

Venture / Operation	RSA Exploration	Prepared By	Mothobekhi, L and vd Westhuizen, D	Approved By	Gabisile Simelane
Project	Free State	Version No	2		
Project Ref No		Revision date	2015/03		

**1st ELIMINATION (Get Rid of)... 2nd SUBSTITUTION (Replace, Limit People, etc)... 3rd ENGINEERING (Review Design, Provide Guards, etc)...4th ADMINISTRATION (Procedure, Training, Signage)..5th PPE**

TAPES:Task,Activity, Product, Equipment or Service

Refer to Energies list in "Inventory" worksheet for hard copy



Area of Responsibility	Activity, Task, Process, Products and service	Routine / Non Routine	Energy	Hazard/Aspect	Consequences/ Impact/ Event (opportunity and threat).	Cause (S)	*Inherent Risk Rating	Critical Controls	Hierarchy of control	Emergency Measures	**Residual Risk Rating	Comments
<b>Desktop Study</b>												
Office Admin	Office Work	Routine	Resource usage	Use of electricity (office sanitary and kitchen)	Depletion of non-renewable energy resources	Operational	5	Use of energy saving devices and environmental awareness	Engineering & Admintrative	Non-required	2	
Office Admin	Office Work	Routine	Environmental impact	Use of Water (Kitchen and sanitary)	Depletion of water resources	Operational	5	Toolbox discussion-Environmental awareness	Admintrative	Non-required	2	
Office Admin	Office Work	Routine	Environmental impact	Generation of general waste	Reduction of space in landfill site and loss of land productivity	Operational	5	EXP_02-Prospecting procedure - Minimisation of domestic waste generation at the house. Toolbox discussion	Admintrative	Non-required	2	
Office Admin	Office Work	Routine	Environmental impact	Generation of recyclable waste	Resource conservation	Operational	5	EXP_02-Prospecting procedure -Waste separation and Environmental awareness	Substitution & Admintrative	Non-required	2	
<b>Travelling by road to and from suites</b>												
Parking	Parked vehicles	Non Routine	Environmental impact	Potential Oil spillage	Contamination of soil	Incidental	4	Oil spill kit readily available, environmental awareness, Vehicles regularly serviced and daily pre-start check.	Administrative	Oil spill kit	2	
Parking	Parked vehicles	Non Routine	Environmental impact	Potential Oil spillage	Contamination of water	Incidental	4	Oil spill kit readily available, environmental awareness, Vehicles regularly serviced and daily pre-start check.	Administrative	Oil spill kit	2	
Parking	Parked vehicles	Non Routine	Environmental impact	Generation of hazardous waste - Cleaning of oil spillages and contaminated soil.	Reduction of space in landfill site	Incidental	3	Traing and awareness	Administrative	Non-required	3	
Travelling	Vehicle driving (travel to site for ground geophysical survey, drilling & sampling)	Routine	Environmental impact	Exhaust emissions	Air pollution	Operational	16	Vehicles serviced as per manufactory recommendation, driving within speed limits and toolbox talk	Administrative	Non-required	11	
Travelling	Vehicle driving (travel to site for ground geophysical survey, drilling & sampling)	Routine	Environmental impact	Fossil fuel consumption	Depletion of non-renewable energy resources	Operational	16	Vehicles serviced as per manufactory recommendation, driving within speed limits and toolbox talk	Administrative	Non-required	11	
Travelling	Vehicle driving (travel to site for ground geophysical survey, drilling & sampling)	Routine	Environmental impact	Dust generation	Air pollution	Operational	12	Awareness and reduced speed	Administrative	Non-required	7	
Travelling	Vehicle driving (travel to site for ground geophysical survey, drilling & sampling)	Routine	Environmental impact	Generation of general waste	Reduction of space in landfill site and loss of land productivity	Operational	5	EXP_02-Prospecting procedure - Minimisation of domestic waste generation at the house. Toolbox discussion	Admintrative	Non-required	2	
Travelling	Potential road accident	Emergency	Community impact	Animals/Livestock/People	Moving vehicles may accidentally hit persons or animal causing injuries/deaths.	Accident	8	Toolbox Talks; Adherence to vehicle procedures and speed limits	Admintrative	Emergency procedure to be followed.	5	
Travelling	Potential road accident	Emergency	Environmental impact	Potential Oil spillage	Contamination of soil	Accident	8	Toolbox Talks; Adherence to vehicle procedures and speed limits	Administrative and awareness	Spill Kit	5	
Travelling	Potential road accident	Emergency	Environmental impact	Potential Oil spillage	Contamination of water	Accident	8	Toolbox Talks; Adherence to vehicle procedures and speed limits	Administrative and awareness	Spill Kit	5	
<b>Field_Geophysics</b>												
Field	Airborne and Ground geophysical work -Waste generation	Routine	Environmental	Generation of general waste	Environmental/land pollution	Poor risk assessment and briefing	8	EXP_02-Prospecting procedure -Toolbox talks and Emplan Briefing	Administrative	Non-required	4	
Airport	Aircraft efueling - oil and jet fuel spillage	Non Routine	Environmental impact	oil and jet fuel spillage	Contamination of soil	Incidental	4	Spill kit readily available, environmental awareness,	Administrative	Oil spill kit	2	
Airport	Oil and jet fuel spillage clean-up.	Non Routine	Environmental impact	Generation of hazardous waste - Cleaning of oil spillages and contaminated soil.	Reduction of space in landfill site	Incidental	3	EXP_02-Prospecting procedure -Traing and awareness	Administrative	Non-required	3	
Field	Airborne geophysics	Routine	Environmental impact	Exhaust emissions	Air pollution	Operational	16	Aircraft serviced as per manufactory recommendation.	Administrative	Non-required	11	
Field	Airborne geophysics	Routine	Environmental impact	Jet fuel consumption	Depletion of non-renewable energy resources	Operational	16	Aircraft serviced as per manufactory recommendation.	Administrative	Non-required	11	

Field	Airborne accident	Emergency	Environmental impact	Potential Oil spillage	Contamination of soil	Accident	8	Aircraft serviced as per manufactory recommendation.	Administrative and awareness	Emergency procedure to be followed, Spill Kit	5
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Field	Airborne accident	Emergency	Environmental impact	Potential Oil spillage	Contamination of water	Accident	8	Aircraft serviced as per manufactory recommendation.	Administrative and awareness	Emergency procedure to be followed, Spill Kit	5	
Field	Airborne accident	Emergency	Environmental impact	Fire or explosions	Air pollution	Accident	5	Aircraft serviced as per manufactory recommendation.	Administrative and awareness	Emergency procedure to be followed.	5	
<b>Accomodation/temporary camps</b>												
Field accomodation	Accomodation	Routine	Electrical	Use of electricity for field office, Kitchen etc.	Depletion of non-renewable energy resources	Operational	11	Awareness	Administrative	Non-required	5	
Field accomodation	Accomodation	Routine	Environmental impact	Use of Water (Kitchen and sanitary)	Depletion of water resources	Operational	8	Awareness	Administrative	Non-required	5	
Field accomodation	Accomodation	Routine	Environmental impact	Generation of general Waste	Reduction of space in landfill site and loss of land productivity	Operational	8	EXP_02-Prospecting procedure - Awareness, Waste separation	Administrative	Non-required	5	
Field accomodation	Accomodation	Routine	Environmental impact	Generation of Recyclable waste	Reduction of space in landfill site and loss of land productivity	Operational	8	EXP_02-Prospecting procedure - Awareness, Waste separation	Administrative	Non-required	5	
Field	Human waste	Routine	Environmental impact	Sewage generation	potentail soil, ground and surface water contamination	No proper toile provided	17	EXP_02-Prospecting procedure - Chemical toilets to be provided atprospecting sites.	Engineering, Administrative	Non-required	5	
<b>Site establishment - drill site,</b>												
Field	Site establishment/clearing	Routine	Environmental impact	Removal of endangered tree species	Extinction of endangered tree species. Land degradation	Operational	8	EXP-02-PR_Prospecting operational procedure. Induction. Shift drill position if in area with protected species. Transplanting trees if no alternative is available .No endangered and Nationa protected trees onsite	Administrative	Non-required	5	
Field	Site establishment/clearing	Routine	Environmental impact	Vegetation clearance	Loss of vegetation, increased erosion	Operational	8	Induction, Minimise are of disturbance , only 2m of fire break is created around drillsite	Administrative	Non-required	5	
Field	Site establishment/clearing	Routine	Environmental impact	Increased erosion due to vegetation clearance	Loss of topsoil	Operational	8	Induction, Minimise are of disturbance , only 2m of fire break is created around drillsite	Administrative	Non-required	5	
Field	Site establishment/clearing	Routine	Environmental impact	Disturbance to heritage site i.e graves	Destroyed heritage site or assets	Operational	8	EXP-02-PR_Prospecting operational procedure 2.2.3 and awareness and Induction.	Substitute and administrative	Non-required	5	
Field	Site establishment/clearing	Non Routine	Environmental impact	Potential Oil spillage	Contamination of soil	Indicental	4	Oil spill kit readily available, environmental awareness, machinery regularly serviced and daily pre-start check.	Administrative	Oil spill kit	2	
Field	Site establishment/clearing	Non Routine	Environmental impact	Potential Oil spillage	Contamination of water	Indicental	4	Oil spill kit readily available, environmental awareness, machinery regularly serviced and daily pre-start check.	Administrative	Oil spill kit	2	
Field	Site establishment/clearing	Non Routine	Environmental impact	Generation of hazardous waste - Cleaning of oil spillages and contaminated soil.	Reduction of space in landfill site	Indicental	3	Traing and awareness	Administrative	Non-required	3	
Field/ Camp site	Site establishment	Routine	Environmental impact	Generation of general waste	Reduction of space in landfill site and loss of land productivity	Operational	5	Minimisation of domestic waste generation at the house. Toolbox discussion	Admintrative	Non-required	2	
<b>Drilling</b>												
Filed	Drill rig operation	Non Routine	Environmental impact	Prospecting within riparian zone	Impact on stream flow	Operational	18	EXP_02-Prospecting procedure 2.1.1	Administrative	Non-required	8	
Filed	Drill rig operation	Non Routine	Environmental impact	Abstraction of water for drilling purposes.	Reduction on water availability for other existing land users	Operational	18	EXP_02-Prospecting procedure 2.1.2	Administrative	Non-required	8	
Field	Drill rig operation	Routine	Environmental impact	Pollution by spillages (hydraulic oil & fuel). Drill string left on the ground	Breakages of hoses, valves or controls; loss of drilling equipment downhole.	Poor inspection and maintenance	8	EXP-03-PR_Drilling Procedure- Pre-start checklist and service of equipment	Engineering, Administrative	Oil spill kit	5	
Field	Drill rig operation	Routine	Environmental impact	Drilling into natural gas	Fire and/or explosion	Operational	22	EXP-03-PR_Drilling Procedure	Administrative	Emergency procedure to be followed.	8	
Field	Drill rig operation	Routine	Environmental impact	Fire	Safety risk, impact on both flora and fauna	Indicedental	8	EXP_02-Prospecting procedure	administrative	Emergency procedure to be followed.	5	
Field	Drill rig operation	Routine	Environmental impact	Chemicals used as lubricant	Ground water pollution	Poor Risk Assessment, awareness	8	Only use non-toxic and biodegradable chemicals. Provide MSDS for all chemicals used.	Administration and substitute	Oil spill kit	5	
Field	Human waste	Routine	Environmental impact	Sewage generation	potentail soil, ground and surface water contamination	No proper toile provided	17	EXP_02-Prospecting procedure - Chemical toilets to be provided atprospecting sites. Pit toilets only to be used away from watercourses.	Engineering, Administrative	Oil spill kit	5	
<b>Field site rehabilitation</b>												
Field site rehabilitation	Dewatering of sump	Routine	Environmental impact	Spillage of contaminated water	Soil contamination	Poor Risk Assessment,	8	EXP-06-PR_Prospecting Site Rehabilitation procedure -Risk assessment, Secondary containment	Administrative	Oil spill kit	5	
Field site rehabilitation	Excavations and reshaping	Routine	Environmental impact	Distribution of weeds/invesive species seeds	Infestation of weeds/invasive species	Operational	6	EXP-06-PR_Prospecting Site Rehabilitation procedure - Weeds/invesive species seeds eradication procedure	administrative	Non-required	4	
Field site rehabilitation	Excavations and reshaping	Routine	Environmental impact	Soil erosion	Loss of topsoil	Operational	6	EXP-06-PR_Prospecting Site Rehabilitation procedure	administrative	Non-required	5	
<b>Field site closure</b>												
Field site closure	Closing exploration activities from one camp	Non Routine	Environmental impact	Post closure residual environmental aspects - invasive plant species, erosion and water pollution	invasive plant species, erosion and water pollution	Operational	6	EXP-06-PR_Prospecting Site Rehabilitation procedure and financial provision	administrative	Non-required	5	

Field site closure	Closing exploration activities from one camp	Non Routine	Community impact	Community expectation	Company Reputation and community relationship getting affected	Lack of job for local people and contractors may possibly create a negative impact for future exploration	15	Propoer communication between the engaged community and Debeers representative. Building Good relationship with the stakeholders	Administrative	Non-required	5	
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## Significant Risk rating methodology

### **Anglo American 5x5 Risk Matrices**

Anglo American 5x5 Risk Matrix is a systematic methodology that has been adopted to evaluate the risk of each respective impacts/unwanted event. The risk of each impacts/unwanted events is determined for Safety, health and Environment.

The fundamental principle of Risk Matrices is to recognise that it is simply a tool to prioritise risks and the actions required to manage the risk to an acceptable level. It is a risk ranking tool that provides a qualitative means to determine the significance of risks and the required effort to address priorities in addressing the risk.

A minimum of two factors are considered for each risk identified:

- **Likelihood:** chance/probability that the risk will occur within a time period

The definition of likelihood provides time based frequency guideline for evaluating risks associated with (repeat) events on a 5 point scale.

- **Consequence:** The impact the risk will have, should it materialise

Given the types of headline risks that the Family of Companies encounters, the consequences/ impact of these risks are categorised across the following areas:

- ✓ People
- ✓ Safety
- ✓ Delivery of Results
- ✓ Occupational Health
- ✓ Financial
- ✓ Environmental
- ✓ Legal
- ✓ Reputational


*Note: The risk are categorised into low, medium, significance and high. Anglo American has adopted a ranking approach from 1 to 25, meaning there are unique Risk Numbers for each risk rated:*

Low: 1 -5: Medium: 6 to 12: significant: 12 to 20 and high: 21 to 25

Note: When rating significance of environmental aspects the duration and extent of impact must be taken into consideration as follows:

- ✓ For Pollution impacts – Toxicity, Volume and nature of the substance in question.
- ✓ For habitat disturbance – sensitivity of the habitat, the size of the area affected and the ability of the environment to rehabilitate (Assimilative capacity).
- ✓ For biodiversity impact – red data rating of the species and the range of the species
- ✓ For resource use – amount of resource used, resource availability and whether it is renewable or not.


Impact			1 – Insignificant	2 - Minor	3 - Moderate	4- Significant	5 - High	
Financial			<1% of budgeted EBITDA & listed assets	>1 %<3% of budgeted EBITDA & listed assets	>3%< 10% of budgeted EBITDA & listed assets	>10% <30% of budgeted EBITDA & listed assets	>30% of EBITDA & listed assets	
			<US\$10M	>US\$10M < US\$35M	>US\$35M < US\$120M	>US\$120M < US\$350M	> US\$350M	
			No disruption to operation and/or insignificant impact on financial targets (budget)	Brief disruption to operation and/or Minor impact on financial targets (budget)	Partial loss of operation and/or Moderate impact on financial targets (budget)	Partial loss of operation and/or Significant impact on financial targets (budget)	Substantial loss of operation and/or Material impact on financial targets (budget)	
People- Delivery of Results			Slight impact on delivery of the business plan due to skills shortage, poor succession & talent management and inability to meet legislative requirements	Minor impact on delivery of business plan due to skills shortage, poor succession & talent management and inability to meet legislative requirements	Moderate impact on delivery of the business plan skills shortage, poor succession & talent management and inability to meet legislative requirements	Significant impact on delivery of the business plan due to a shortage of skills, poor succession & talent management and inability to meet local legislative requirements	Substantial impact on delivery of the business plan due to a shortage of skills, poor succession & talent management planning and inability to meet local legislative requirements	
People - Safety			First aid case	Medical treatment case	Lost time injury	Permanent disability or single fatality	Numerous permanent disabilities or multiple fatalities	
People – Occupational Health			Exposure to health hazard resulting in temporary discomfort	Exposure to health hazard resulting in symptoms requiring medical intervention and full recovery (no lost time)	Exposure to health hazards/ agents (over OEL) resulting in reversible impact on health (with lost time) or permanent change with no disability or quality loss of life	Exposure to health hazards/ agents (significantly over OEL) resulting in irreversible impact on health with loss of quality life or single fatality	Exposure to health hazards/ agents (significantly over OEL) resulting in irreversible impact on health with loss of quality of life of numerous group/ population or multiple fatalities	
Environmental			Lasting days or less; affecting small area (metres); receiving environmental highly altered with no sensitive habitats and no biodiversity value (e.g. urban/ industrial areas)	Lasting weeks; affecting limited area (hundreds of metres); receiving environment altered with little natural habitat and low diversity value	Lasting months; affected extended area (kilometres); receiving environment comprising largely natural habitat and moderate biodiversity value	Lasting years; affecting area on sub-basin scale; receiving environment classified as having sensitive natural habitat with high biodiversity value	Permanent impact; affecting area on a whole basin or regional scale; receiving environment classified as highly sensitive natural habitat with very high biodiversity value	
Legal & Regulatory			Technical non compliance. No warning received; no regulatory reporting required	Breach of regulatory requirements. Report/ involvement of authority. Attracts administrative fine	Minor breach of law, report/ investigation by authority. Attracts compensation/ penalties/ enforcement action	Breach of the law, may attract criminal prosecution, penalties/ enforcement action. Individual licence temporary revoked.	Significant breach of the law. Individual or company law suits; permit to operate substantially modified or withdrawn	
Social/ Communities			Minor disturbance of culture/ social structures	Some impacts on local population, mostly repairable. Single stakeholder complaint in reporting period	On going social issues. Isolated complaints from community/ members/ stakeholders	Significant social impacts. Organised community protests threatening continuity of operations	Major widespread social impacts. Community reaction affecting business continuity. "License to operate" under jeopardy	
Reputation			Minor impact – public awareness may exist but no public concern	Limited impact – concern/ complaints from certain groups/ organizations (e.g.	Local impact, public concern/ adverse publicity localised within	Suspected reputational damage; local/ regional public concern and reactions	Noticeable reputational damage – national/ international public attention	
Likelihood/ Probability	5 Almost Certain	99%	The unwanted event has occurred frequently; occurs in order of 1 or more x per year & is likely to reoccur within 1 year	11 (M)	16 (S)	20 (S)	23 (H)	25 (H)
	4 Likely	60%	The unwanted event has occurred infrequently; occurs in order of less than 1 x per year & is likely to reoccur within 3 years	7 (M)	12 (M)	17 (S)	21 (H)	24 (H)
	3 Possible	30%	The unwanted event has happened in the business at some time; or could happen within 10 years	4 (L)	8 (M)	13 (S)	18 (S)	22 (H)
	2 Unlikely	15%	The unwanted event has happened in the business at some time; or could happen in 30 years	2 (L)	5 (L)	9 (M)	14 (S)	19 (S)
	1 Rare	7.5%	The unwanted event has never been known to occur in the business; or it is highly unlikely that it will occur within 30 years	1 (L)	3 (L)	6 (M)	10 (M)	15(S)

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## 1. PURPOSE

The purpose of this prospecting operational procedure is:

- To document, ensure the implementation and maintenance of the prospecting operational requirements, that must be adhered at all times by all field staff and drilling contractors.

## 2. PROCEDURAL REQUIREMENT

A photographic gallery of before, during and after drilling and/or any other activities that has potential or has environmental impacts shall be established, implemented and maintained.

### 2.1. CONTRACT ON-BOARDING

- The tender process shall be complied with by both the Exploration Programme Manager and contractor.
- The Exploration Programme Manager shall ensure that tender documents are sent to potential contractors containing all relevant operational procedures, required risk assessment, legal and other requirements.
- Once the tender is accepted and signed by the contractor, the contractor is then legally bound to adhere to the operating procedures and other requirements of De Beers RSA Exploration that will be made available from time to time by the Project manager.
- The Exploration Programme Manager/Project Manager shall ensure that site specific risk assessment, prestart checklist and other inspection are carried out, with the involvement of relevant contractors.
- Everyone working for or on behalf of De Beers RSA Exploration shall be subjected to occupational health screening and a possible security background check.

### 2.2. SPECIFIC ENVIRONMENTAL LEGAL REQUIREMENTS WITH REGARDS TO PROTECTED AREAS AND RESOURCES


#### 2.2.1. Riparian Zones

- Section 21 (c) and (i) of National Water Act, (act No 36 of 1998) as amended must be complied with, should prospecting take place within the Riparian Zone, prior to the commencement of the activities.
- The above section requires application for a permit or Water Use License (WUL) whichever is applicable, to the competent authority (Department responsible for water resources), in a prescribed format as amended from time to time.
- Record of compliance with the requirements must be maintained.

#### 2.2.2. Water Supply

- The Project Manager must establish water availability for prospecting activities in consultation with landowners, to prevent impact on landowners water needs.



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- Should water not be sufficient on site to cater for prospecting activities, a local bulk water supplier, authorized to issues water shall be approached to ascertain if the required volume of water will be available. Agreement must be recorded and record maintained.
- Prospecting is classified as “Small Industrial User” which is regulated by National Water Act, No 39 of 1998 – Regulation and Notice – Government Notice 339 of March 2004 as amended from time to time.

*(“Small Industrial User” Means water user who qualify as work creating enterprises that do not use more than twenty cubic metres per day (20 m<sup>3</sup>) and identified in the Standard Industrial Classification of All Economic Activities (5<sup>th</sup> edition), published by Central Statistics Services, 1993, as amended and supplemented, under the following:*

- 1: Food Processing
- 2: Prospecting, mining and quarrying;
- 3: Manufacturing; and
- 5: construction.


- Therefore the requirements of National Water Act, No 39 of 1998 – Regulation and Notice – Government Notice 339 of March 2004 as amended from time to time must be complied with as follows:
  - Submit to the Minister responsible for Water resources an application for Water Use Registration in a prescribed registration form and/or supporting information as requested prior to commencement with the activity in terms of section 21 (a) and/or (b).
  - Establish and maintain a monitoring programme to measure the quantity of water taken and/or stored in a prescribed manner.

### 2.2.3. Cultural and historical sites

- For drilling and/or bulk sampling a phase 1 Heritage Impact Assessment (HIA) must be carried out by a registered archaeologist, to identify the potential impacts of the proposed activity on cultural and historical resources.
- Such findings and mitigation measures shall be communicated to and/or approved by South African Resources Agency (SAHRA).
- Everyone working for or on behalf of De Beers RSA exploration must be briefed the following course of action if any artefacts or structures or remains of buildings are encountered during the course of their prospecting work:
  - Stop work in the vicinity of the discovery and report to the Project Geologist.
  - If the Project Geologist is not sure, that the structure is modern (< 50 years old) then the Programme Manager must be contacted to organize a Phase 2 Heritage Impact Assessment.
  - The outcome of this assessment will determine whether and how prospecting may proceed in the vicinity of the discovery.

### 2.2.4. Removal of Vegetation (Limpopo Province or other province as specified)


In the Limpopo Province, (Limpopo Department of Economic Development, Environment and Tourism) LEDET will be approached for the permit in terms of Limpopo Environmental Management Act (Act No

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7 of 20030 as amended, section 64 Protection of indigenous plants, for the removal of indigenous vegetation during the course of prospecting.

### 2.3. ACCESS TO SITE AND TRACK/PATH CONSTRUCTION

- The landowner must be consulted in order to gain access to the site.
- No fences will be cut without the permission of the surface owner; these must be repaired on completion of work at a cost to RSA Exploration.
- As far as possible existing tracks and roads shall be used.
- In cases where off-road driving is unavoidable, the shortest possible route will be taken in consultation with landowner (unless it is a steep slope in which case a zig-zag will be optimal) and the effects to vegetation will be minimized by sticking to fence lines as far as possible, trimming trees and bushes only where necessary and only removing bushes and small trees (<3m) if absolutely necessary.
- Off-road access by this means will be for short periods only (< 3 months).
- Off-road access will be restricted to a single track.
- Use 3-point turns when turning around in the field, not large turning circles.
- The landowner will be consulted as to the position of the off-road route.
- The route will be demarcated (use rocks or stones along the edge if possible) and there will be no driving outside this footprint so as to prevent the disturbed area from getting any wider.
- If a footpath is made, it will be demarcated in the same way such that the footprint cannot be increased.
- If the track traverses an area where it is known there are red data species, the route will be checked with a botanist prior to being confirmed.
- If the area is very steep a slope stability test will be conducted prior to the track being established.
- Plan tracks to impact as little as possible on the most sensitive areas, where these have been defined.
- If the track is such that traversing it is likely to cause erosion, consideration will be given to cementing two strips, making use of water breaks and mitre drains to take the water off the road, reduce velocity of water and silt traps to allow sediment to settle out before the water flows into an area where there is least chance of erosion or damage to a wetland. The cement will be removed during rehabilitation, unless landowners request that it be left in place.
- In very steep areas or where the habitat is very sensitive or prone to erosion, the services of an appropriate engineer will be used to design and build the track.
- Any rocks or stones removed will be stored for replacement during rehabilitation, as will any topsoil if it necessary to remove any soil.
- The open or closed status of gates shall be clarified with the landowner/tenant and maintained throughout the prospecting period.
- Reasonable speeds must be observed to avoid accidents, excessive noise, dust and injury to livestock.
- Tracks should not be used during very wet weather as the impact of compaction and chances of incidents and accidents and impacts on the environment will be much higher.
- For rehabilitation of tracks and footpaths – See **EXP-PR-06 Prospecting Site Rehabilitation procedure**.

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## 2.4. SITE ESTABLISHMENT

Everyone working for and doing work on behalf of De Beers RSA Exploration are expected to conduct themselves in a manner that projects our values.

### 2.4.1. SHE risk assessment

- An onsite SHE risk assessment must conduct and controls/ mitigation measures be put in place to minimize the potential SHE risk, in the prescribed formant.

### 2.4.2. Smoking area

- A smoking area must be established, with the following as minimum: Cigarette butt bin, cleared dry grass to prevent fire, smoking signage, and fire extinguisher.
- Smoking is restricted to the smoking area. Smoking in any other area will result in non-compliance and may result disciplinary action.

### 2.4.3. Sanitation Facilities


- The drill contractor shall at all drilling sites provide adequate and well maintained sanitation in the form of a portable toilet.
- Environmentally friendly agents will be used in the toilets to biodegrade the contents.
- The toilet contents will be disposed of at a registered water treatment works / sewerage works.
- The toilet will be maintained so that it remains in an acceptable condition.
- A copy of the registration of the treatment works / sewerage works should be obtained.
- The record of disposal shall be maintained.

### 2.4.4. Waste management

- A waste management area shall be demarcated with clearly marked waste bins with lids.
- Hazardous waste will be kept separate from general waste.
- No waste will be disposed of on-site and no littering is allowed.
- Before taking waste to the nearest municipal landfill a copy of the license issued by the Department of Environmental Affairs and Forestry should be asked for and kept on file.
- General waste will be removed from the site on a weekly basis and disposed of at an authorized disposal site.
- Hazardous waste shall be disposed in a demarcated bin and precautions should be taken to avoid any additional spillage when stored, until it can be disposed of at a licensed hazardous waste site.
- Records will be kept of the disposal of all hazardous waste.

### 2.4.5. Hydrocarbon/chemical spillage management

- A spill kit with all items up to date must be kept on site at all times. The content of the spill kits should be checked regularly.
- Drip trays and/or PVC sheeting will be placed under any machinery on site that has the potential for oil leak.
- All oil containers kept on site must be kept in drip trays.
- Spare drip trays shall be kept and used to collect oils and fluids from any emergency on-site servicing and repair of machinery and vehicles.

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- The contents of drip pans / PVC linings must be soaked up with oil biodegrading loose fibre and disposed of as hazardous waste (see 2.4.4).
- Any spill onto the ground should be cleaned up immediately by using oil absorbent material such as saw dust and removing the contaminated soil, spillage and absorbent material and dispose of as hazardous waste (see 2.4.4).

## 2.5. VEHICLES, EQUIPMENT, FUELS AND OILS

- It is the duty of each driver to perform a daily and weekly pre-start check on his/her vehicle to ensure that all components of the vehicle are in a good state of repair and that it has no oil or hydraulic leaks which may cause damage to our environment if it leaks onto the ground. These checks must be documented
- It is not planned to do any maintenance of vehicles on prospecting sites. Only emergencies will receive attention.
- Other equipment used in the prospecting process must also be adequately maintained to minimize spillage of fuel and oils during operations which cause pollution of the environment.
- Ensure all heavy items are raised off the ground to limit compaction where practicable.
- A log book is kept for each vehicle.
- The amount of fuel used and kilometers travelled per month are calculated from the log book.
- These are forwarded to the Project Manager and/or Operations Support Manager who checks the consumption of fuel against kilometers travelled. This highlights problems of excessive fuel usage.
- Should there be a problem; vehicles are sent in for maintenance by outside contractors, as is the case with routine preventative maintenance.
- Old tyres are retained by the suppliers for retreating or disposal.
- Battery servicing should be done by outside contractors; De Beers's staff should only top up distilled water to the indicated level.
- Battery charging, if required, will be done in a well-ventilated area, with a drip tray underneath the battery.
- If the battery does not charge due to damaged cells a replacement battery will be obtained on an exchange basis from outside contractors.

## 2.6. WALKING IN THE FIELD

- Plan the walk and consider location, degree of difficulty, environmental sensitivity of the site and duration of the walk.
- Walkers should ensure they have appropriate navigational equipment e.g. GPS maps and compass.
- Avoid where possible hazards such as cliff edges, slippery tracks, rocks, dangerous trees, extreme weather and be informed on the nature of the terrain to be travelled over.
- Water/Clothing/Equipment – walkers should ensure they carry adequate water, dress appropriately and wear suitable hiking footwear.
- Be aware of the following risks while walking in the field:
  - Dehydration, sunburn and sun/heat stroke
  - Shock arising from injury
  - Ankle sprain
  - Bone fracture

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- Symptoms suggesting the onset of hypothermia
- Asphyxiation and smoke inhalation
- Burns
- Snake bites
- Smoke and foreign matter in eyes
- Senior Field Officer/Supervisors of teams walking should be trained in first aid to cope with the above risks.
- Bush Walkers code – aim for minimal impact bush walking. Take only photographs and leave only footprints!
- Additional equipment to be carried in a hands free back pack: sun hat and sunscreen (essential, even in winter). The following additional equipment items may also be considered: a lighter or waterproof matches, penknife, identification, money, survival bag/blanket, spare boot laces, gaiters, mobile phone, sun glasses, whistle, torch and warm top.
- Observe - Each member of the group should keep in sight the walkers immediately ahead and behind to reduce the risk of the group becoming split.
- Do not rely on others for your welfare. Bring the correct equipment, clothing, food and water so that you are fully prepared.
- Be careful – avoid walking alone into unknown terrain.

#### 2.7. GEOPHYSICAL SURVEYS

- Ground geophysical surveys usually require operators of geophysical instruments to walk along straight lines collecting data.
- Line cutting shall be limited to the trimming of branches and undergrowth; no cutting down of trees or large bushes is permitted.
- Some surveys require the marking of positions along each survey line; this is done by using biodegradable flagging tape. Occasionally wooden stakes are used to mark the ends of lines; these should be removed on completion
- Occasionally, a permanent marker will be required to mark the position of a survey for future reference. A steel fence dropper, cemented to the ground if required, will be used for this purpose. The position of the permanent marker will be cleared with the landowner.

#### 2.8. DRILLING

Refer to **EXP-PR-03 Drilling procedure** and **EXP-PR-06 Prospecting Site Rehabilitation procedure**.

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## 1. PURPOSE

The purpose of the Drilling procedure is:

- To implement and maintain Safety Health and Environmental (SHE) working procedures to manage potential significant impacts/significant impacts related to exploration drilling. This includes site preparation, large diameter drilling and small diameter drilling.
- To include the procedure for prevention of flammable gas explosions when drilling in areas of high to medium risk e.g. where Karoo rocks or other potential sources of flammable gas are present.


## 2. PROCEDURAL REQUIREMENT

### 2.1. GENERAL SAFETY AT DRILL SITES

- A risk assessment must be conducted in a prescribed format.
- An area of control is to be demarcated (with danger tape and/or painted stakes) in consultation with the drill contractor/operator, within which relevant PPE must be used (hard hats, overalls, safety shoes/boots, eye protection, dust and hearing protection).
- This area will correspond with the “No smoking” area defined where there is a risk of flammable gas being encountered (see below).
- Dust and eye protection should also be provided to all staff outside the area of control as the wind may blow dust in different directions.
- All staff and contractors must obey safety instructions issued by the appointed responsible person (usually the drill manager / foreman).
- Only qualified persons (usually the drill contractor’s staff) are allowed to operate the drill rig itself.
- Do not drill during an electric storm. Lightning striking the drill mast is a very real danger. Terminate drilling for the day or wait out the storm inside vehicles parked away from the drill rig.

### 2.2. THE USE OF DRILLING AGENTS AND LUBRICANTS

- The quantity of drill agents and lubricants used shall be recorded by the contractor and record be kept by the project geologist (**Appendix I: Record of quantity of drilling agent used**)
- The potential impacts caused by oil leaks from machinery used at surface are covered by **EXP-PR-02 Prospecting Operational Procedures**.
- The 16 point Material Safety Data Sheets containing all relevant data pertaining to all substances used by the drilling contractor should be obtained.
- Wherever possible and available, environmentally friendly drilling agents and drill bit lubricants should be used.

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## 2.3. CODE OF PRACTICE FOR THE PREVENTION OF FLAMMABLE GAS EXPLOSIONS

### 2.3.1. Status of Code of Practice (COP)

- Inland occurrences of natural gas are restricted to the sediments of the Karoo Supergroup in South Africa. When drilling through rocks belonging to the Karoo Supergroup, the following Code of Practice (COP) will be adhered to.
- This mandatory COP was drawn up in accordance with Guideline DME Ref. No. DME 16/3/2/1 - A2 issued by the Chief Inspector of Mines.
- This is a mandatory COP in terms of sections (2) and (3) of the MHSA.
- This COP may be used in accident investigations to ascertain compliance and also to establish whether the COP is effective and fit for the purpose.
- This COP supercedes all previous relevant COP's.
- All managerial instructions or recommended procedures (voluntary COP's) and standards on the prevention of flammable gas explosions must comply with this COP and must be reviewed to ensure compliance.

### 2.3.2. General Information and Terms and Definitions

This COP is to be used by De Beers Consolidated Mines Limited during exploration for diamonds within the RSA. As such, the words "mine" or "mining" should be read as indicating prospecting as there is no distinction between prospecting and mining in the Minerals Act.

### 2.3.3. Properties and Dangers of Methane


- Methane is often mixed with other flammable gases (hydrogen, butane, etc.)
- Methane gas is lighter than air (S.G. 0.55).
- Colourless, odourless and tasteless and can only be detected by an instrument.
- Combustible below 5%.
- Explosive between 5% and 15%.
- Over 15% it replaces the oxygen in the air and can cause suffocation in confined spaces.

### 2.3.4. Risk Assessment

- The occurrence of gas pocket intersections whilst drilling surface boreholes is fairly rare.
- However due to the high probability of serious injury should such a gas pocket be intersected unnoticed or without taking due precautions, the need to monitor gas emissions by implementation of the COP exists.
- The main risk therefore exists in non-detection of possible gas emissions from the hole and the COP therefore concentrates on detection procedures.
- It is not envisaged that any drilling shall be conducted whilst detected gas emissions are flowing from the hole and therefore procedures around spark and flame suppression are not looked at.

### 2.3.5. Identification of Flammable Gas Sources



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- Pockets of gas trapped by impermeable strata underground.
- These pockets of gas are likely to be under pressure, resulting in sudden release of gas once the borehole penetrates the impermeable strata.

### 2.3.6. Detection Flammable Gas

- Prior to commencing any work each day, a flammable gas reading must be taken at the top of the drill hole and in the drill rods by a geologist who is trained to use flammable gas measuring instrument.
- The flammable gas measuring instruments will be fully charged and calibrated prior to a drilling project and at least every three months during a drilling project (if the drilling project lasts longer than 3 months).


### 2.3.7. Procedure at Drill Site

- An area up to 40 (forty) metres around the drill site will be fenced off with wire fencing/gate fencing.
- Symbolic signs, such as “No Smoking, No Open Flames, Danger Keep Out”, will be posted.
- Fire extinguishers will be placed at strategic points within and without the demarcated area.
- Prior to commencing any work each day, a flammable gas reading must be taken at the top of the drill hole and in the drill rods.
- During drilling, gas readings are taken at the hole during the changing of rods. The meter should not be further than 1m from the hole but care should be taken in that a danger is posed by swinging rods if the reading is taken too close to the hole.
- Always ensure that the operator is aware that you are taking the reading and always keep an eye on the drill rods that they are not being moved whilst the reading is being taken. The reading should not take less than 30 seconds.
- Results for all tests, whether negative or positive, must be recorded in a book kept for this purpose.
- Maintenance on the drill equipment will only be done if the flammable gas reading is negative and during maintenance, periodic readings will be taken at intervals not exceeding 1 hour.

### 2.3.8. Control of Gas Emissions

When **flammable gas exceeds 1% by volume**, the following steps must be followed:

- Stop all work and immediately shut down all engines.
- Withdraw all personnel to outside of the 40 m barricade and fully inform them of potential dangers.
- Inform the Exploration Programme Manager, the appointed Manager under section 3 of the Mine Health and Safety Act and the Principal Inspector of Mines of the Region.
- Continue monitoring and if the explosive mixture drops to less than 1% by volume for a period exceeding 1 hour, the rods may be removed from the hole to allow the free flow of gas.
- If the explosive mixture remains above 1%, the hole must be monitored for a minimum of 24 hours. If the mixture remains constant at 4% or less, the rods may be removed under the direct supervision of a person in position of authority. With the rods removed, the hole must again be

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left with free flow for a minimum period of 24 hours. If gas remains constant the entire hole must then be cemented.

- If the explosive mixture remains in excess of 4% for a period of 1 week, any work to be done will be in close consultation with the Principal Inspector of Mines of the Region.

#### 2.4. EMERGENCY PREPAREDNESS FOR FIRE

See **EXP-PR-05 Emergency Preparedness and Response Procedure**.

#### 2.5. DRILLING SITE MANAGEMENT

Photographic gallery of before, during and after drilling and/or any other activities that has potential or has environmental impacts shall be established, implemented and maintained.


The establishment of a drill site must be established with closure, in mind taking into consideration that the rehabilitated area must be re-vegetated, safe, stable, non-polluting, non-eroded and in a state that is suitable for the agreed post closure land use.

##### 2.5.1. Access and Siting

Refer to **EXP-02-PR Prospecting Operational procedure**, section 2.3.

##### 2.5.2. Preparation and Drilling

- This section must be read with (**EXP-02-PR Prospecting operational procedure**, section 2.2 and 2.4.)
- The Project Geologist must complete the drill site check provided at the back of this procedure for each drill hole completed (**Appendix II: Drill site checklist**)
- Determine what anti-erosion measures are necessary and implement these.
- Restrict drill site to the minimum size of cleared area.
- Where drilling is necessary in thickly vegetated area, tree cutting is limited to small trees (< 3m height) only. No large trees will be removed, except if accessing exotic timber plantations, in consultation with the plantation owner and with due compensation being agreed to. The cleared bushes will be stored on a tarpaulin for rehabilitation.
- If practicable, design drill holes to avoid having to set up on the most sensitive area e.g. by planning hole direction, drilling more than one hole from a single cleared site
- In areas containing red data plant species, the planned drill sites and access routes are to be checked with a botanist to see if any red data species are present, and if these positions need to be adjusted so as not disturb these if at all possible, prior to the positions being confirmed.
- In arid areas, remove all plus centimetre size quartz or other light coloured float, if present, and store in a drum.
- Remove all vegetation, logs, stones and rocks on surface and store separately.
- Level only required area for safe and effective operation of the drill rig or as required for truck to move safely to rig.

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- Where it is necessary to remove the topsoil (e.g. digging a sump), a tarpaulin or heavy duty plastic sheet shall be put in place to temporarily store and cover the topsoil to protect against wind and rain.
- Water coming out of the hole whilst drilling will be directed away from the rig along a trench and left to flow in a controlled manner into the sump so as not to cause erosion. This will be recycled. The small trench will be lined with heavy duty plastic sheet or tarpaulin to minimise ground contamination and/or soil erosion.
- Plan the sump to be dug in less sensitive area if possible and line the sump to ensure that there is no pollution by fine sediment forming a layer over the soil in which very little vegetation grows.
- Ensure the capacity of the sump is adequate so as to avoid pollution of the surrounding area by fine sediment.
- The only chemicals to be used down the hole are the detergent based drilling foam which is not hazardous and is not toxic to ground water or drilling muds which must also not be toxic. These are used only when sidewall stabilisation is required.
- On some rigs, small amounts of bio-degradable rock grease are used to lubricate the compressed air system and the moving parts. The amount of this bio-degradable rock grease used will be recorded by the drilling contractor and documented by the project geologist **(Appendix I: Record of quantity of drilling agent used)**
- Ensure that all equipment at the drill site that can leak is in drip trays or on tarpaulins bunds to avoid leaks or spills onto the ground. Repair any leaks as soon as possible.
- Ensure that all heavy items are raised off the ground to limit compaction, where practicable.
- Large diameter drill samples are placed directly into bulk bags which should be removed directly from site and not placed elsewhere on the ground.
- On completion the areas around the drill hole will be cleared of all drill sludge and litter and the rehabilitation procedure be adhered to, reference below.
- At the end of the drilling programme the land owner is to be asked to sign the closure letter provided once satisfied with the rehabilitation.

### 2.5.3. Rehabilitation of a Drill Site

Refer to EXP-06-PR Prospecting Site Rehabilitation procedure.

### 2.5.4. Closure

Refer to EXP-06-PR Prospecting Site Rehabilitation procedure, 2.7 closure and landowner letter.

**Appendix I: Record of quantity of drilling agent used**



**Appendix II: Drill site checklist**

**DRILL SITE CHECKLIST**

DATE / TIME START HOLE\_\_\_\_/\_\_\_\_ DATE / TIME END HOLE\_\_\_\_/\_\_\_\_

DATE / TIME REHAB COMPLETE \_\_\_\_/\_\_\_\_

HOLE POSITION (cape datum) LAT\_\_\_\_\_ LONG\_\_\_\_\_

FARM NAME\_\_\_\_\_NUMBER \_\_\_\_\_DISTRICT\_\_\_\_\_

DRILL HOLE REFERENCE NO:\_\_\_\_\_

CASING METRES\_\_\_\_\_ CASING RETRIEVED? Y/ N

LDD METRES DRILLED\_\_\_\_\_ METRES CORED\_\_\_\_\_

GEOLOGIST: \_\_\_\_\_ DRILLING FOREMAN\_\_\_\_\_

ITEM	Y	N	COMMENTS
GAS METER CALIBRATED PRE START			
BEFORE PHOTOGRAPH			
CHEVRON TAPE AROUND SITE			
NO SMOKING SIGN			
FIRE EXTINGUISHER AVAILABLE			
PVC SHEETING UNDER DRILL TRUCKS			
SAFETY SHOES, HARD HATS, EAR PLUGS, DUST MASKS WORN BY ALL			
RECORD GAS METER READINGS			
MSDS FOR OF OIL DRILLING FOAM & OIL			
ANY LOOSE FIBRE USED			
HOLE FILLED WITH DRILL CHIPS			
1M STEEL PLATE COVERING HOLE AT 50cm / 1m DEPTH VIRGIN/CULTIVATED			
NO DRILL CHIPS LEFT AT SURFACE			
AFTER REHABILITATION PHOTOGRAPH			
HOLE GROUTED WITH BENTONITE			

SIGNATURE: \_\_\_\_\_  
Project Geologist

**DE BEERS GROUP SERVICES**

**Resource Development cycle**

**CORE HOLE CLOSURE FORM**

Group Exploration Information Centre (GE IC) Reference No. or Location/link

Approved by: DBGS-GE Advanced Exploration

<b>Bore Hole No.</b>	
<b>Date</b>	
<b>Depth of Hole</b>	
<b>Drill Rig Name</b>	
<b>Geologist</b>	
<b>Driller</b>	

ACTIVITY	YES	NO	Comments
Hole depth as drilled confirmed by measuring drill string when pulling out?			
As drilled coordinates surveyed?			
All scoped downhole geophysical surveys done?			
All core trays consigned to the coreshed			
Drillhole capped and clearly marked?			
All mud pits and sumps backfilled and levelled?			
All rubbish cleaned and properly disposed off?			
All spilages cleaned up?			
All drilling equipment removed?			
Pictures of drill site captured and on server?			
Drill site left in as reasonable state?			
All forms signed off by geologist and project Manager?			

**ADDITIONAL COMMENTS**


**GEOLOGIST** \_\_\_\_\_ **SIGNATURE** \_\_\_\_\_ **DATE** \_\_\_\_\_

**DRILLER** \_\_\_\_\_ **SIGNATURE** \_\_\_\_\_ **DATE** \_\_\_\_\_

**ECOHS REP** \_\_\_\_\_ **SIGNATURE** \_\_\_\_\_ **DATE** \_\_\_\_\_

**PROJECT MANAGER** \_\_\_\_\_ **SIGNATURE** \_\_\_\_\_ **DATE** \_\_\_\_\_




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## 1. PURPOSE


The purpose of this prospecting operational procedure is to :

- To implement and maintain procedures to manage potential significant impacts/significant impacts related to appropriate rehabilitation of all prospecting activities.
- To implement and maintain a procedure for the eradication of alien species from sites significantly disturbed by De Beers RSA exploration for prospecting purposes (newly created access tracks and/or roads, drilling).

## 2. PROCEDURAL REQUIREMENT

### 2.1. SMALL AND LARGE DIAMETER DRILLING SITE REHABILITATION

- The areas around the hole will be cleared of all drilling chips.
- The excess drill sludge must be disposed of at the designated site. Where the sludge is left for some time on site to dry, the area shall be barricaded to avoid accidental access and possible drowning of livestock and/or wild game.
- Remove the lining of the sump.
- Fill the sump with the material originally moved to make the excavation, and which has been stored on a tarpaulin.
- Restore profile of site to fit in with adjacent ground – first overburden, subsoil and then topsoil
- Loosen compacted ground.
- Replace stored rocks and stones evenly over site to prevent wind and water erosion, trap seeds and aid water retention.
- If quartz or other light coloured pebbles were collected separately (in arid areas), these must be scattered evenly over the area – causing heat to be reflected and thus cooling the surface, creating microhabitats.
- If any soil on the site has been severely compacted, it must be loosened /scarified to allow water and seed penetration. If the gradient is steep, this loosening / scarifying should be done in bands on the contour, leaving some undisturbed sections between the loosened sections.
- If the slope is very steep the advice of a competent person must be obtained regarding rehabilitation measures so as to ensure minimal chance of erosion.
- Determine if the gradient requires berms to be constructed across the site from natural materials (stones, rocks, branches) to reduce the velocity of rain water and catch soil and reduce the chances of erosion.
- If vegetation was removed and stored, scatter this over the site as a mulch to hold soil and seeds, and help prevent erosion.
- Check with project geologist if a) seeding is to be done and if b) Eco-T is to be used. If so follow the steps in 2.5.
- All equipment, fencing, fuel etc must be removed from site.
- Portable toilets must be removed and the contents disposed of at an approved facility (**Refer to EXP-02-PR Prospecting Operational procedure section 2.4.3**).
- All waste must be removed from site and disposed of at the appropriately licenced facility (**Refer to Refer to EXP-02-PR Prospecting Operational procedure section 2.4.4**).

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- All tarpaulins must be removed from the site.
- Generally boreholes shall be covered and made safe by means of a 1m<sup>2</sup> concrete slab placed over the hole at a depth of not less than 50cm (1m in cultivated land), and marked with the borehole number.
- Any drill holes which have intersected water are to be left open at the request of the landowner; casing will be left sticking out of the concrete slab. A steel plate will be welded on top of the casing to cover the hole from contaminants. The drill hole may only be left open if the landowner takes responsibility by completing the necessary forms and lodging these with DWAF to obtain the water usage license. Relevant documentation must be kept (**Appendix III: BOREHOLE HANDOVER LETTER**).
- Establish and maintain record (including photographs) of the rehabilitation.

## 2.2. REHABILITATION OF FOOTPATHS, ROADS AND TRACKS

- Ensure all equipment, fuel, waste, tarpaulins etc. have been removed from site.
- Place a natural barrier at the junction to the footpath/track/road being rehabilitated e.g. rocks to prevent further access.
- Remove any cemented strips on steep / loose slopes but create contour barriers in their place.
- Loosen compacted soil on tracks when track not needed again.
- If on a slope, reduce potential water erosion with contour barriers
- Check with project geologist if a) seeding is to be done and if b) Eco-T is to be used. If so follow the steps in 2.4.
- Photograph rehabilitated footpath, track / road and update record.

## 2.3. GROUTING OF BOREHOLES

- In cases where there are concerns over disruptions to groundwater flow, or potential contamination of groundwater by acidic leachate from particular rocks encountered during drilling, boreholes will be grouted as specified in this procedure.
- The grouting procedure has been agreed upon with department responsible for water resources see (**Appendix II: Email received by Jan Phelan from DWAF confirming use of recycled drill water and sludge for bentonite mix in grouting of boreholes**).
- If not, make preparations for grouting of borehole where required.
- Remove any hydrocarbon from surface of drill water in sump and dispose as hazardous waste (**Refer to EXP-02-PR Prospecting Operational procedure 2.4.4. and 2.4.5**).
- Take drill water sample and submit the sample for testing and confirm with standard that all hydrocarbon and chemical concentrations fall within limits.
- Use remaining drill water (uncontaminated) and fine sludge in the mixing of the bentonite.
- A grout mix for cementing the small diameter exploration boreholes which contains a synergistic blend of bentonite and drill sludge / fines and building sand of up to 55% by weight of cement (BWOC) along with Portland cement is suggested.
- The cement mix, when combined with mix water in the cementitious slurry having a density less than or equal to 1378 kg/m<sup>3</sup>, the amount of mix water in the cementitious slurry being between

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from about 200 to about 560 percent by weight of cement (BWOC). Such a mix using the water left in the sump that has been circulating the hole (max 1.5m<sup>3</sup>) as well as the fine cutting sludge from the well also in the sump (max 0.2m<sup>3</sup>), which have been checked and skimmed for any oils and grease would respectively provide roughly double to one and a half of the mixture needed to grout a small diameter hole ( +/- 0.8m<sup>3</sup> per 100m hole), thus allowing for possible outwash of the unconsolidated zone as well as formation loss. Mixture hardens to 110 Psi within 72 hours.

- For grouting large diameter boreholes, a dry fill consisting of gravel, sand and bentonite is suggested for the bulk of the fill, while the top 10m of the hole can be grouted in the same way as the narrow diameter boreholes, incorporating any leftover drilling circulation water and cutting sludge.


## 2.4. USE OF ECO-T IN REHABILITATION OF DRILL SITES AND OF PATHS / TRACKS

### 2.4.1. General

- The use of a microbe called Eco-T can be beneficial in ensuring successful rehabilitation of prospecting sites. Eco-T will control root diseases, increase root side shoots and root hairs and also enhance plant growth. This effect is particularly noticeable under stress conditions. Eco-T is tried and tested and works well. It will help the seeds get established slightly faster and help the young seedlings handle any stresses such as drought (by a stronger root system).
- Eco-T must be stored in cool conditions preferably in the fridge. It has a shelf life of 6 months.
- When taken into the field it should be taken in a coolbox, and should NOT be left standing in the sun.
- Eco-T may be used as a drench or a seed treatment.
- The optimum time to apply seed and microbes would be between October and December which is after the first rains and during the active growing season. If rehabilitation is done outside this time, seeding and the use of Eco-T should be postponed and done during the first monitoring period which falls between October – December.
- Discuss with botanist as to which seeds should be used for re-seeding.

### 2.4.2. As a Drench:

- Read General (2.4.1) above.
- Mix 1 heaped teaspoon (5g) of Eco-T in 20 litres of water.
  - a. Small diameter drill site:
    - ✓ Use 3 to 4 x 20 litre mixes per 64m<sup>2</sup> site using 5 / 10 litre watering can.
  - b. Footpath:
    - ✓ 1 x 20 litre of drench mixture will do about 20m of a 1m wide path; double or triple the mixture for a vehicle track depending on width.
  - c. Large Diameter Drill Site or Mechanised Pit Site:
    - ✓ A water cart filled with 700 litres of water to which 1 cup (175g) Eco-T is added will be adequate for a large diameter drill site or a mechanised pit site.( 625-750m<sup>2</sup>)
    - ✓ Use spray attachment and wet site as evenly as possible.
    - ✓ Photograph the site and update records.

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### 2.4.3. As a Seed Treatment:


- Read General (2.4.1) above
  - a. Small Diameter Drill Site (64m<sup>2</sup>):
    - ✓ Use 200g treated seed per site.
  - b. Large Diameter Drill Site (625 – 750m<sup>2</sup>):
    - ✓ Use 2 kg treated seed per site.

## 2.5. INVASIVE SPECIES CONTROL

- Newly created access tracks/roads and large diameter drilling sites will be monitored 6 monthly after rehabilitation, until prospecting right closure is obtained, to check for the appearance of invasive alien species.
- Any species present will be recorded and photographed.
- Some of the more common species likely to be encountered are *Acacia dealbata* & *mearnsii* (Back & Silver Wattle), *Pinus* species, *Eucalyptus* species, *Solanum mauritianum* (Bugweed), *Cestrum* (Inkberry)
- Control of species should be as follows:

Species	Below Knee High	Waist High	Tall
Pines	Pull out, tramp flat with feet.	Slash / ringbark or use tree popper depending on situation.	
Gums	Hand pull if possible	Cut down/slash and paint stem stump with recommended herbicide.	
Bugweed	Hand pull	Cut down /slash and paint stem stump with recommended herbicide.	Cut down and paint with recommended herbicide.
Inkberry ( <i>Cestrum</i> )	Hand pull	Slash and Paint stem stump with recommended herbicide.	Cut down and paint stem stump with recommended herbicide.
Wattles	Hand pull if possible	Spray seedlings with recommended herbicide.	


- Other species present will be identified and the appropriate control determined, with input from a person competent in invasive alien plant control. Concentrations of herbicide for control of each species and the need for wetting agents will be established.
- Training will be done for the persons who will undertake this work. This will include health and safety and environmental measures.
- The specific methods and products used will be updated / amended if this is in the interests of the environment and reaching the desired goal.
- If herbicide is taken into the field, it must be taken in a basin (drip tray) and will be painted onto the species.
- Brush and basin must be rinsed out where water goes into a French drain and not into a stream or wetland.
- There are restrictions on using herbicides near wetlands and waterways.

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- Any spillage of herbicide must be collected up and taken back to be disposed of at recognised facility as hazardous waste.
- Only registered herbicides should be used and herbicide concentrations must be followed carefully.
- Herbicides must be stored where access is restricted and where containers cannot be damaged to cause spilling of contents.
- A register must be kept to account for use of herbicides.
- Clean water must be used to ensure good uptake of herbicides.
- Careful records must be kept of areas treated, chemicals or other methods used, dates of operations, quantities, and monitoring of these areas following treatment.

## 2.6. MONITORING AND REPORTING

- The Project Geologist shall ensure that ongoing monitoring of significant impacts on site is conducted and maintained.
- The Monitoring shall involve before, during and after photographing of drilling sites from set perspectives. The “After” photographing will take place as close as possible to six monthly intervals commencing after the completion of activity at the site.
- Monitoring will be done every 6 months to take a photographic record, to check for signs of erosion, progress in rehabilitation and to see if the invasive plants have come onto the site.
- Following discussions with the landowners, consideration could be given to a co-operative monitoring and treatment of an area larger than just the prospecting sites, for the presence and treatment of invasive species.
- Invasive plants will be removed, cut down or treated with the appropriate herbicide (see 2.5).
- Pioneer species on prospecting sites will also be cut down to give the grasses an increased chance and in this way hasten the progress of succession, if so advised by a botanist.
- Appropriate action will be taken to correct any signs of erosion.
- If water quality is monitored, the accurate location of monitoring points must be recorded and the samples must be collected in bottles, with the site identified on these (sterile bottles if for bacteriological analysis). All samples must be kept cool (fridge and coolbox) and must be delivered to the registered laboratory for testing within 24 hours of collecting. Results must be checked against the limits for compliance and action taken if there are non-conformances. This information can be incorporated in the closure report when the Prospecting Right is relinquished.
- The Project Geologist will include a report on environmental compliance in the project report after major activities such as drilling. This should include photographs and written descriptions of all significant impact sites currently under observation, i.e. drill. This includes requirements of regulation 55 of the Minerals and Petroleum Resources Development Act.
- An internal EMS audit will be conducted annually and the external audit could include one or a number of field sites. These audits will check compliance with the SHE MP.
- DMR do ad hoc inspections to check compliance with the SHE MP.
- Records of monitoring will be filed and used in the annual report to DMR.
- This will continue until the agreed closure objective is achieved and/or closure permit has been granted.

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## 2.7. CLOSURE AND LANDOWNER LETTER

- Minimum closure objective requirements:

*To ensure that the rehabilitated area is re-vegetated (and/or soil erosion measures), safe, stable, non-polluting, non-eroded and in a state that is suitable for the agreed post closure land use.*

- When sites have reached a satisfactory level of rehabilitation according to the set goals (F.4.1 & F.4.2 in EM Plan) and/or agreed closure objective, sites are inspected by DMR prior to approval for closure of the permit being granted.
- Prior to closure being applied for, a final performance assessment and an environmental risk assessment will be carried out and submitted to DMR together with the closure application.
- If any post closure maintenance is necessary, this will be documented and arrangements made for the responsible person to continue with and report on this according to F5.3 below.
- Consideration will be given to discussing certain post closure monitoring with the landowner, and if agreement can be reached, environmental responsibility will be transferred to the landowner to continue with some monitoring such as invasive alien species, and the control of these
- Approach landowners to sign the closure letter (**Appendix I: Closure Letter**).

**Appendix I: Closure Letter**



**CLOSURE LETTER**

**TO WHOM IT MAY CONCERN**

This letter serves to confirm the following with regard to De Beers Exploration:

1. De Beers RSA Exploration conducted a drilling programme on the farm \_\_\_\_\_, Number \_\_\_\_\_, District \_\_\_\_\_ from (date) \_\_\_\_\_ to (date) \_\_\_\_\_.
2. During this time the De Beers employees caused no lasting environmental impact.
3. The De Beers employees left the farm in a good condition.

This note forms part of the Group Exploration RSA based operation's ISO14001 Environmental Management System.

Signed by: \_\_\_\_\_  
Surface Owner

Full Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Project Geologist**

Full Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Appendix II: Email received by Jan Phelan from DWAF confirming use of recycled drill water and sludge for bentonite mix in grouting of boreholes.

Email received by Jan Phelan from DWAF confirming use of recycled drill water and sludge for bentonite mix in grouting of boreholes.

Hi Jan,

If the test results of the remaining recycled water are of acceptable standard and the hydrocarbon component has been removed I don't see why DWAF would have any objections to the method. We have used bentonite for the sealing and grouting of boreholes ourselves and have no problem with it.

Willem

-----Original Message-----

From: Jan Phelan [mailto:mwplanit@mweb.co.za]  
Sent: 08 January 2009 09:45 AM  
To: Du Toit Willem  
Subject: Use of Drill Water for Grouting of Boreholes

Dear Willem,

It has been proposed that once the drilling operation is complete at each site that the remaining recycled drill water be tested for quality to ensure that there was nothing of concern, and any hydrocarbon component on the surface is skimmed off. The water will then be used for the mixing of the bentonite mixture for the grouting of the borehole as a best practice method of disposal.

Cement and bentonite mixtures have historically been used in the drilling industry for seals (piezometers in monitoring boreholes), hole abandonment etc.

The suggested specifications are as follows:

A grout mix for cementing the small diameter exploration boreholes which contains a synergistic blend of bentonite and drill sludge/fines and building sand of up to 55 % percent by weight of cement (BWOC) along with a Portland cement is suggested. The cement mix, when combined with mix water, may render a cementitious slurry having a density less than or equal to 1378 kg/m<sup>3</sup>, the amount of mix water in the cementitious slurry being between from about 200 to about 560 percent by weight of cement (BWOC). Such a mix using the water left in the sump that has been circulating the hole (max 1.5 m<sup>3</sup>) as well as the fine cutting sludge from the well also in the sump (max 0.2 m<sup>3</sup>), which have been checked and skimmed for any oils and grease would respectively provide roughly double to a one and a half of the mixture needed to grout a small diameter hole ( $\pm$  0.8 m<sup>3</sup> per 100 m hole), thus allowing for possible outwash of the unconsolidated zone as well as formation loss. Mixture hardens to 110Psi within 72 hours.

As far as grouting the large diameter borehole are concerned a dry fill consisting of gravel, sand and bentonite is suggested for the bulk of the fill, while the top 10 m of the hole can be grouted in the same way as the narrow diameter boreholes, incorporating any leftover drilling circulation water and cutting sludge. Information on bentonite is attached.

I would really appreciate hearing from you as to whether this recommended best practice for the use / disposal of drill water will meet the requirements of your department as it will form part of the amended EM Plan.

Regards,  
Jan Phelan.  
Environmental Assessment Practitioner  
Phone:033 330 2948.  
Cell: 082 876 0003

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DE BEERS  
GROUP OF COMPANIES

**Appendix III: BOREHOLE HANDOVER LETTER**

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