Management Series. Minimum Requirements for Waste Disposal by Landfill.

2.17. Department of Water Affairs & Forestry, 1994. Waste Management Series. Minimum Requirements for the Monitoring at Waste management Facilities.

2.18. PERMIT: Black Rock Landfill Site Permit, issued in terms of Section 20 of the Environmental Conservation Act

3. General

3.1. This procedure covers the disposal of all waste as defined and it applies to all parties using any of the waste handling or waste disposal facilities described in the procedure.

3.2. DEFINITIONS

3.2.1. Operator

The person / party responsible for operating the disposal area and where enquiries may be made about the acceptability of waste at that site.

3.2.2. Waste (Definition based on National Environmental Management: Waste Act (Act 59 of 2008)

"waste" means any substance, whether or not that substance can be reduced, re-used, recycled and recovered—

(a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of; 30

(b) which the generator has no further use of for (he purposes of production;

(c) that must be treated or disposed of; or

(d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but—

(i) a by-product is not considered waste; and 35

(ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste;

3.2.3. Waste Producer

The legally appointed person for the area is responsible for the waste produced in the area and the responsible handling and / or disposal thereof.

3.2.4. Waste Transporter /Collector

The contractor contracted to collect, transport and dispose the waste at the designated site

3.2.5. Waste Disposal facility

It means any site or premise used for the accumulation of waste with the purpose of disposing of that waste at that site or on that premise.

3.2.6. Waste Management Activity

It means any activity listed in Schedule 1 or 40 published by notice in the Gazette under section 19, and includes:

- the importation and exportation of waste
- the generation of waste, including the undertaking of any activity or process that is likely to result in the generation of waste
- the accumulation and storage of waste
- the collection and handling of waste
- the reduction, re-use, recycling and recovery of waste
- the trading in waste
- the transportation of waste
- the transfer of waste
- the treatment of waste
- the disposal of waste

4. Description of Procedure

4.1. Minimum Requirements

Waste management for Black Rock Mine Operations is divided into various sections for the application of this procedure. This division is based on the state of the waste (re-cyclable or not), the hazard classification as well as the available disposal areas.

The division may be summarised as follows (please contact the Black Rock Mine Operations Environmental Specialist if the waste is not described below):

Waste description	Waste classification	Disposal area
Aluminium oxide	Non hazardous	Landfill Site
Asbestos waste	Hazardous	As per Asbestos procedure.
Batteries: lead Acid (big), battery acids / electrolytes	Recyclable	As per Battery Disposal work instruction
Batteries: NiCad and lead acid	Hazardous	Special container at Strip and Quote workshop - Final destination class H-H site
Building rubble and cement	General	Landfill Site
Bulk paint containers, aerosol cans	Hazardous	Salvage yard - Final destination class H-H site
Carton / cardboard	General	Landfill Site
Computer equipment	Recyclable	Salvage Yard
Conveyor belting (big and small pieces)	Recyclable	Salvage Yard
Domestic, household, office and garden waste	General	Landfill Site
Drums containing used oil	Recyclable	Drums to be emptied at Black Rock Workshop storage tank. Drums to Salvage yard.
Electrical cables	Recyclable	Salvage Yard
Empty containers and Drums	Possibly hazardous / Recyclable	Salvage Yard as per Disposal of Empty Containers and Storage of Full Containers work instruction
Fluorescent lights	Hazardous	Special container – Final destination class H-H site
Instrumentation and related equipment	Recyclable	Salvage Yard
Insulation material (excluding asbestos containing material)		Landfill Site
Manganese Dust	Non hazardous	Landfill Site
Medical waste (All related waste e.g. bandages)	Hazardous	As per Medical Waste procedure EP 01-1-4
Mercury containing waste	Hazardous	Encapsulation at a class H-H site
Metals: reclaimable precious and base metals and	Recyclable	Salvage Yard

Waste description	Waste classification	Disposal area
material		
Metals: Scrap metal	Recyclable	Salvage Yard
Obsolete operating material and assets	Recyclable	Salvage Yard
Oil - used	Recyclable	
Paint – “wet” paint(can be in containers) and bulk paint (can be paint containers)	Hazardous	Salvage yard Final destination Class H-H site
Paint – empty and dry in small quantities		Landfill Site
Plastics	Recyclable	Landfill Site
Putrescible organic waste from hostel and single quarters	Hazardous	Sill storage area at hostel
Reclaimable oil	Recyclable	Black rock Workshop storage tank
Slimes	Non-Hazardous	Slimes dams
Sludge: sewerage or activated	Non-Hazardous	Landfill Site
Soil: natural excavated material and top soil		Rehabilitation area
Toxic, ignitable, corrosive, carcinogenic and poisonous process waste and heavy metals (Cobalt, Nickel, Mercury, Vanadium, Lead, etc – un recyclable), chemical waste	Hazardous	Salvage yard Final destination Class H-H site
Tyres: motor vehicles	Recyclable	Salvage yard
Wood	Recyclable	Salvage Yard
Wood	General	Landfill Site

The types of waste indicated give a broad synopsis of the types of acceptable waste at various disposal areas. See Annexures A to C for more details as well as guidelines for the use of the disposal areas. This list is not static owing to changing needs and products e.g. lubricants, flocculent, etc. Assmang Black Rock Mine Operations does not have a Class H-H dumping sites and shall make use of a licensed class H-H site where required.

4.1.1. Waste must be dumped at the applicable identified site. Sites for final disposal may not be used without the required permits. As all bins for general waste are taken to the Landfill Site the waste producer must ensure that only waste permitted at the Landfill Site is in the general waste bin.

4.1.2. The Assmang Black Rock Mine Operations Environmental Specialist shall monitor and report on subterranean water and the surface water.

4.1.3. Records must be kept in accordance with the conditions of the permit(s) for the waste site, and in cases where the site is not operated by Assmang, Black Rock Mine Operations such records must be furnished to the Assmang Black Rock Mine Operations Environmental Specialist six-monthly.

4.1.4. Should a waste producer be in doubt regarding the classification or suitable practices for the dumping of any specific waste material, it remains the responsibility of the waste producer to ensure that the waste is dealt with correctly. Information regarding handling and dumping facilities is available from the Environmental Specialist.

4.1.5. No person may remove any item from any disposal area, unless the responsible Engineer has given written approval for such removal. Contracts will be awarded according to normal commercial procedures for recycling at the disposal area. The Salvage Yard Supervisor

must keep records of the volume and nature of the recycled waste in accordance to the permit conditions.

4.1.6. Records of all safe disposal certificates from a Class H-H disposal site will be kept by the Environmental Specialist.

4.1.7. Waste bins from the different sections should be clearly marked with the section name and number to ensure gate control at the Landfill Site.

4.1.8. The Landfill Site operational times are from 06h30 to 15h30 during weekdays (Mondays to Thursdays), from 06h30 to 12h45 (Fridays) and from 06h30 to 14h00. The site will be closed on Sundays.

4.1.9. Requests to re-use/recycle materials dumped in the Landfill Site will be lodged to the Environmental Specialist. The Landfill Site Operator will be notified by the Environmental Specialist of such request and a Logbook will be kept (detailing all materials removed from the Landfill Site).

4.1.10. A documented waste inventory shall be compiled and kept. Such an inventory shall reflect each waste stream, the source/location, volume, hazardous nature, temporary storage requirements, waste minimisation measures considered (e.g. re-used/recycling), disposal option (e.g. landfill, incineration), contractor disposal and other special requirement, e.g. transportation or treatment. The inventory shall include all/any waste generated by contractors or service providers.

4.1.11. Authorisations for waste management activities shall be obtained.

4.1.12. Reasonable measures shall be implemented to avoid the generation of waste and if not possible, minimise the quantity and any toxicity. Steps will be undertaken to reduce, re-use, recycle and recover waste. Records of the investigations into the avoidance or minimisation of the landfill options shall be kept.

4.1.13. Employees shall be trained on the basic principles of waste management to ensure effective implementation of the principles contained in this procedure.

ANNEXURE C

Salvage Yard

1. LOCATION

Black Rock Salvage Yard

2 OPERATOR

Black Rock Mine Operations Engineering Department

3 TYPES OF WASTE

Accepted Types of Waste	Types of Waste not Accepted
All types of metal	Building materials
Conveyor belting	Household, office and general waste
Empty steel and plastic drums/containers	Drums containing used oil
Motor vehicle tyres	As listed in paragraph 3's table
Computer equipment	
Instrumentation and related equipment	
Electrical cables	
Plastics	
Wood	
Precious metals (see Annexure D)	
Obsolete operating material, such as:	
Furniture, Housing units, Operating machinery	
Vehicles	
Lead acid and Ni Cad batteries	
Fluorescent tubes	

4 PROCEDURE

The procedure should be fully supported by a commercial work instruction. The procedure can be summarised as follows.

4.1 It is the responsibility of the waste producer to declare the material as scrap.

4.2 Material declared as scrap must be pre-classified in the waste producer's area of responsibility. The classification is quoted in 4.5 below for convenience sake.

4.3 Empty drums must be cleaned in the waste producer's area of responsibility in accordance with Disposal of Empty containers and Storage of Full Containers work instruction before being presented to the Scrap Reclamation Yard.

4.4 If the requirements of paragraphs 4.2 and 4.3 are not adhered to, the official in charge of the Salvage Yard has the right to return the waste to the waste producer at his cost.

4.5 Classification of scrap

- Aluminium
- Brass
- Copper
- Electrical cables
- Empty 210 litre drums (plastic)
- Empty 210 litre drums (steel)
- Instruments
- Steel, grades A to E (solid)
- Steel, subgrade
- Steel, stainless

ANNEXURE D

Precious Metals

1 Assmang Black Rock Mine Operations has no facilities for reclaiming precious metals. This type of waste is, therefore, sold under contract. Waste precious metals are collected at the Salvage Yard and sold.

2 Line managers must create internal procedures and control measures to ensure that the company does not lose precious metals in their areas of responsibility when such metals have served their purpose. The Salvage Yard must create procedures and control systems to ensure that waste precious metals delivered at the Salvage Yard will be stored safely until it is sold. Safety risks for the storage of for example magnesium must be taken into account.

3 TYPES OF WASTE

Accepted Types of Waste	Types of Waste not Accepted
Gold (e.g. printed circuit boards) Platinum wire and rods Silver (e.g. old X ray photos and photographic films. Tungsten (fine or pieces, e.g. from machining and from broken machine tool bits) Fine magnesium or blocks of magnesium (e.g. cuttings and spent anodes) Stainless or mild steel Copper, Brass, Bronze and Aluminium	As listed in the table under paragraph 3

4 PROCEDURE

4.1 The waste producer must declare precious metals as scrap.

4.2 Scrapped precious metals must be placed in suitable containers in accordance with the accepted control method. Producers of magnesium waste must adhere to the directives of the magnesium code on the packaging of magnesium waste.

4.3 The official in charge of the Salvage Yard shall acknowledge receipt of the consignment.

ANNEXURE E

Class H-H Dumping Sites

1 LOCATION

Assmang Black Rock Mine Operations does not have a Class H-H dumping site at its disposal. These sites are normally used for hazardous waste only and are subject to very strict control.

2 OPERATOR

Class H-H dumping sites are operated by companies who have been screened by the Department of Environmental Affairs on the basis of proven control methods.

3. TYPES OF WASTE

Accepted Types of Waste	Types of Waste not Accepted
Toxic, hazardous and poisonous process, laboratory and medical waste Contaminating waste	Household, office and general waste Re workable waste Reclaimable waste Precious metals

4 PROCEDURE

4.1 Each line manager / waste producer is responsible to be conversant with the grade of the waste that is generated in his area of responsibility and, with the assistance of knowledgeable persons, to prescribe procedures for the handling of hazardous, poisonous and toxic waste.

4.3 Since Assmang Black Rock Mine Operations does not have the facilities for dumping this type of waste, the Environmental Specialist must enter into a contract with the operator of a Class H-H dumping site for the removal and disposal of the waste referred to.

4.3 Line managers must take care that waste that is acceptable at the Landfill Site is not dispatched to a Class H-H site, as the operators of Class H-H sites charge a high rate for the use of their sites.

4.4 Assmang Black Rock Mine Operations shall negotiate a contract to remove and dispose **fluorescent tubes**. These lamps contain mercury and must, therefore, be dumped on a Class H-H site.

4.4.1 Each area replacing fluorescent tubes must collect the old tubes and place them in supplied containers. All the pieces of broken fluorescent tubes must be swept up and placed into a strong plastic bag and the bag must be sealed tightly. Persons handling fluorescent tubes must wear a suitable dust mask, plastic gloves and overalls as preventive protection from exposure to mercury and mercury vapours in case the tubes break.

4.4.2 The areas collecting used tubes as mentioned above, must dispose the tubes as regularly as good housekeeping requires in the container belonging to the operator of a Class H-H site. The Environmental Management Section will keep records of the number of containers, as well as of the waste producer and arrangement for removal of these containers by the operator of the Class H-H site.

ANNEXURE E

Waste Disposal Guide

AREA	WASTE GENERATED	COLLECTION METHOD	DISPOSAL METHOD	RESPONSIBLE PERSON
Black Rock Hostel	Domestic	Waste Bins	Weekly (Approved site)	Hostel Manager
	Cooking Oil	Drums	As per Man. Instruction	Hostel Manager
Security Dept	Domestic	Waste Bins	Weekly (Approved site)	Security Officer
Clinic	Needles	Sealed container	Collected by approved contractor	Nurse in charge
	Swabs	Sealed container	Collected by approved contractor	Nurse in charge
	Syringes	Sealed container	Collected by approved contractor	Nurse in charge
	Bandages	Sealed container	Collected by approved contractor	Nurse in charge
	Plastic	Waste Bins	Weekly (Approved site)	Nurse in charge
	Radio Active waste	Waste Bins	Annually (Approved site)	Nurse in charge
	Domestic	Waste Bins	Weekly (Approved site)	Nurse in charge
Administration Offices (Gloria, Nchwaning and Black Rock)	Domestic	Waste Bins	Weekly (Approved site)	Foreman
Mechanical Workshops	Domestic	Waste Bins	Weekly (Approved site)	Foreman
	Cable	Salvage yard	As per existing contract	Foreman
Mechanical Workshops	Slings	Salvage yard	As per existing contract	Foreman
	Chains	Salvage yard	As per existing contract	Foreman
	Motors	Salvage yard	As per existing contract	Foreman
	Scrap metal	Salvage yard	As per existing contract	Foreman
	Plastic/cardboard packaging	Waste Bins as for domestic	As per existing contract	

AREA	WASTE GENERATED	COLLECTION METHOD	DISPOSAL METHOD	RESPONSIBLE PERSON
	Wooden packaging	Salvage yard	As per existing contract	Foreman
	Drums	Salvage yard	As per existing contract	Foreman
	Used oil	Transfer to marked container	Approved contractor (OILKOR)	Foreman
	Used oil and petrol/diesel filters	Transfer to marked container	As per existing contract	Foreman
	Used air filters	Domestic waste	As per existing contract	Foreman
Electrical workshops	Domestic	Waste Bins	Weekly (Approved site)	Foreman
	Scrap cable	Salvage yard	As per existing contract	Foreman
Electrical workshops	Electrical motors/Air conditioners	Salvage yard	Sell to successful tenderer	Foreman
	Cable plastic/rubber/plastic and cardboard packaging	Weekly (Approved site)I	As per existing contract	Foreman
	Motors	Salvage yard	Sell to successful tenderer	Foreman
	Scrap metal	Salvage yard	As per existing contract	Foreman
	Fluorescent tubes	Crushed and drummed. Marked as such	As per existing contract	
	Sodium/mercury vapour lamps	Crushed and drummed. Marked as such	As per existing contract	Foreman
Sewage plant – Nchwaning/Black Rock	Effluent water	Pump to water recovery dams	Utilise on sports grounds	Engineering Foreman
	Dried sludge	Collect in drying beds	To be disposed as Hazardous Waste	Environmental Specialist
Sewage Plant - Gloria	Effluent water	Pump to storage dams	Utilise in plant and on roads for dust allaying purposes	Environmental Specialist
	Dried sludge	Collect in drying beds	to be disposed as Hazardous Waste	Environmental Specialist

AREA	WASTE GENERATED	COLLECTION METHOD	DISPOSAL METHOD	RESPONSIBLE PERSON
Villages- Nchwaning, Schoonspuit and District Six	Domestic	Waste Bins as for domestic	Weekly(Approved site)	Foreman
	Garden	Waste Bins as for domestic	Weekly(Approved site)	Foreman