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VOLUME III

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN OF THE PROPOSED URANIUM MINE 'ETANGO PROJECT' NEAR SWAKOPMUND

DECEMBER 2009

Prepared for:
Bannerman Mining Resources (Namibia) (Pty) Ltd
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DEFINITIONS

Biological biodiversity: The variability among living organisms from all sources including, amongst others, terrestrial ecosystems and aquatic ecosystems and the ecological complexes of which they are part and this includes diversity within species, between species and of ecosystems (Environmental Management Act, No. 7 of 2007).

Draft Interim PFS: The Draft Interim Preliminary Feasibility Study prepared by Bannerman in June 2009, the outcomes of which form the technical basis for this ESIA and the ESMP.

Environment: The complex of natural and anthropogenic factors and elements that are mutually interrelated and affect the ecological equilibrium and the quality of life. The environment includes (a) the natural environment, being land, water and air, all organic and inorganic material and all living organisms; and (b) the human environment, being the landscape and natural, cultural, historical, aesthetic, economic and social heritage and values (Environmental Management Act, No. 7 of 2007).

Environmental aspect: This comprises all elements of an organisation's activities, products or services which can interact with the environment (ISO 14001).

Environmental element: Those components that make up the natural environment, e.g. soil, surface water, groundwater, plants and animals.

Environmental impact: Any change to the environment, whether adverse or beneficial, wholly or partly resulting from an organisation's activities, products and services (ISO 14001).

Environmental and Social Management Plan (ESMP): The ESMP is a legal requirement and forms part of the pro-forma environmental contract. It is a document which stipulates environmental objectives and targets to avoid or mitigate environmental aspects. It further should establish the responsibilities and timeframe to achieve the set objectives. An ESMP should be regularly reviewed and if necessary be amended to meet any changes of the company's activities.

Environmental objective: An achievable goal set by management to manage significant environmental aspects. The objectives are set at the beginning of the life of mine and reviewed at least once a year.

Environmental policy: A statement by an organisation of its intentions and principles in relation to its overall environmental performance which provides a framework for action and for the setting of its environmental objectives and targets (ISO 14001).

Environmental targets: The specifications which show that the environmental objective set out in the Environmental Management Plan has been achieved.

Hazardous substances: Any substance or mixture of substances declared hazardous in terms of Section 3(1) of the Hazardous Substances Ordinance 14 of 1974, or in terms of any other legislation which may be enacted to provide for the control of hazardous substances (Environmental Management Bill, 2002).

Hazardous waste: A hazardous substance that is no longer of use to the organisation and which needs to be disposed of in the appropriate manner.

Management program: A written document developed to outline the management and monitoring measures necessary to meet a set of defined objectives and targets.

Pollution: The direct or indirect introduction as a result of human activity of substances, vibrations, heat, radiation or noise into the air, water or land which may be harmful to human health or well-being or to the quality of the environment, or may result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment (Environmental Management Bill, 2002).

Waste: Any substance or thing that the holder discards or disposes of, or intends or is required to discard or dispose of, irrespective of its value to any person, and any substance or thing deemed by regulations to be waste (Environmental Management Bill, 2002).

ABBREVIATIONS

ADU	Ammonium diuranate
ASEC	A. Speiser Environmental Consultants cc
CAPCO	Chief Air Pollution Control Officer
CCD	Counter Current Decanter
CEO	Chief Executive Officer
CFCs	Chlorofluorocarbons
CO_2	Carbon dioxide
CoM	Chamber of Mines
DLEU	Drug Law Enforcement Unit
DoC	Degree of Contrast
DPW	Department of Parks and Wildlife
DWA	Department of Water Affairs
EAR	Environmental Assessment Report
EC	European Community
EIA	Environmental Impact Assessment
ELR	Environmental Legislation Register
EMS	Environmental Management System
EPL	Exclusive Prospecting Licence
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EU	European Union
GRN	Government of the Republic of Namibia
HCFCs	Hydrochlorofluorocarbons
HDPE	High-density Polyethylene
HIV	Human immunodeficiency virus
HLP	Heap leach pad
HLRF	Heap leach residue facility
IBCs	Intermediate bulk containers
ILS	Intermediate liquor solution
ISO	International Standard Organisation
IX	Ion exchange
LOM	Life of mine
MAWF	Ministry of Agriculture, Water and Forestry
MC	Mining Commissioner
MCP	Mine Closure Plan
MET	Ministry of Environment and Tourism
MHSS	Ministry of Health and Social Services
ML	Mine lease
Mlbs	Million pounds
MME	Ministry of Mines and Energy
MoF	Ministry of Finance
MoL	Ministry of Labour
Mtpa	Million tonnes per annum
NBRI	National Botanical Research Institute
NMC	National Monuments Council
NNNP	Namib Naukluft National Park
PFS	Pre-feasibility study
PLS	Pregnant liquor solution
PM10	Particular matter less than 10 micrometre
PM2.5	Particular matter less than 2.50 micrometre
RMP	Radiation Management Plan
ROM	Run of mine
SA	South Africa

SANS	South African National Standards
SLT	Strategic leadership team
SME	Small-medium enterprise
STP	Sewage treatment plant
TB	Tuberculosis
TSF	Tailings storage facility
U_3O_8	Uranium oxide
UNFCCC	United Nations Framework Convention on Climate Change
USC	Uranium Stewardship Committee
VCT	Voluntary Counseling and Testing
WHO AQG	World Health Organisation Air Quality Guidelines
WNA	World Nuclear Association
WRD	Waste rock dump

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1 INTRODUCTION

The Environmental and Social Impact Assessment (ESIA) for the proposed uranium mine at Etango Project, situated on the EPL 3345 of Bannerman Mining Resources (Namibia) (Pty) Ltd, was awarded to A. Speiser Environmental Consultants cc (ASEC) in October 2007. The overall objective of the study was to conduct an Environmental and Social Impact Assessment (ESIA) to determine the potential positive and negative impacts the project might incur. The ESIA report is contained in **Volume 1**. Based on the findings of the ESIA, an Environmental and Social Management Plan (ESMP) has been developed for all stages of the project's life cycle; namely, design, construction, operation, decommissioning and post closure. **Figure 1** shows Bannerman's EPL 3345.

1.1 BANNERMAN MINING RESOURCES (NAMIBIA) (PTY) LTD – BACKGROUND

Bannerman Mining Resources (Namibia) (Pty) Ltd (Bannerman) is 80% owned by Bannerman Resources Ltd which is based in Perth, Australia and is listed on the Australian Stock Exchange (ASX:BMN) and on the Toronto Stock Exchange (TSX:BAN). In April 2008, Bannerman Resources Ltd listed on the Namibian Stock Exchange (NSX:BMN).

Table 1 provides the details of the Exclusive Prospecting Licence holder.

Table 1 Details of Exclusive Prospecting Licence holder

Company name	Bannerman Mining Resources (Namibia) (Pty) Ltd
Name of holder	Bannerman Mining Resources (Namibia) (Pty) Ltd
Telephone, fax, e-mail	Tel: +264 64 416 200 Fax: +264 64 416 240 admin@bannermanresources-na.com
Postal address	P.O. Box 2854, Swakopmund, Namibia
Reference number of the licence	EPL 3345
Expiry date of EPL	26 April 2011
Registered names of land	Namib Naukluft National Park/West Coast Recreational Area, Erongo Region, Karibib/Swakopmund District
Minerals to be explored	Nuclear fuel

1.2 PROJECT AREA

EPL 3345 falls within the Namib Naukluft National Park (NNNP) and West Coast Recreational Area (WCRA) to the east-south-east of Swakopmund (**Figure 1**). The Ministry of Environment and Tourism (MET) is in the process of consolidating all the parks along the Namibian coastline into one Mega Park that will extend from the Orange River in the south to the Kunene River in the

north. However, this new park has not yet been promulgated. Thus, the current park names will be used in this document.

This ESIA only focuses on Bannerman's main target area, referred to as the Etango Project, which is located approximately 41 km (by road) east of Swakopmund and 47 km northeast of the port town of Walvis Bay, within the NNNP. It is easily accessed via the C28 and D1991 and is situated in close proximity to the popular tourism area known as the moon landscape. Tour operators and self-drive tourists alike are attracted by the impressive views of the rugged hills and valleys that flank the Swakop River.

A number of smallholdings are situated in the Swakop River valley, west of Goanikontes. In general, the farmers are either growing olives, date palms or vegetables and are involved in ecotourism. There are no people living in the park. The area on which the Etango Project is situated has never been populated by indigenous people.

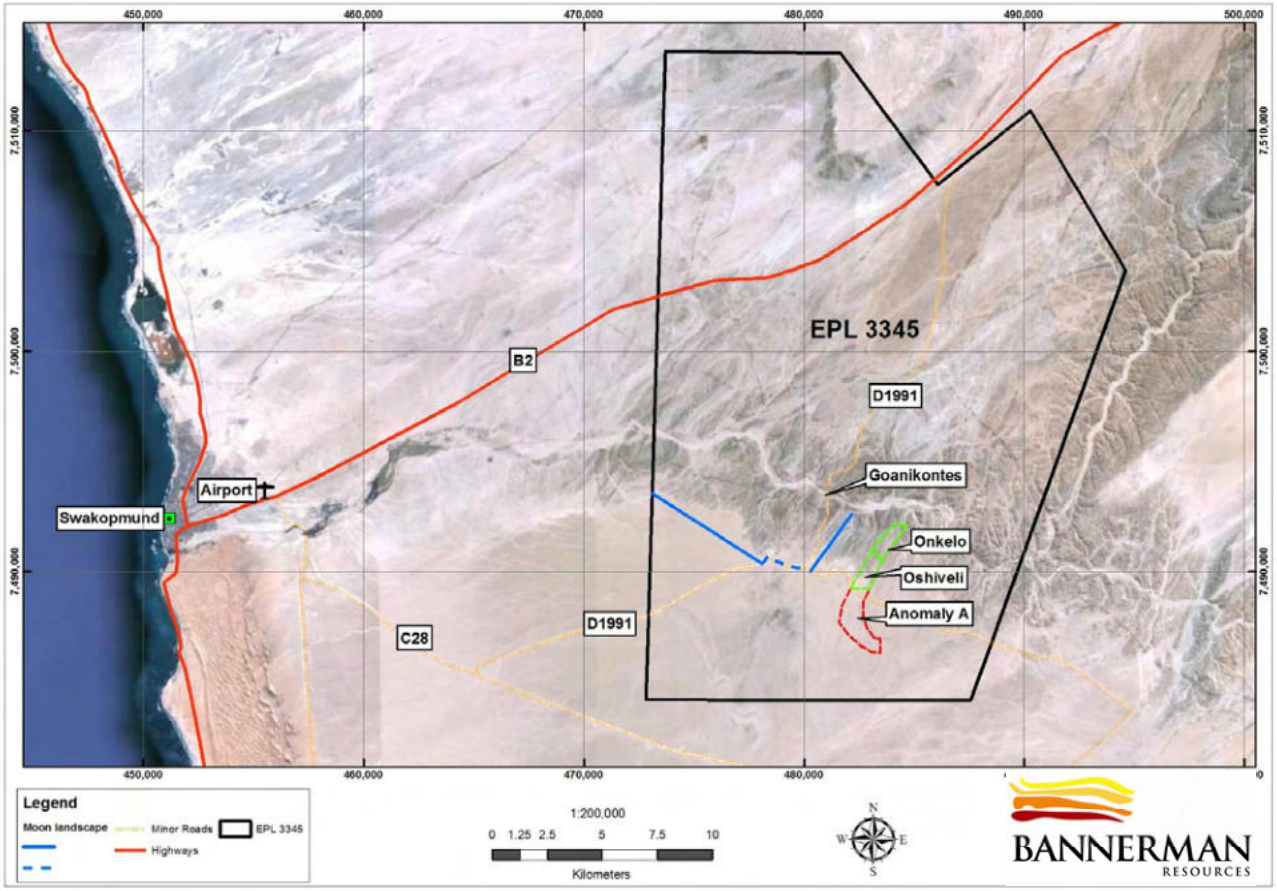


Figure 1 Map showing location of proposed Etango Project

When the scoping report was released in September 2008, the Etango Project only targeted Anomaly A prospect. During the mid-1970s and the beginning of the 1980s, this prospect was subject to various exploration programmes and studies, including the establishment of access tracks, test trenches and percussion and diamond drilling. Bannerman's exploration programme expanded on these.

In 2009, the exploration programme was expanded to include the Oshivelo and Onkelo exploration targets. The latter two are situated to the north of Anomaly A (**Figure 1**) and are excluded from the scope of the ESIA.

In early December 2009 Bannerman announced the completion of its Final PFS. Whereas, the Draft Interim PFS is based on the February 2009 mineral resource estimate, the Final PFS is based on the July 2009 mineral resource estimate and, hence, proposes a mine design which incorporates the Anomaly A, Oshiveli and Onkelo ore bodies. The results of the Final PFS are detailed in **Chapter 4.11** of the ESIA report (Volume I). This ESIA and ESMP consider only a mine design incorporating the Anomaly A deposit and, accordingly, in mid 2010 Bannerman will provide an ESIA Revision 1 for public consultation and lodgement with the MET. The ESIA Revision 1 will assess all impacts of the Final PFS, including the extended pit design.

Bannerman proposes to develop an open-pit uranium mine and to process the ore on site using heap leach technology. The final product (U_30_8) will be transported from the site to Walvis Bay for export to foreign markets.

As the proposed Etango Project is located in a section of a national park that has high conservation and tourism value, there are a number of stakeholders with vested interests in the area. The main concerns of park officials include minimising both the poaching of game and off-road driving. Since mid-2007, Bannerman has been conducting its exploration activities under strict park rules, e.g. employees are not allowed to camp in the park, no drilling is permitted after sunset, and progressive rehabilitation of its drill sites is mandatory. The main concerns of tour operators include a decrease in the quality of the roads, potential destruction of the scenic value of the area, and the closure of a section of the D1991, which would mean a severing of the circular route that takes them from the moon landscape to Goanikontes and on to the Welwitschia flats in the east. The farmers living along the Swakop River are concerned about dust, radiation and loss of access to their farms.

2 SCOPE OF WORK

2.1 SCOPE OF WORK FOR THE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The environmental and social management plan includes both the biophysical and the socio-economic (human) elements of the environment, hence it being referred to as an environmental and social management plan (ESMP).

The ESMP provides a description of the activities and the associated environmental impacts connected to the proposed Etango Project *throughout the project life cycle*; namely, from planning to construction, commissioning, operations and closure. The aim of this document is to:

- provide a description of the proposed mining, processing and associated activities;
- identify environmental and social risks; and
- outline how Bannerman proposes to avoid, minimise, mitigate and, if necessary, offset these risks.

2.2 EXCLUSIONS TO THE SCOPE OF WORK

Environmental Resource Management (ERM, an international consultancy, has been engaged to prepare the Radiological Public Impact and Safety Assessment and Occupational Health and Safety Plan. The draft Radiation Management Plan and draft Occupational Health and Safety Study Report are included in the **Appendices 2** and **3** to the ESIA report (Volume 1). These documents will need to be completed and the outstanding matters are set out by ERM in the gap analysis in each document.

2.3 TECHNICAL SCOPE OF WORK

The technical scope of work, which is based on Bannerman's Draft Interim PFS, is to consider and manage the impacts associated with:

- open-pit mining of Anomaly A; and
- the processing of ore using heap leach technology.

2.4 EXCLUSIONS TO THE TECHNICAL SCOPE OF WORK

The following operations and facilities are excluded from the scope of this document:

- Exploration drilling on Bannerman's EPLs (exploration activities have been covered by separate Environmental Management Plans since June 2006).
- NamWater pipeline, pump stations and reservoirs.
- NamPower power line and substation.
- The proposed new access road to site.
- The proposed/potential rail spur line to site.
- Transport of reagents, final product and fuel (via rail or road).

The ESIAs for these supporting services have not yet been conducted as negotiations are ongoing with relevant service providers and Bannerman wishes to take into account the findings of the Strategic Environmental Assessment (SEA) particularly with regards to external infrastructure corridors. Both the Environmental and Social Impact Assessment reports and their accompanying

Environmental and Social Management Plans will be submitted to the relevant ministries once they are complete.

2.5 STRUCTURE OF THIS DOCUMENT

Chapter 1 Introduction

Outlines why the ESMP has been developed.

Chapter 2 Scope of work

Outlines the scope of operations, facilities and impacts addressed in this document and lists those items that are not addressed in this document.

Chapter 3 Environmental legislation applicable to uranium mining in Namibia

Identifies the suite of environmental legislation that is applicable to companies involved with the mining and processing of uranium in Namibia.

Chapter 4 Description of activities

Provides a description of the activities associated with the different stages in the mine life cycle.

Chapter 5 Description of the biophysical and human environment

Provides a brief description of the existing biophysical and human environment. It looks at the different elements of the environment (e.g. hydrology and biodiversity) that may be impacted on by the aspects (e.g. dust or noise) arising from the proposed operations.

Chapter 6 Environmental aspects that give rise to environmental impacts

Lists the environmental aspects associated with the proposed operations/activities, provides a description of the nature of these aspects, as well as a summary of significant aspects and associated environmental impacts.

Chapter 7 Overarching environmental commitments

Outlines overarching management commitments (i.e. commitments that address more than one aspect or are applicable to more than one phase in the project's life cycle).

Chapter 8 Management of environmental impacts

Outlines how Bannerman intends to manage the impacts associated with the Etango Project through the various stages in the mine life cycle. All management aspects are considered in light of the mitigation hierarchy (i.e. first avoid, then minimise, then mitigate, and if necessary offset, the residual impact).

Chapter 9 Environmental and social management plan for the planning phase

Chapter 10 Environmental and social management plan for the construction phase

Chapter 11 Environmental and social management plan for the operation phase

Chapter 12 Environmental and social management plan for the decommissioning and post closure phases

Chapter 13 Inspecting, auditing and reporting on compliance

Chapter 14 New projects/additions/technology or process changes

Describes the process Bannerman will follow when new projects, expansions or changes to process are envisaged.

3 ENVIRONMENTAL LEGISLATION APPLICABLE TO URANIUM MINING IN NAMIBIA

3.1 LEGAL REQUIREMENTS

Bannerman complies with all Namibian legislation, and where legislation is lacking will comply with the World Nuclear Association (WNA) principles outlined in their document entitled *Sustaining Global Best-Practices in Uranium Mining and Processing*.

Chapter 5 of the ESIA report (**Volume 1**) provides a detailed description of all Namibian legislation that is relevant to the mining of uranium.

Legislation that is relevant to the management of environmental aspects or elements is also provided at the beginning of each section in this management plan.

Table 2 provides a list of relevant legislation.

Table 2 List of legislation relevant to uranium mining in Namibia

Year	Name
Current Namibian legislation	
1990	Petroleum Products and Energy Act, No. 13 of 1990, as amended
1990	The Constitution of the Republic of Namibia, No. [ ] of 1990
1992	The Labour Act, No. 6 of 1992
1992	The Minerals (Prospecting and Mining) Act, No. 33 of 1992
1997	Regulations relating to the Health and Safety of Employees at Work (promulgated in terms of Section 101 of the Labour Act, No. 6 of 1992 (GN156, GG 1617 of 1 August 1997)
1998	Affirmative Action (Employment) Act, No. 29 of 1998
1997	Namibian Water Corporation Act, No. 12 of 1997
1998	The Health Act, No. 21 of 1998
1999	Road Traffic and Transport Act, No. 22 of 1999
2000	Petroleum Products regulations
2000	Electricity Act, No. 2 of 2000
2000	Explosives Act, No. [ ] of 2000
2001	The Forestry Act, No. 12 of 2001
2004	Water Resources Management Act, No. [ ] 2004
2004	National Heritage Act, No. 27 of 2004
2007	Labour Act, No. 11 of 2007
2005	Atomic Energy and Radiation Protection Act, No. 5 of 2005
2007	Environmental Management Act, No. 7 of 2007
Former South African and SWA legislation still applicable in Namibia	
1919	Public Health Act, No. 36 of 1919
1956	Water Act, No. 54 of 1956
1956	Explosives Act, No. 26 of 1956

Year	Name
	Regulations promulgated in terms of the Explosives Act, No. 26 of 1956
1968	Regulations made under the provisions of the Mines, Works and Minerals ordinance, 1968 (Ordinance 20 of 1968)
1969	Soil Conservation Act, No. 76 of 1969
1974	Hazardous Substances Ordinance No. 14 of 1974
1975	Nature Conservation Ordinance No. 14 of 1975
1976	Atmospheric Pollution Prevention Ordinance No. 11 of 1976
Namibian policy	
1994	Policy for the Conservation of Biotic Diversity and Habitat Protection
1995	Namibia's Environmental Assessment Policy for Sustainable Development and Environmental Conservation
1998	Draft White Paper on the Energy Policy of Namibia
1999	Policy for Prospecting and Mining in Protected Areas and National Monuments
2000	National Water Policy White Paper
2002	Minerals Policy for Namibia
International law to which Namibia is a signatory	
1985	Vienna Convention for the Protection of the Ozone Layer
1987	Montreal Protocol on substances that deplete the Ozone Layer
1989	The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal
1989	The Rotterdam convention on the Prior Informed Consent Procedure for Certain Hazardous chemicals and Pesticides in International Trade
1992	The Rio de Janeiro Convention on Biological Diversity
1992	United Nations Framework Convention on Climate Change
Other/best practice	
1997	Namib Naukluft Park Regulations (original 1976 amended 1997) (No. 3556)
	World Nuclear Association (WNA) principles, outlined in their document entitled *Sustaining Global Best-Practices in Uranium Mining and Processing*
	Chamber of Mines of Namibia (CoM) – USC constitution

3.2 PERMITS

Before mining and processing of uranium can commence, Bannerman will need to acquire a number of permits and certificates. It is too early in the project design phase for this to take place. However, a list of the permits and certificates that Bannerman have already acquired is provided in **Table 3**. The originals of these documents are kept at the Swakopmund town office, with copies to be kept on site. **Table 4** summaries the notification, registration, approval and permits relating to environmental aspects. **Table 5** identifies the permits and certificates that Bannerman may be required to apply for in due course.

Table 3 List of permits that have already been awarded to Bannerman

Permit name	Regulator	Permit number	Period of validity
EPL 3345	MME	3345	26 April 2011
Environmental Clearance for EPL 3345	MET	n/a	26 April 2011
Entry Permit to Game Park/Reserve Namib Naukluft National Park	MET	n/a	To be renewed annually

Appendix 1 states the general conditions which are applicable when entering the Namib Naukluft National Park. These conditions are laid down by the Ministry of Environment and Tourism and must be adhered to at all times.

Table 4 Notification, registration, approval and permits

Issue	Act/Section	Type of requirement/ Ministry
Environmental Contract	**Environmental Policy 1994**	MET
Changes to the original management plan	**Minerals (Prospecting and Mining) Act, No. 33 of 1992** Section 50 (g)	Approval of revised ESMP/ MME and MET
Notification and approval of expansion and/or change to accessory works area	Section 90 (1) (e) and (2) (a)	Notification and approval of expansion and/or change to accessory works area/MME
Mining licence	Section 91 (f)	Approval of ESIA and ESMP/MME and MET
Written permission of the MC to erect any accessory works	Section 90 (2) (a)	Written permission from MC/MME
Permission to sell, discharge, etc. minerals won	Section 102 (1)	Permission from MC/MME
Permit to store and handle explosives on site	**Explosives Act, No. 26 of 1956**	Permit
Stipulates the use of public water for industrial purposes	**Water Act, No. 54 of 1956** Section 11 (1) – (7)	Permit
Sets out the requirements to obtain a permit to use public water for industrial purposes	Section 12 (1) – (9)	Permit
Water Abstraction permit – WA002	Section 13 (2)	Permit
Stipulates the purification of waste water and discharge	Section 21 (1) (2) (3) (4) (5)	Permit for industrial waste water and effluent disposal water abstraction/ DWA in MAWF
Picking and transport of protected plants	**Nature Conservation Ordinance, No. 4 of 1975** Section 73	Plant removal permit/Approval of landowner/DPW in MET or NBRI
Picking, removal of protected plants	Section 73	Permit/DPW in MET
Sale, donation, export and removal of protected plants	Section 74	Plant export permit /MET
Cultivation of protected plants in nursery	Section 75	Permit/MET
Scheduled processes in controlled area	**Atmospheric Pollution Prevention Ordinance, No. 11 of 1976** Section 5 (1)	Air pollution control certification/MHSS
Registration, selling, operating, installing of	**Hazardous Substance**	Hazardous Substance

Issue	Act/Section	Type of requirement/ Ministry
Environmental Contract	**Environmental Policy 1994**	MET
infrastructure related to Group I and III hazardous substances	**Ordinance, No. 14 of 1974** Section 5 (1) (a) (b) (c)	Licence and registration/MET or DLEU
Disturbing or destroying of national heritage sites (archaeological/palaeontological sites)	**National Heritage Act, No. 27 of 2004** Section 48 – 52 and 55	Permit National Heritage Council
Consumer installation certificate	**Petroleum Product Regulations, 2000** Section 18 (5)	Certificate MME, Department of Energy
Actions to be taken after a spill has occurred (major petroleum spill means 200 l per spill)	Section 49 (1) (4)	Notification/MME, Department of Energy
Export of uranium	**Import and Export Control Act, 1994,** Government Notice AG 6 of 1981	Permit/Ministry of Trade and Industry
Storage and use of explosives	**Explosive Act, 1956** Section 22	Permit/MME
30-days notification prior to commencement of construction	**Labour Act, No. 6 of 1992, Regulations for Labour Act 1992** Section 20	Notification/MoL
30-days notification prior to commencement of mining operation	Section 21	Notification/MoL
Transport/operating licence to transport goods on public roads	**Roads Traffic and Transport Act, 1999** Section 60	Licence/Ministry of Works, Transport and Communication
Approval to work on Sundays, public holidays and continuous operation	Section 33	Approval/MoL
Company must inform Chief Inspector (Ministry of Health and Social Services) before commencing building or construction work on the mine	**Regulations concerning the Health and Safety of Employees at Work, 1997** (Government Notice 156 of 1997)	MHSS and Notification to MME
VAT registration	**Value Added Tax Act, 2000**	Certification
Tax registration	**Income Tax Act, 1981**	Certification
Social Security	**Social Security Act, 1994** Section 20	Registration
Valid Affirmative Action compliance certificate	**Affirmative Action Employment Act, 1998** Section 42	Certification

Table 5: List of permits or certificates that may be required

Permit name	Regulator
Mining licence	MME
Environmental Contract for ESIA and ESMP	MET
Consumer installation certificate (Fuel farm)	MME
Water use (NamWater)	MAWF
Water abstraction (Swakop River)	MAWF
Disposal of domestic and industrial water/solid waste	MET/MAWF
Disposal of domestic and industrial effluent	MET/MAWF
Licence for explosives magazine	MME
Explosive burning permit	MME
Registration certificate for scheduled process	MME
Import/export authorisation for radioactive ore samples	MME
Import authorisation for radioactive materials	MME

4 DESCRIPTION OF ACTIVITES

Chapter 4 of the ESIA report (**Volume I**) provides a detailed description of the various stages of both mining and processing. **Chapters 4.1** and **4.2** of this report provide a summary of the activities that will be undertaken at the Etango Project site.

Note that in early December 2009 Bannerman announced the completion of its Final PFS. Whereas the Draft Interim PFS is based on one processing route, namely heap leaching, the Final PFS considers an additional processing option: tank-based leaching of a high-grade flotation concentrate. Bannerman is conducting further test work in respect of the two processing options and expects to make a decision on the preferred option in the first quarter of 2010. This ESIA and ESMP consider only the heap leach processing option and, accordingly, if the flotation concentrate option is selected, Bannerman will provide an ESIA Revision 1 for public consultation and lodgement with the MET. The ESIA Revision 1 will assess all impacts of the Final PFS, including the flotation concentrate processing option, if selected. The results of the Final PFS are detailed in **Chapter 4.11** of the ESIA report (Volume I).

4.1 MINING

Descriptions of the activities associated with mining are provided in **Table 6**.

Table 6 Table summarising open-pit mining at the Etango Project site

Activity	Description
Ore-resource development	The mineral resources are defined through exploration activities, surface mapping, electromagnetic and radiometric surveys, exploration drilling, sampling, assaying, etc. Mineral resources are subject to economic and technical evaluation, and not all identified mineral resources can be economically and/or technically exploited. Mineable resources are a subset of the mineral resources. Mineable resources are that part of the mineral resources that can be technically and profitably exploited.
Strip ratio	The strip ratio is a measure of the amount of waste that has to be mined in order to mine 1 tonne of ore. The average strip ratio for Etango is approximately 3.8:1.0, meaning there is 3.8 tonnes of waste for every 1.0 tonnes of ore. Generally, the strip ratio increases through the mine's life, and Etango ranges from 1.8:1 at the start and peaks at ~6:1 about midway through the mine's life.
Mine plan – open-pit sequencing	The pit will be developed in four overlapping stages, starting with the innermost stage and gradually progressing to the outer stages. The mining starts with stage 1, with pre-stripping starting at the subsequent stages prior to the previous stage being mined out.
Mining	The mining method is expected to be a conventional open-pit mine with drilling, blasting, loading, hauling and dumping as the main mining processes. Mining is expected to take place in 10 m-high benches on up to six benches at a time. Haul roads will be developed on surface to the crusher, stockpiles and waste rock dumps. A series of ramp systems will be developed in the pit as it increases in depth. Temporary haul roads in the pit will link loading operations to the ramp systems. Mining haul trucks will be loaded by excavators and haul the material over the access roads and ramps to the various dumping locations. It is currently expected that mining operations will start off with a mining contractor for the first ~5 years and then convert to an owner-mining operation.
Drilling and blasting	Drilling of blastholes will be achieved with a fleet of crawler-mounted drill rigs, drilling 165 mm diameter holes to a depth of 11 m on every bench. Blastholes will be charged with bulk explosives, called emulsion. Blasting will take place four to five times per week.
Work schedule	Mining is scheduled to operate on a shift and panel roster basis consistent with

<table>
<tr><th>Activity</th><th>Description</th></tr>
<tr><td></td><td>the Namibian labour law, 7 days per week, 365 days a year. The time spent at work will be carefully controlled and be within the guidelines of the labour law.</td></tr>
<tr><td>Ancillary equipment</td><td>The main mining operations will be supported by a fleet of ancillary equipment to maintain and build haul roads, dust suppression, and maintain mining equipment. Ancillary equipment may be owner operated or contract and will include, but not be limited to, track dozers, tyre dozers, graders, water trucks, mobile cranes and wheel loaders.</td></tr>
<tr><td>Pit dewatering</td><td>As the pit deepens it is expected that groundwater will be encountered. This water will be collected in sumps where possible and used for dust suppression, etc. It may be required to dewater certain sections of the open-pit walls to improve stability, but further geotechnical and hydrological studies will provide the information necessary to quantify this. During operations, no other water will be abstracted from any other potential underground sources.</td></tr>
<tr><td>External waste rock dumps (WRD) (built outside of the open pit)</td><td>The mine will require two waste rock dumps (WRDs), one on the east side of the pit and one on the west side. The WRDs will be the permanent storage for the waste rock mined from the open pit. During the design phase, particular care was paid to the visual impact of the WRDs. As a result, the heights of the dumps are restricted and their edges are smoothed to allow them to blend in with surroundings. Bannerman will investigate the possibility of backfilling part of the open pit with waste rock.</td></tr>
<tr><td>Low-grade stockpiles</td><td>During the normal course of operation, some lower grade ore may be preferentially stockpiled on the ROM pad to manage grade or for processing later in the mine’s life. It is possible that some ‘sub-grade’ material that could potentially become economical in the future will also be stockpiled adjacent to the WRDs but closer to the processing plant.</td></tr>
<tr><td>Topsoil stockpiles</td><td>As the entire project is located on the gravel plains of the Namib Desert, there is no topsoil and thus topsoil stockpiles will not be created.</td></tr>
<tr><td>Land disturbance</td><td>Open pit: 2 400 000 m^2
Waste rock dumps: 8 800 000 m^2
Stockpiles and primary crusher: 100 000 m^2
Workshops, magazines, offices: 10 000 m^2
Total mining: 11 310 000 m^2</td></tr>
<tr><td>Mining Fleet (including owner operated and contractors)</td><td>
<table>
<tr><th>Item</th><th colspan="2">Equivalent Class</th><th>Number</th></tr>
<tr><td>Excavator</td><td>Hitachi</td><td>EX5500</td><td>4</td></tr>
<tr><td>FEL</td><td>Caterpillar</td><td>CAT994</td><td>2</td></tr>
<tr><td>Haul truck</td><td>Caterpillar</td><td>793D</td><td>25</td></tr>
<tr><td>Blast hole drill</td><td>Atlas Copco</td><td>DMLSP</td><td>5</td></tr>
<tr><td>Track dozer</td><td>Caterpillar</td><td>D10</td><td>5</td></tr>
<tr><td>Grader</td><td>Caterpillar</td><td>16M</td><td>3</td></tr>
<tr><td>Water cart</td><td>Caterpillar</td><td>777</td><td>2</td></tr>
<tr><td>Wheel dozer</td><td>Caterpillar</td><td>844</td><td>1</td></tr>
<tr><td>Lighting plants</td><td></td><td></td><td>10</td></tr>
<tr><td>Excavator/Breaker</td><td>Caterpillar</td><td>345D</td><td>1</td></tr>
<tr><td>Tool carrier</td><td>Caterpillar</td><td>IT950</td><td>2</td></tr>
<tr><td>Total</td><td></td><td></td><td>60</td></tr>
</table>
</td></tr>
</table>

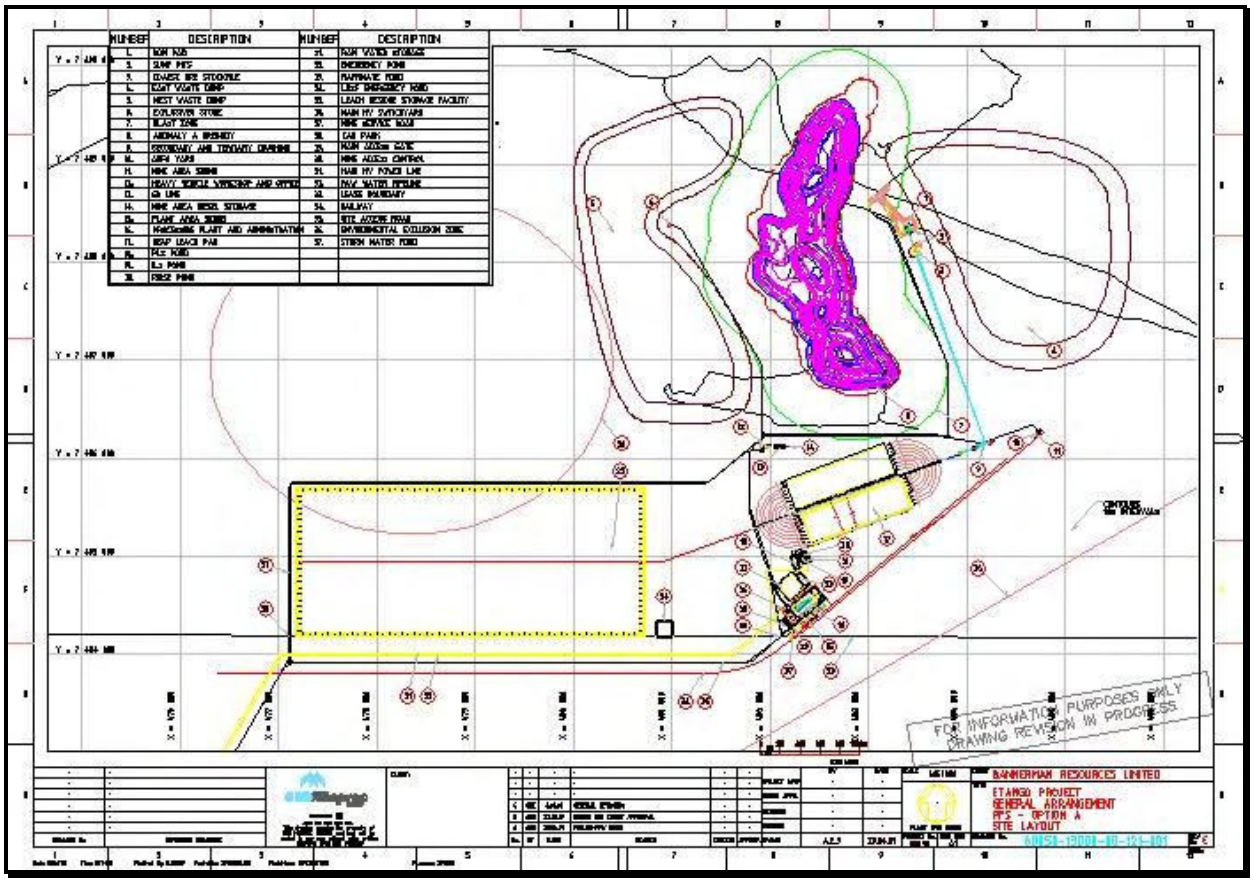


Figure 2 Proposed layout of the mine, plant and associated infrastructure (source: GRD Minproc)

4.2 PROCESSING

Descriptions of the activities associated with processing of uranium ore into U_3O_8 are provided in **Table 7**.

Table 7 Table summarising uranium processing at the Etango Project site

Activity	Description
Crushing and screening	The ore from the ROM is fed into the primary crusher and stored at the coarse ore stockpile. From there it is screened and fed into the secondary crushers. A high pressure grinding rolls (HPGR) crushing and screening circuit is used for tertiary crushing of the ore. Dust-suppression sprays are used for all transfer points in the crushing and screening areas. Water is bled from each of these scrubber tanks into the process water system to be used in the plant.
Heap leach stacking and reclaiming	Fine ore from the comminution plant is transferred by conveyor to the heap leach stacker with an agglomeration phase included in this transfer. The stacking and reclaiming is a race-track type system which comprises a fixed overland conveyor with tripper which transfers ore to a staking bridge. During operation it moves lateral to the overland conveyor. A tripper travels along the fixed conveyor while transferring material onto the mobile stacking conveyor. The stacking conveyor transfers onto a stacker boom which has a nominal reach of 15 m. The stacking bridge and boom mechanism is able to retreat away from the heap as the stacking progresses, so generating a

Activity	Description
	continuous even heap. The maximum stacking height is 7 m. At the end of the pad, the stacking operation stops and the entire assembly is moved off the pad. The centre end stops and pivots around a fixed point so the whole mechanism rotates and enters the opposite pad facing the other direction so that stacking will progress in a similar way back to the opposite end. Here the rotation occurs again and the cycle is repeated. The reclaiming system operates on a similar race-track type system as the stacking system. A bucket wheel excavator is used to reclaim the ore from the heap and transfer it to the bucket wheel excavator conveyor to the reclaim bridge conveyor and back to the fixed overland conveyor to the heap leach residue storage facility. The heap leach pads are constructed with a double layer HDPE lining, with leak detection (between the layers). The layers are protected from mechanical damage by protective layers of material above and below the liners.
Heap leach residue facility	Heap leach residue is transferred from the heap via the overland conveyor to the leach residue stacking system. After the heap leach residue is transferred to the residue pad fixed conveyor, a tripper travels along the top chord of the frames to place material anywhere along the length of the mobile stacking conveyor. The stacker stacks the residue onto the heap leach residue pad. The disposal area length is 3 500 m with a width of 1 750 m and an average stacking height of 23 m. The heap leach residue storage facility is constructed with an HDPE lining. The liner is protected from mechanical damage by protective layers of material above and below the liners. If there is an exceptional rain event, any seepage from the residue storage facility is collected in the heap leach residue emergency pond, which has a capacity of 94 000 m^3. This effluent is then pumped into the raffinate pond and recycled onto the plant. Both the emergency pond and the raffinate pond have a single layer HDPE liner.
Solvent extraction	The uranium-bearing solution from the leach pads is referred to as pregnant liquid solution (PLS). PLS is pumped from the PLS pond to the solvent extraction (SX) circuit, which consists of extraction, scrubbing, stripping, organic regeneration and crud removal. The SX stage configuration is two extract (series), two scrub, four strip, one regeneration. Mixer-settlers are used for all contacting duties. Several layers of fire protection have been incorporated into the design of the SX circuit, as fire is the most significant risk associated with the solvent extraction process.
Precipitation and calcination	Loaded strip liquor from SX is pumped into precipitation tanks. Anhydrous ammonia is added to both tanks to raise the pH to 6.5-7.2, which results in the precipitation of ammonium diuranate (ADU). The resultant slurry is discharged to the ADU thickener, where a majority of the liquor (now depleted of uranium) is separated from the ADU solids. Barren liquor is clarified using a pressure polishing filter to remove suspended ADU solids. The solids are returned to precipitation tank 1 as seed, while the clarified barren liquor is stored in the barren liquor surge tank. From here, the barren liquor is returned to the SX circuit as strip liquor. Any surplus barren liquor is bled to the raffinate pond via the SX recovered aqueous tank. Dewatered and washed ADU solids are fed into the calcining furnace via the furnace screw feeder. The furnace is a 4.35 m-diameter, refractory-brick lined, multiple-hearth furnace and can operate at up to 850ºC. Diesel is fed to the furnace burners from the fuel oil day tank where it is burnt in air provided by the furnace air blowers. Solids move downward through the furnace and the high

Activity	Description
	temperature environment results in the removal of water, ammonia and sulphur, which report to the furnace off-gas. Off-gas is cleaned in a venturi scrubber using acidified water to remove entrained dust and absorb contained ammonia, while scrubber off-gas is vented to atmosphere via an exhaust stack. Scrubber water is recirculated around the scrubber via the scrubber water tank; a bleed is returned to the ADU thickener to provide an outlet for recovered components. Calcined solids (uranium oxide, U_3O_8) are discharged from the bottom of the furnace into the trommel lump breaker, which breaks any solid agglomerates formed during calcination. Powdered U_3O_8 solids are transferred to the product bin via the product screw feeder.
Product packaging	An automated packaging plant is used to carry out all elements of packaging, including off-gas cleaning, drum weighing, filling, sealing and labelling. This section of the plant operates on day shifts only.
PLS, ILS, raffinate and emergency ponds	The PLS, ILS, raffinate and emergency ponds are lined with a geotextile/bentonite low-permeability base layer, followed by a double layer HDPE liner with a geonet separator for leak-detection purposes. For the rinse pond, a single layer HDPE liner is used.
Reagents store	The reagents store will be located close to the rail loading station. **Chapter 4.2.1** lists the different reagents used in the process.
Land disturbance	HLRF (Ripios): 5 300 000 m^2 Leach pads: 1 250 000 m^2 Crushing plants: 51 000 m^2 Process ponds and sumps: 85 000 m^2 Office and admin: 28 000 m^2 Raw-water storage: 1 800 m^2 HT switch yard: 1 500 m^2 **Total plant: 6 717 300 m^2**

4.2.1 Key reagents

The key reagents to be used for the proposed operations are summarised in **Table 8**. These reagents will be delivered to site by rail or road. Solids will be transported as powders packed in bags or bulk bags, and solutions/liquids in tankers. The capacity of onsite storage facilities is 30 operating days.

Table 8 List of key reagents that will be stored and used on site (based on Draft Interim PFS)

Reagent	Description	Estimated consumption (tonnes/annum)
Sulphuric acid	Sulphuric acid is received by rail and transferred into an appropriately designed storage facility close to the plant. From here it is pumped by small-bore piping as required in the process. The amount to be used during the operation of the plant has yet to be determined.	195 697
Peroxide	Peroxide is delivered in 25 t tankers and unloaded into a storage tank, providing 30 days storage. A duty/standby pumping system is used to transfer the peroxide solution to the heap leach area, where it is added to the raffinate and ILS solutions prior to irrigation onto the heap leaching pad. Peroxide is a strong oxidant and a safety shower is provided in the storage/distribution area. Spillage is collected in the peroxide area sump and transferred to the raffinate pond using a sump pump.	616
Diluent	Shellsol 2325 diluent is delivered in tankers and unloaded into a storage tank, providing 30 days storage. A transfer pump is used to	543

Reagent	Description	Estimated consumption (tonnes/annum)
	transfer the diluent to the solvent extraction area, where it is added to the crud tank and to the stripped organic tank to make up organic lost from the circuit by evaporation and entrainment. Diluent is flammable and fire protection and a safety shower is provided in the storage/distribution area.	
Extractant and modifier	Alamine 336 extractant and Isodecanol modifier are both delivered to site in 1 m^3 IBCs, which are stored in a storage shed, where enough IBCs are stored for 30 days supply. Transfer to the stripped organic tank is by transfer pump, to make up organic lost from the circuit by entrainment. The transfer IBCs are located next to the stripped organic tank.	23 17
Ferrous sulphate	Ferrous sulphate is delivered to site in 1 tonne bulka which are stored in the reagent store, providing 30 days storage. Bags are transferred to the mixing area using a forklift and split using a bag splitter located above the agitated ferrous sulphate mixing tank. The mixing tank is designed to mix one bag per batch with raw water to produce a ferrous sulphate solution. Once mixed, the batch is transferred to the ferrous sulphate storage tank, which provides 24 hours of storage solution. The solution is transferred to the HLF using a dosing pump, where it is mixed with the raffinate and ILS solutions prior to irrigation onto the heap leaching pad. Spillage is collected in the ferrous sulphate area sump and transferred to the mixing tank using a sump pump.	3 512
Binding agent	The binding agent, magnafloc 351, is used to assist in the agglomeration of fine particles prior to heap leaching. Magnafloc is delivered to site in 1 t bulka bags, which are stored in the reagent store, providing 30 days storage. Bags are transferred to the mixing area using a forklift and split using a bag splitter located above the agitated binding agent bin. Binding agent is transferred to the agitated mixing tank using a feeder, eductor and blower via a wetting head. The mixing tank is designed to mix 360 kg per batch with raw water. Once mixed, the batch is transferred to the agitated binding agent storage tank, which provides six hours of storage. The binding agent is pumped to the agglomerating drums using two dosing pumps. Spillage is collected in the binding agent area sump and transferred to the agglomeration area sump using a sump pump.	3 784
Coagulant	Polysil RM1250 coagulant is delivered to site in 1 m^3 IBCs, which are drained into a storage tank, providing 30 days storage. The coagulant is pumped through a static mixer, where it is mixed with raw water to provide a diluted solution, which is stored in the dosing tank. The dosing tank has a capacity of 24 hours storage of diluted coagulant. A dosing pump is used to transfer the coagulant solution to the heap leach area, where it is added to the PLS pond with the PLS for removal of silica prior to solvent extraction. A safety shower is provided in the coagulant mixing area. Spillage is collected in the coagulant area sump and transferred to the mixing tank using a sump pump.	822
Sodium hydroxide	Sodium hydroxide is delivered to site in 1 t bulka bags, which are stored in the reagent store, providing 30 days storage. Bags are transferred to the mixing area using a forklift and split using a bag splitter located above the agitated sodium hydroxide mixing tank. The mixing tank is designed to mix one bag per batch with raw water to produce a sodium hydroxide solution. Once mixed, the batch is transferred to the sodium hydroxide storage tank, which provides 24 hours of storage solution. The solution is transferred to the regeneration mixer/settler using a dosing pump, where it is used to regenerate stripped organic.	224

Reagent	Description	Estimated consumption (tonnes/annum)
	Spillage is collected in the hydroxide/carbonate area sump and transferred to the sodium carbonate mixing tank using a sump pump.	
Sodium carbonate	Sodium carbonate is delivered to site in 1 t bulka bags, which are stored in the reagent store, providing 30 days storage. Bags are transferred to the mixing area using a forklift and split using a bag splitter located above the agitated sodium carbonate mixing tank. The mixing tank is designed to mix one bag per batch with raw water to produce a sodium carbonate solution. Once mixed, the batch is transferred to the sodium carbonate storage tank, which provides 24 hours of storage solution. The solution is transferred to the regeneration mixer/settler using a dosing pump, where it is used to regenerate stripped organic. Spillage is collected in the hydroxide/carbonate area sump and transferred to the sodium carbonate mixing tank using a sump pump.	592
Anhydrous ammonia	Pressurised ammonia is delivered to site in 40 t capacity rail tankers via Walvis Bay or road tankers with a capacity of 8 t or 14 t via Johannesburg. The anhydrous ammonia is transferred to one of two storage bullets using a compressor. The storage bullets each have a 73 t capacity, or 141 m^3, allowing for a maximum liquid level of 85% due to the vapour pressure of ammonia. This allows for 30 days storage. Ammonia is pumped from the storage bullets through a diesel-powered vapouriser to the solvent extraction and precipitation areas as ammonia gas. In solvent extraction, ammonia is mixed with demineralised water and the resulting ammonia solution is used to strip uranium from the organic to the aqueous phase. In the precipitation area, ammonia gas is added to the precipitation tank to produce the ADU precipitate.	1 754

4.3 ACCESSORY WORKS

At this stage of the design phase Bannerman has not yet clarified exactly what supporting structures will be on site and what their design specifications will be. **Table 9** provides a list of the *anticipated* accessory activities.

Table 9 Table summarising accessory activities at the Etango Project site

Activity	Description
Construction	
Project offices	The construction offices will house the construction management and supervision activities. They will be prefabricated structures intended for easy removal.
Contractors lay-down areas	Contractors lay-down areas will be assigned per contractor. They will be sited wherever possible on ground to be disturbed during the operation phase of the mine. The contractors will use their lay-down areas for site offices, storage of components and equipment, pre-assembly and testing of machinery, and other activities required in the fulfilment of their contracted duties.
Construction camp	The construction camp will also be constructed of pre-fabricated buildings for easy removal. This facility will include sleeping quarters, ablution facilities, kitchen and dining halls, a recreation room, and any of various recreation facilities, including gymnasiums, snooker rooms, table tennis, internet rooms, etc.
Water reservoirs	A temporary water reservoir will be set up to supply the construction camp with potable water.

Activity	Description
Sewerage plant	It is envisaged to install six portable sewage-treatment plants in parallel to treat all the sewage and grey water arising from the construction camp. On completion of the construction phase, these will be moved to various points around the mine so that it will not be necessary to pump sewage long distances for treatment. This distribution may be three units installed at the plant ablution block, and one each near the mining office/workshop, the primary tip area, and the mine rail siding. These units include a small concrete sludge drying bay and can be operated in a zero-discharge manner. Recycled water will be pumped to the process water pond via the existing wash-water recycling, as appropriate.
Mining	
Mining offices and workshops	Permanent offices and workshops will be constructed for use during the life of the mine. Offices will house the management of the mining operation, as well as the geologists, mine-fleet maintenance and support staff.
Explosives depot	The explosives storage facility will be built according to applicable legislation.
Fuel farm	Diesel will be received by rail into a diesel storage facility constructed according to applicable legislation. The main storage facility will in turn supply 'day-tanks' at the diesel-fired calciner in the plant and the mine vehicle refuelling facility at the mine workshop. These day tanks will also be designed appropriately and a zero discharge policy will apply to spillage and bunded areas, etc.
Tyre bay	Attached to the mine fleet workshop will be a tire bay for the changing and repairing of mine-fleet tyres.
Processing	
Offices and canteen	A plant office block will house the plant management, operations and maintenance personnel, as well as all support functions. This building will also be the main reception area for visitors and include a training room, boardroom, meeting rooms, canteen and dining area.
Change house	A change house will be provided for all staff who work in dirty areas to allow them to shower at the end of their shift. A laundry will be provided to wash overalls as required.
Security office and gate house	A security office and gatehouse will be provided at the perimeter fence to control access to the site. This will be for the maintenance of safety standards, as well as for the security of the staff and the facility.
Medical facility	A first aid station will be equipped to receive injured personnel (in case of emergency or accident). It will be equipped to do patient stabilisation in preparation for transfer to local hospitals.
Engineering workshops	Alongside the main store and store yard will be engineering and maintenance workshops. It is envisaged that there will be a fitting workshop, a platework (boilermaking) workshop, and an electrical and instrumentation shop.
Salvage yard	A demarcated salvage yard will be used for accumulating materials and items that might have become contaminated by radiation. These will be accumulated, or if applicable, disposed of in terms of the Radiation Management Plan and/or Mine Closure Plan.
Wash bay	A wash bay will be provided on the exit road from the plant so that vehicles exiting the plant can be washed down. A wash bay for the mining fleet will also be provided in the vicinity of the mining workshop.
Laboratory	An onsite laboratory will be provided for testing mining and process samples, as well as product quality. It will also be used for monitoring water quality from groundwater samples, as well as other environmental management tasks. Radiation monitoring and management of staff will be contracted out to the centralised facility established for this purpose.

Activity	Description
Fire water, fire detection and suppression system	A fire-water storage facility will be provided with an ensured minimum volume for fire-fighting purposes. An electric pump and jockey pump (for maintaining pressure) will be supplemented by a diesel pump as per accepted fire-protection standards and practice. A ring main of hydrants will be supplemented in the SX area with an automatic foam deluge system.
Fuel storage and distribution	See above
Sewerage plant (for mining and processing areas)	See above
Domestic waste storage area	Bins will be maintained for domestic waste which shall be removed to local municipal waste facilities.
Electrical substation	The main HV substation will be situated at the incoming line from the NamPower supply. Power distribution will then be to separate substations and motor control centres (MCCs) as required in the plant and mining sections.
Land disturbance (est.)	Salvage yard 30 000m^2 Construction lay down area 75 000m^2 Buildings/workshops 15 000 m^2 Magazine 2 000 m^2

5 DESCRIPTION OF THE BIOPHYSICAL AND HUMAN ENVIRONMENT

Chapters 6 and **7** of the ESIA report (**Volume 1**) provide a detailed description of the biophysical and human environments, respectively, and are based on desktop studies and specialist studies conducted as part of the environmental impact assessment study. A summary of the biophysical and human elements and their associated issues is provided in **Tables 10** and **11**, respectively.

Table 10 A summary of issues associated with the various elements of the biophysical environment

Biophysical element	Impact
Geology and soil	Removal of mineralised rock to extract uranium will permanently change the geological formation. This resource will not be available for future generations. Desert soils are generally nutrient-poor but are still able to support a surprising array of plant life. If this soil is lost (from water or wind erosion or through physical removal), plants may not be able to re-establish in the area. Disturbed soil may also not be conducive for burrowing activity which could result in localised extinctions of burrowing animals such as lizards, scorpions and rodents.
Hydrology	The west coast of Namibia is the most arid part of the country. Water is a scarce resource and is pumped from ground aquifers to the coastal towns and mines. Over-abstraction of groundwater is a national concern. Although sporadic, surface water plays a major role in structuring and driving desert ecosystems. For example, flash floods transport valuable nutrients and seeds from one area to the next and recharge the sub-surface alluvium. Disruption of surface-water flow patterns at the Etango site has the potential to negatively impact on downstream communities of plants and animals.
Land use	The Etango Project is located in the Namib Naukluft National Park (NNNP). The current land use is conservation and eco-tourism. Etango is located in close proximity to some of the park's most important tourist attractions, namely the moon landscape (dramatic landscapes), Swakop River (dramatic landscape and linear oasis for plants and animals) and Welwitschia flats (home to one of the largest populations of Welwitschia in the world). Mining has the potential to conflict with land uses such as conservation and eco- tourism, both during operations and post closure.
Air quality	Air quality has the potential to be affected by a variety of pollutants. The emissions which can be expected at Etango are described below. Fallout and long-term radioactive dust will result from blasting, loading, hauling and handling of ore and waste rock. It will also be blown from the waste rock dumps, ROM, stockpiles and primary crusher. Fallout dust will also be created by vehicles travelling on the gravel road to and from site. The desert is a naturally dusty environment and many plants and animals have adapted to living in dusty conditions. Nevertheless, elevated fallout and long-term radioactive dust have the potential to deteriorate local air quality (giving rise to occupational and public health issues), impact on plants by blocking their stomata and causing smothering or structural damage, and impact on burrowing animals by blocking their holes. Please note that this issue is addressed in the draft Radiation Management Plan. PM10 and 2.5 dust will be generated in the same areas as fallout dust and have the potential to affect the health of employees and the public. CO_2 and diesel particulates generated by vehicles, heaters and generators will affect air quality by contributing to smog. Fortunately, Etango is located in a remote environment so the local impact is expected to be minimal. However, as greenhouse gas emissions are an international concern (they contribute to global

Biophysical element	Impact
	warming), monitoring and management of these emissions will be undertaken. Chemical fumes will be emitted from the process plant and have the potential to harm employees' health. It is expected that the volumes will be very small but they will need to be identified and quantified.
Biodiversity	Biodiversity (i.e. the plants and animals living in an area and the ecosystems that support them) will be affected by mining activities. The primary impact will result from land disturbance, which will remove habitats (homes, territories and movement corridors), and disrupt ecosystem function (such as water flow through the system). Dust fallout and long-term radiation dust, remote noise, availability of permanent water, vehicular activity are other aspects that are likely to impact directly on biodiversity.
Remote environments	To operate a mine, resources such as chemicals, equipment and electricity are needed. While these products do not necessarily generate impacts on site, the manufacturing of them does cause impacts in other places. Thus, remote environments many kilometres away from the mine may be negatively impacted.

Table 11 A summary of issues associated with the various elements of the human environment

Human element	Impact
Socio-economic	The mine is expected to contribute approximately 800 jobs during construction, which will last about two years. Approximately 900 permanent jobs will contribute to the economic and social upliftment during operations, in a country where unemployment is estimated at 37%. The inward migration of employees and job-seekers will increase pressure on the availability and standard of education and health services and affordable housing, and may increase social ills. It is possible that the loss of sense of place in the national park may negatively impact on tourism in Swakopmund and on guest farms neighbouring the mine.
Noise	The main noise components from an open-pit mining and processing operation are those generated by the diesel-powered mining equipment and the processing plant on the mine site itself. The range over which the noise emissions will cause a perceivable impact is largely determined by meteorological and other atmospheric conditions at different times of the day and seasons. In addition, blasting, transport operations and reverse hooters will cause high noise emissions, although the latter two can be mitigated.
Archaeology and cultural	Four archaeological sites located within the proposed pit provide links to the overall picture of the repopulation of the Namib Desert in the late Pleistocene and Middle Stone Age. They are regarded as not important sites and have a low or indirect threat regarding the acceptable vulnerability ranking used. A further site study is required once the site layout is finalised.
Visual	Taking all the key observation points into consideration, the Visual Resource Management (VRM) Class I objectives will not be met for the proposed landscape modifications at the Etango Project site, either without or with mitigation in place. This is because the sense of place is associated with wilderness, and any human-made structures conflict with this. However, if mitigation measures are implemented, the important tourist landscapes associated with the moon landscape, Swakop River and Welwitschia flats can be preserved. Thus, even if the proposed Etango Project is developed in this natural landscape, the potential exists to meet the VRM Class I objectives in the long term, although not during the life of mine, which will be at least 15 years.
Sense of place	Sense of place is formed from a combination of attributes such as space, visual, noise, biodiversity and archaeological. The combined impacts (both direct and indirect) of all the activities taking place in and around the proposed Etango site have the potential to profoundly alter the way people perceive and use this section of the national park, affecting both peoples' psyches and some people's livelihoods.
Remote environments	To operate a mine, people need a place in which to live. The influx of people into the nearby towns will not necessarily generate impacts on site, but it will have both a positive and negative impact on the municipalities that have to support the growing population (e.g. provision of extra schools, water, housing, etc.) The NNNP will also feel the impacts of an increased local population as there will be more people using the park. The positive implication is increased revenue through permits, while the negative implication is an increase in off-road driving, littering and illegal activities such as over-fishing.

6 ENVIRONMENTAL ASPECTS THAT GIVE RISE TO ENVIRONMENTAL IMPACTS

Understanding the biophysical and human environment in which a mine operates is the first step to understanding environmental impacts. The next and possibly more important step is to identify the environmental aspects that give rise to the impacts. For example, the activity of blasting has more than one environmental aspect associated with it; namely, noise, vibration, dust generation and fallout debris. All of these aspects impact on the environment in a different way. Management success will be gauged by how well Bannerman avoids, minimises or mitigates all the impacts associated with each environmental aspect. **Table 12** provides a broad description of the types of environmental aspects that are associated with mining operations and how they impact the biophysical and human environments, respectively.

Table 12 Description of environmental aspects associated with mining operations

Environmental aspects	Explanation	Nature of impact
Aspects associated with consumption of resources		
Energy use	Use of any fuel (fossil fuels, electricity, renewable and nuclear fuel) to meet a power requirement. Includes the use of power-generated on site (e.g. by diesel-powered generators or solar panels) or off site (e.g. by electricity).	Energy Resource Depletion, remote impacts (full suite associated with mining and processing the particular fossil fuel).
Use of natural resources	This includes the use of water (surface and ground), timber and minerals (unprocessed) but excludes fossil fuels, which are covered under 'Energy use'.	Natural Resource Depletion, loss of land (habitat), change in land-use potential, loss of future economic opportunities.
Use of manufactured materials	Use of all materials which do not fall into the natural-resource category (i.e. materials which have been subject to processing, for sale as manufactured items). This includes items such as paper, printing cartridges, cleaning agents, packaging materials and chemicals.	Natural Resource Depletion, loss of land (habitat), change in land-use potential, loss of future economic opportunities.
Aspects associated with waste/pollution generation		
Emissions to air process fumes	All releases to atmosphere, excluding dust, radon and ionising radiation. Includes point-source emissions, e.g. from process stacks, exhausts, leaks from pipes, and also fugitive emissions, e.g., evaporation. Includes gaseous emissions from power generation (on and off site), acid gases, carbon dioxide, CFCs, HCFCs and halons, solvents (volatile organic compounds), stack emissions of particulate matter, and other noxious gases.	Greenhouse effect, acid rain, ozone depletion, change in local/regional air quality. Impact on health of plants and animals. Impact on occupational health of employees or downstream populations.
Emissions to air – dust	Fine, dry particles of earth or other matter so comminuted that they may be raised and carried by the wind; that which is crumbled to minute portions.	Reduce visibility, pollute air. Mechanical damage to leaves of plants, damage to invertebrate habitat. Mechanical damage to organs, irritant.
Emissions to air odours	The property or quality of a thing that affects stimulates or is perceived by the sense of smell.	Hygiene, safety and health.
Emissions to air – radioactive	Radioactive waves from radioactive material (alpha, beta and gamma), including radon.	Safety and health, mechanical damage to organs.
Emission to land (solid and liquid non-hazardous waste)	Production and disposal of domestic and industrial wastes that are not hazardous, e.g. paper, wood, plastic, etc.	Visual pollution (e.g. littering). Pollution of water. Alteration of soil chemistry and/or composition. Safety and health. Scavenging by animals.

Environmental aspects	Explanation	Nature of impact
Emission to land (solid and liquid hazardous waste)	Production and disposal of domestic and industrial mineral waste that is hazardous. Includes oils, chemicals, batteries, fluorescent tubes or accidental release of hazardous materials.	Visual pollution (e.g. littering). Pollution of water. Alteration of soil chemistry and/or composition. Safety and health. Scavenging by animals.
Emission to water (domestic)	Includes all waste (liquid or solid) that is disposed of into water first. This includes domestic waste water from toilets, showers, kitchen facilities and drains. It is generally contaminated with organic waste and cleaning reagents that are high in phosphorus, nitrates and chlorines. Domestic effluent released into a sewer.	Contamination of streams, dams, groundwater and ocean. Alteration of soil chemistry and/or composition. Impact on fauna and flora living in aquatic environments. Safety and health.
Emission to water (industrial)	Industrial effluent includes process water and contaminated storm water. It may be polluted with chemicals, products, fossil fuels and radiation. It should be diverted to industrial ponds for treatment before being discharged into the environment.	Contamination of streams, dams, groundwater and ocean. Alteration of soil chemistry and/or composition. Impact on fauna and flora living in aquatic environments. Safety and health.
Sound or visual pollutants		
Local noise	Excessive noise affecting immediate surroundings (fenced-in area).	Safety and health. Change in animal behaviour.
Remote noise	Excessive noise affecting larger area and external parties (outside the fenced-in area).	Negative public perception. Change in animal behaviour.
Light	Effect on the aesthetic quality of the environment, also on natural functioning of nocturnal communities.	Visual impact (aesthetic quality of environment). Alteration in nocturnal activities of fauna and flora.
Infrastructure	Effect on the aesthetic quality of the environment from abnormal infrastructure such as pipelines, buildings, etc.	Visual impact (aesthetic quality of environment). Impact on movement of some animals.
Vibrations	Vibration is caused by machinery, blasting, vehicles, etc.	Impact on safety of employees. Impact on property – buildings and other infrastructure. Impact on biodiversity, e.g. damage to tunnels.
Disturbance or alteration of ecosystems		
Disturbance of land	Temporary or permanent alteration of land as a result of mining activities (e.g. construction of roads, pit, waste dumps).	Visual change in surroundings, scars, loss of biodiversity, damage to ecosystems, altered soil potential, change in land- use potential, loss of future economic opportunities.
Disturbance of biodiversity	Temporary or permanent damage to ecosystems, including the animals, plants or lichens living in the various habitats and the ecosystem processes (water movement, pollination) that enable the ecosystem to function.	Loss of biodiversity. Loss of future economic opportunities.
Disturbance of water courses or groundwater	Temporary or permanent alteration of river systems or groundwater aquifers as a result of mining activities (e.g. strip mining, dewatering, blasting).	Alteration in surface and groundwater flow patterns, depletion of surface or groundwater, loss of aquatic biodiversity, impact on downstream communities.

Environmental aspects	Explanation	Nature of impact
Other (any aspect not considered to fall into the defined aspect categories)		
Emergency situation	Emergency conditions, which have the potential to give rise to environmental (and human) incidents. Emergency conditions might arise from natural occurrences, e.g. flooding and lightning. They can also be human- induced and deliberate, e.g. arson, or accidental situations, e.g. a vehicle crash.	There are a number of different situations which could arise, each with its own suite of impacts, e.g. fire will have an impact on air quality, health and safety, property, fauna and flora.

7 OVERARCHING ENVIRONMENTAL COMMITMENTS

There are several overarching commitments that will be applicable at all stages of the project cycle and which demonstrate Bannerman's high level of commitment to sound environmental and social management. These are discussed in the chapters below.

7.1 GOVERNANCE AND ETHICS

Good governance is *essential* to ensure effective management of risks arising from an operation. Bannerman is a member of the World Nuclear Association (WNA), which is a worldwide community of professionals engaged in uranium mining and processing. Bannerman is also a member of the Uranium Stewardship Committee of the Namibian Chamber of Mines. The WNA has established a charter of ethics to which all of its members subscribe. The charter of ethics is founded on the belief that "sustainability must be the guiding principle of global development – requiring worldwide policies that meet the needs and aspirations of the present generation without compromising the opportunity of future generations to fulfil their needs and aspirations".

The charter is supported by the WNA Principles of Uranium Stewardship. These principles embody best practice and ethical conduct for the entire global nuclear industry, including uranium miners, equipment suppliers, service providers and generators of electricity, and are listed below.

- Support the safe and peaceful use of nuclear technology.
- Act responsibly in all areas we manage and control.
- Operate ethically with sound corporate governance.
- Uphold and promote fundamental human rights.
- Contribute to the social and economic development of regions where we operate.
- Provide for responsible sourcing, use and disposition of uranium and its by-products.
- Support best practice and responsible behaviour throughout the nuclear fuel cycle.
- Improve continually in all areas of our performance.
- Communicate regularly on progress.
- Review and update the Radiation Management Plan.

Bannerman commits to upholding the principles described above.

7.2 ROLES AND RESPONSIBILITIES FOR ENVIRONMENTAL MANAGEMENT

It is too early in the feasibility study process for Bannerman to have developed an organogram for the construction and operational phases of the project. However, a management plan is meaningless unless someone takes responsibility for ensuring that it is implemented. Bannerman recognises that the skills needed to manage environmental, community, safety, health and radiation issues are different. Bannerman will appropriately resource the correct skills to meet these different disciplines.

Bannerman commits to the following:

- Bannerman's management will be responsible for implementing all environmental and social commitments outlined in this ESMP throughout the mine life cycle.
- Bannerman will establish an appropriately staffed environmental department to co-ordinate and ensure effective implementation of the ESMP throughout the mine life cycle.
- Bannerman will ensure that there are appropriate human and financial resources to ensure effective implementation of the management plan.

7.2.1 All personnel on site

While management play a valuable role in ensuring that risks are effectively managed, Bannerman understands that it is the responsibility of every employee and contractor to ensure the safety of both him/herself and his/her colleagues, as well as the safety of the environment in which he/she operates. For this reason, Bannerman's underpinning philosophy will be that each department (e.g. mining, processing, engineering) shall identify and manage their risks, whether they be safety, radiation or environmental.

Bannerman commits to ensuring that all its employees consider the risks that their work creates and that they take responsibility for managing these risks.

7.2.2 Contractors

Contractors usually pose one of the largest risks to an organisation when not properly managed by the client. For this reason it is essential that Bannerman manages its contractors as if they were part of the Bannerman staff. To this end, the ESMP shall be binding on all contractors appointed by Bannerman.

Bannerman commits to the following:

- The inclusion of environmental compliance standards in **tender documents**. Contractors will need to describe how they intend to meet these requirements. They will also have the opportunity to clarify any uncertainties prior to appointment, thus allowing for the necessary budgetary allowances for implementation of all ESMP specifications.
- The inclusion of environmental compliance requirements in all **contracts**. As a minimum, the conditions stipulated in the ESMP shall be met by all of Bannerman's contractors. Bannerman will seek to include in the contract penalties for non-compliance, which will result in a penalty and/or constitute a breach of contract, depending on the severity of the non-compliance.
- In order to effectively implement and adhere to the requirements set out in the Bannerman ESMP, all contracting companies that have the potential to damage the environment shall appoint their **own environmental coordinator** or designate the responsibility to one of its senior managers on site. Bannerman must approve this nomination.
- All contractors that have the potential to damage the environment shall provide the Bannerman environmental department with a **method statement** outlining how that company intends to comply with the ESMP. The method statement shall provide details regarding operating procedures, roles and responsibilities, timeframes of activities, and reporting.
- It shall be the contractor's responsibility to ensure that all their staff members, sub-contractors and suppliers understand and adhere to the ESMP. The contractor shall ensure that sub-contractors and suppliers are also contractually bound to adhere to the ESMP. Such persons will be inducted on adherence to the ESMP.

7.3 POLICIES, PLANS AND SYSTEMS

The integrity of a company will be judged, to a large extent, by the quality of the vision that it develops and the policies that it puts in place. At this stage of the project, such documentation is not available.

Bannerman commits, prior to operation, to:

- Develop and communicate an environmental policy that outlines the company's commitment to proactive environmental management.
- Develop and communicate a social policy that outlines the company's commitment to the proactive management of socio-economic issues.
- Meet the applicable Namibian legal requirements and applicable international conventions to which Namibia is a signatory. Where no Namibian legislation exists, Bannerman will determine the most suitable industry practice that is relevant and applicable for the Southern African and uranium-mining context.
- Establish and maintain an EMS, for its operational phase, which will meet the ISO 14001 requirements as soon as practicable during the operational phase. The establishment of such an EMS implies that all environmental risks will be identified on an ongoing basis and that action plans will be put in place to address the risks that are identified. The ISO standard requires that monitoring, auditing and continual improvement of the EMS also be undertaken.
- Establish a communications system by which all interested and affected parties may communicate their concerns or comments regarding Bannerman's activities and receive, in return, a reasonable response from Bannerman's management.
- Ensure that all employees, contractors, partners, service suppliers and any other visitors to site are inducted on, and expected to adhere to, the commitments made in this ESMP.
- Establish an incident-reporting and investigation system.
- Establish emergency-response procedures and ensure that they are reviewed frequently.
- Develop a mine closure plan in accordance with the draft Namibian mine closure framework developed by the CoM. The mine closure plan shall cover both biophysical and socio-economic issues.
- Establish a financial provision (eg bonds or trusts) for rehabilitation and review and update it annually.

7.4 ENVIRONMENTAL AWARENESS AND TRAINING

Successful implementation will hinge very firmly on how well a culture of environmental compliance is developed at Bannerman. Bannerman commits to ensuring that environmental awareness is developed throughout all phases of the project.

Bannerman commits to:

- Develop an **environmental induction programme** for staff, contractors and visitors. The induction programmes will be in the appropriate language and format to ensure that people at all skills levels are able to understand the issues addressed in the programme.
- Develop **environmental awareness materials** that will be provided to staff and contractors during both the construction and operations phase for discussion during tool-box talks, staff meetings, etc.
- **Train relevant staff and contractors** in the implementation of environmental procedures and work instructions. This will include testing to gauge understanding and effectiveness of the training programmes.
- Ensure that the environmental personnel employed at Bannerman have the necessary **qualifications and skills** so that the environmental department is effectively managed.

7.5 REPORTING

Bannerman commits to meeting all **reporting requirements required by regulators**. This will include:

- Regular reporting to DWAF as a condition of water abstraction and discharge permits.
- Biannual reporting to MET and MME as a condition of the environmental contract.
- Regular reporting to MHSS as a condition of clearance in terms of the Atomic Energy Act.

Once in the operations phase, Bannerman shall also produce an **annual report to society**. This report will be in accordance with accepted global standards, for instance the Global Reporting Initiative Sustainability Reporting Guidelines.

Bannerman commits to **keeping its stakeholders and the general public informed**. This will be done in the form, inter alia, of newsletters, media releases, website, annual report, etc.

7.6 CUMULATIVE IMPACTS

Bannerman is cognisant of the fact that there are already two operating uranium mines in the Erongo Region (Rössing and Langer Heinrich) and another one (Trekkopje) is in the construction phase. The potential also exists for other uranium mines to be developed in this region in the near future (e.g. Valencia Uranium Project, which already has a mining licence). The cumulative impacts of multiple uranium mines operating in this region have not been quantified, but some are expected to be significant. The Strategic Environmental Assessment (SEA) that has been commissioned by the MME will be completed by April 2010 and should give guidance to both decision-makers and mining companies regarding responsible uranium mining in the Central Namib.

The primary aim of the CoM's Uranium Stewardship Committee is to ensure that an ethical and stewardship approach to mining of uranium is adopted, and that the cumulative impacts associated with a growing uranium industry are addressed in consultation with national and regional government, specialists and stakeholders.

Bannerman is already a member of the CoM's USC and commits to ongoing active involvement on this committee to ensure that the cumulative impacts associated with a growing uranium industry are addressed.

7.7 COMMUNITY INTERACTION

Increasingly, mining companies are realising the value that can be derived from two-way communication with local communities, rather than a one-way flow of information that only provides updates of the company's activities. Bannerman operates within the Namib Naukluft National Park, and the Etango Project is located in close proximity to a number of Swakop River farmers. In addition, there are a number of stakeholders (local, regional, national and international) who have an interest in how uranium mining proceeds in Namibia, particularly in a national park and close to one of Namibia's top tourist destinations.

Bannerman has demonstrated an open dialogue with key stakeholders and wishes to continue this throughout the LOM.

Bannerman commits to continue to initiate meetings on an annual basis with the following stakeholders or their representatives:

- The Governor of the Erongo Region
- Swakopmund Town Council
- Walvis Bay Town Council
- Arandis Town Council
- Coastal Tourism Association of Namibia
- Neighbouring farmers

Bannerman commits to

- Hold regular meetings with representatives of the Ministry of Environment and Tourism to monitor activities in the national park.
- Hold regular meetings with the Ministry of Mines and Energy.
- Establish a forum through which the wider public and those who registered as IAPs can remain involved.

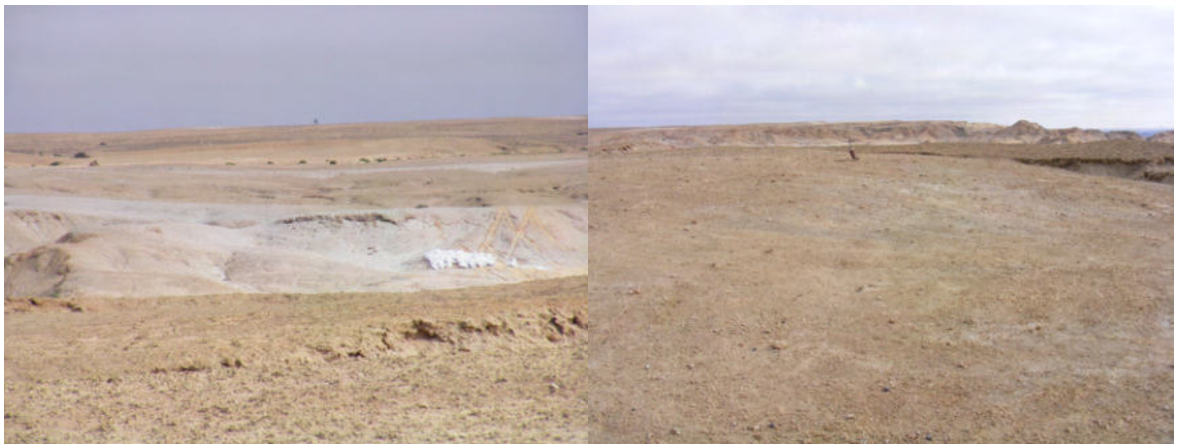
7.8 CURRENT ENVIRONMENTAL REHABILITATION – EXPLORATION PHASE

Since mid 2007 Bannerman has conducted exploration activities on EPL 3345. Exploration activities only started after Bannerman received the Environmental Contract from MET. The application for the Environmental Contract included an environmental overview and a detailed environmental management plan for exploration activities.

Bannerman assisted with the formation of Elga Enviro Rebab cc and contracted them to conduct all the clean up and rehabilitation of the areas impacted upon by exploration activities.

Between one and two teams, each comprising 9 members, are permanently in the field conducting clean up and rehabilitation (e.g. raking, smoothing tyre tracks, distribution of pebbles to create traps for wind blown seed) of drill sites and access tracks to drill sites (see **Figure 3**). Between April and December 2008 ASEC conducted fortnightly monitoring site visits to monitor the rehabilitation process and to provide guidance on how to rehabilitate different habitats. Three procedures were established:

Procedure 0001: Disposal of RC coarse reject samples
Procedure 0002: Rehabilitation of diamond drill site sumps
Procedure 0003: Rehabilitation of tracks and drill sites



The left photo shows the drill site just after RC drilling was completed, while the right photo shows the site after rehabilitation. The grey dust was collected in bags and disposed of at the Husab Mine.

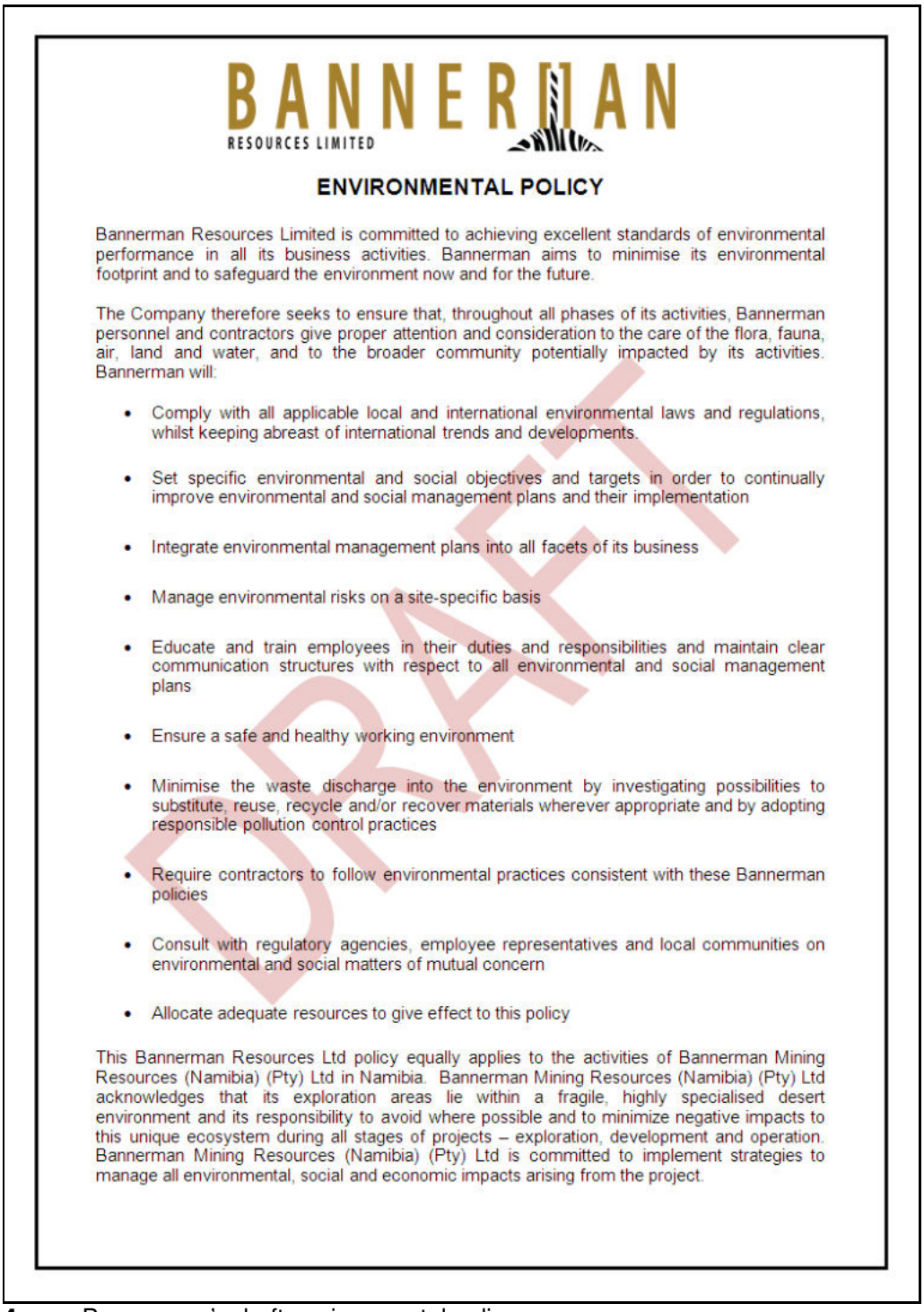
Drill site access track before (left photo) and after (right photo) rehabilitation.

Figure 3 Examples of rehabilitation activities

8 MANAGEMENT OF THE BIOPHYSICAL AND HUMAN ENVIRONMENT

8.1 POLICIES

Over and above the overarching commitments listed in **Chapter 7**, Bannerman will manage the mine's negative and positive impacts on the biophysical and human environments in accordance with the principles described in Bannerman Resources Limited's final Environmental Policy and Social Policy (drafts of which are set out in **Figures 4** and **5** respectively).



BANNERMAN
RESOURCES LIMITED

ENVIRONMENTAL POLICY

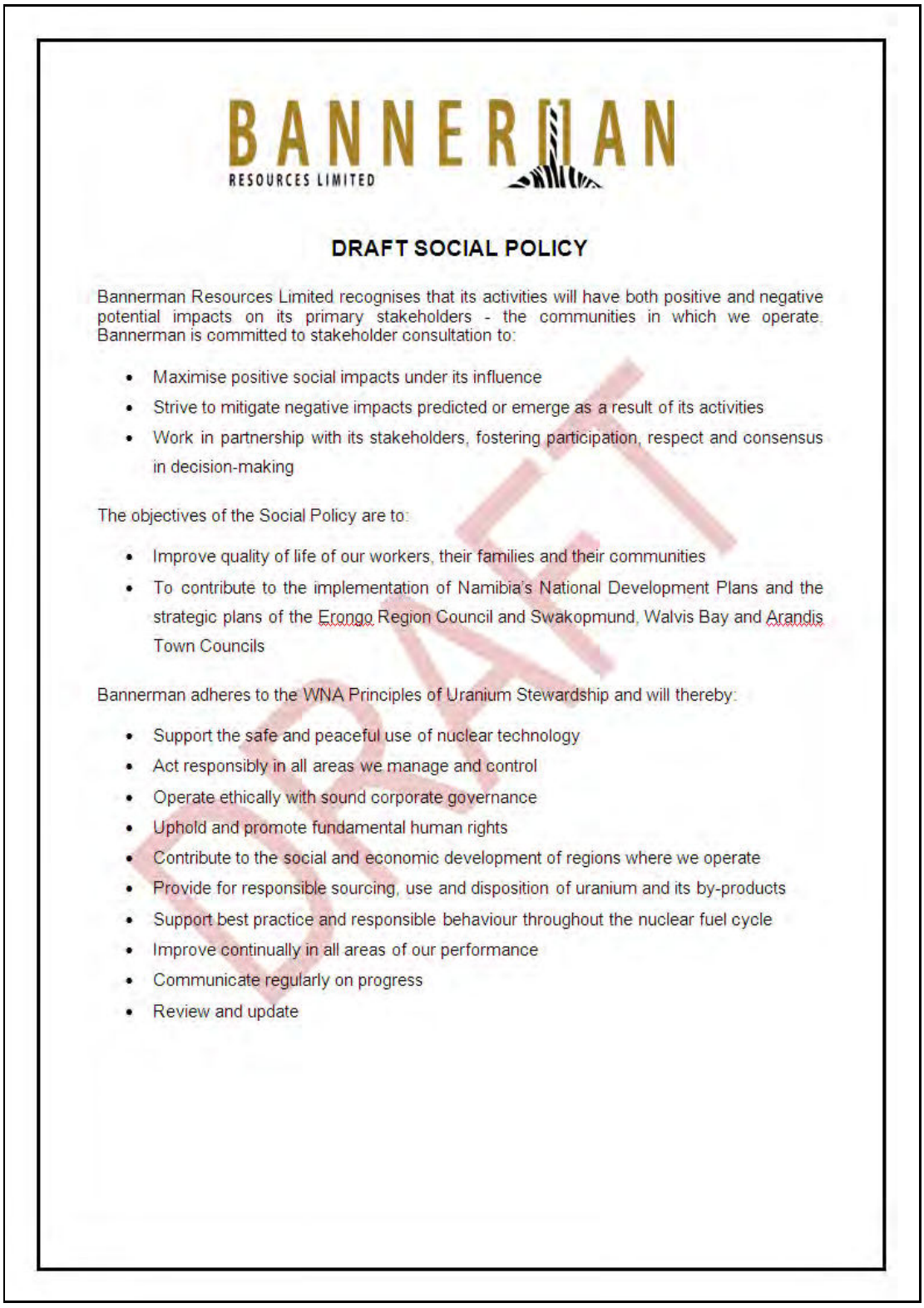
Bannerman Resources Limited is committed to achieving excellent standards of environmental performance in all its business activities. Bannerman aims to minimise its environmental footprint and to safeguard the environment now and for the future.

The Company therefore seeks to ensure that, throughout all phases of its activities, Bannerman personnel and contractors give proper attention and consideration to the care of the flora, fauna, air, land and water, and to the broader community potentially impacted by its activities. Bannerman will:

- Comply with all applicable local and international environmental laws and regulations, whilst keeping abreast of international trends and developments.
- Set specific environmental and social objectives and targets in order to continually improve environmental and social management plans and their implementation
- Integrate environmental management plans into all facets of its business
- Manage environmental risks on a site-specific basis
- Educate and train employees in their duties and responsibilities and maintain clear communication structures with respect to all environmental and social management plans
- Ensure a safe and healthy working environment
- Minimise the waste discharge into the environment by investigating possibilities to substitute, reuse, recycle and/or recover materials wherever appropriate and by adopting responsible pollution control practices
- Require contractors to follow environmental practices consistent with these Bannerman policies
- Consult with regulatory agencies, employee representatives and local communities on environmental and social matters of mutual concern
- Allocate adequate resources to give effect to this policy

This Bannerman Resources Ltd policy equally applies to the activities of Bannerman Mining Resources (Namibia) (Pty) Ltd in Namibia. Bannerman Mining Resources (Namibia) (Pty) Ltd acknowledges that its exploration areas lie within a fragile, highly specialised desert environment and its responsibility to avoid where possible and to minimize negative impacts to this unique ecosystem during all stages of projects – exploration, development and operation. Bannerman Mining Resources (Namibia) (Pty) Ltd is committed to implement strategies to manage all environmental, social and economic impacts arising from the project.

Figure 4 Bannerman's draft environmental policy



BANNERMAN
RESOURCES LIMITED

DRAFT SOCIAL POLICY

Bannerman Resources Limited recognises that its activities will have both positive and negative potential impacts on its primary stakeholders - the communities in which we operate. Bannerman is committed to stakeholder consultation to:

- Maximise positive social impacts under its influence
- Strive to mitigate negative impacts predicted or emerge as a result of its activities
- Work in partnership with its stakeholders, fostering participation, respect and consensus in decision-making

The objectives of the Social Policy are to:

- Improve quality of life of our workers, their families and their communities
- To contribute to the implementation of Namibia's National Development Plans and the strategic plans of the Erongo Region Council and Swakopmund, Walvis Bay and Arandis Town Councils

Bannerman adheres to the WNA Principles of Uranium Stewardship and will thereby:

- Support the safe and peaceful use of nuclear technology
- Act responsibly in all areas we manage and control
- Operate ethically with sound corporate governance
- Uphold and promote fundamental human rights
- Contribute to the social and economic development of regions where we operate
- Provide for responsible sourcing, use and disposition of uranium and its by-products
- Support best practice and responsible behaviour throughout the nuclear fuel cycle
- Improve continually in all areas of our performance
- Communicate regularly on progress
- Review and update

Figure 5 Bannerman's draft social policy

8.2 MINE PHASES

The **project planning phase** is a vitally important phase in the mine's life cycle as far as long-term environmental impacts are concerned. It is during this phase that careful consideration of design alternatives can result in avoidance or minimisation of significant negative environmental impacts. The ESIA highlighted a number of issues that need to be resolved during the planning phase. Some of these issues have already been considered and are reflected in the current layout and design of the mine. However, there are others that will need to be considered at the definitive feasibility study (DFS) stage. The environmental management plan for the planning phase is outlined in **Chapter 9**. The main aim during this phase is either to avoid or to minimise potential impacts before they occur.

Many of the environmental impacts associated with a mine are caused during the **construction phase** because this is when the most land is disturbed and the major portion of the mining footprint is established. The environmental management plan for the construction phase is outlined in **Chapter 10**.

If the design and planning phase has been well done and the construction phase well implemented, most of the impacts associated with the **operational phase** will be routine management requirements that are best implemented by procedures and work instructions. The environmental management plan for the operations phase is outlined in **Chapter 11**.

Mine closure is an integrated process that needs to commence before the end of life of mine. The better the up-front planning and the more closure activities included in the operations phase, the better the likelihood of a successful, timeous closure. The environmental management plan for the decommissioning and post-closure phases is outlined in **Chapter 12**.

A mine never remains static and it can be expected that during the life of mine and as the resource is updated there will be expansion or decommissioning projects, new processes that might be tested, as well as changes to the life of mine plan. Thus, at any one time the mine is likely to have **different phases of the project cycle in operation at any one time**.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR THE PLANNING PHASE

It is the responsibility of management to ensure that the avoidance and minimisation measures identified for the planning phase are considered and addressed. The planning process presents an early opportunity to address negative issues that may occur during the construction, operation or closure phases of the project.

9.1 IMPACTS TO BE AVOIDED

Key issues	Activity	Measures to avoid
Surface water		
Storm water floods the plant area and transports pollutants downstream from the mine lease	The plant facilities are located downstream of the mine pit in an area drained by minor washes and creeks. The surface catchment is relatively small but exceptionally high rainfall can occur, as in March 2008, when 100 mm fell within a few hours on two occasions.	Precautionary principle – additional studies: A hydrological surface runoff model should be developed in order to assess the potential danger of flooding. The model forms the basis for decision making regarding construction of flood protection infrastructure such as berms or storm water ponds.
Geohydrology		
	Groundwater monitoring system.	The proposed groundwater monitoring system needs to be amended prior to construction to ensure the inclusion of all areas on which mine infrastructure and thus potential pollution sources are created. This needs to be addressed in the planning and design phase to avoid and minimise the identified impacts (see **Chapter 9**). All monitoring / test boreholes needs to be sampled for radionuclides to ensure a well-defined baseline prior to any mining activities. The numerical models to be developed must be used to optimise the position of monitoring wells and the frequency of sampling. The sampling protocol, frequency and parameters to be analysed will be detailed.

Key issues	Activity	Measures to avoid
Abstraction of groundwater: water supply from the Swakop River alluvium	One or more production wells are drilled into the Swakop River alluvium near Goanikontes, and brackish groundwater is used for construction work. The estimated daily water demand for the construction phase is between 370 m^3 and 1 110 m^3. The water level in the Swakop River is dropping and irrigation farmers downstream are potentially negatively affected.	Precautionary principle - additional studies: The Ministry of Mines and Energy (MME) is currently carrying out a groundwater study of the Swakop and Khan River system resulting in an overall water balance of the river system. Based on the results and recommendations of this study, it may be decided whether additional abstraction by Bannerman from the Swakop River in the Goanikontes compartment will affect irrigation farmers on small holdings downstream, and to what extent. In addition, a numerical groundwater model should be conducted by Bannerman for the planned abstraction area. Additional intrusive investigations will be required to refine a conceptual groundwater model, i.e. identify and characterise sources of contamination and water level changes, to characterise the groundwater pathway and receptor linkages, and to finalise the impact assessment. This typically includes the identification of groundwater structures, using geophysics, core and percussion drilling, for aquifer testing and sampling as well as geochemical characterisation of mineral wastes and mining spoils.
		It is recommended that water should rather be used from the LHU or Rössing pipelines (i.e. NamWater from the Omdel aquifer). The Swakop River water is brackish to saline and unsuitable for human consumption. Fresh water for the 1 500-strong construction workforce, as well as for concrete works, should be taken from one of these NamWater pipelines.
Abstraction of groundwater: water supply from the Swakop River alluvium	Groundwater from the Swakop River is used for dust suppression in the mine pit and on hauling roads, as well as for drill rigs, wash-down bays and explosive manufacture during the mining operation. The water level in the Swakop River is dropping due to excessive abstraction, which affects downstream users.	Precautionary principle – additional studies: A study must be conducted to determine whether additional abstraction by Bannerman from the Swakop River in the Goanikontes compartment will affect downstream users, i.e. irrigation farmers on small holdings, as well as downstream flora and fauna. A numerical groundwater model should be conducted by Bannerman for the planned abstraction area. Long-term abstraction from the Swakop River is not recommended. Dust-suppression water should be taken from the Bannerman pipeline (desalinated sea water) during the operations phase.
Abstraction of groundwater: water supply from the paleochannel aquifer	Saline groundwater from the paleochannel is used for dust suppression on roads and for construction purposes, e.g. for the compacting of the heap leach pad floor. Initial pumping test showed that the yield is <5m^3/h.	No mitigation available. Groundwater from the paleochannel should not be used for dust suppression and other measures.

Key issues	Activity	Measures to avoid
Abstraction of groundwater: water supply from the paleochannel aquifer	Saline groundwater from the paleochannel is used for dust suppression on hauling roads. The paleochannel groundwater contains elevated concentrations of radionuclides, which would be deposited on the road and could be inhaled through the dust.	No mitigation. Groundwater from the paleochannel should not be used for dust suppression and other measures.
Contamination of groundwater from runoff: surface runoff from waste rock dumps flows in washes to the Swakop River and infiltrates into shallow alluvium	The above scenario is an issue that extends beyond mine closure as the waste rock dumps are permanent. The expected maximum height is 30 m.	The northern extent of the waste rock dumps should be limited to the natural ridge line/watershed in order to allow surface water flow in a southern direction only, away from the Swakop River catchment.
Contamination of groundwater from seepage: contaminated seepage from the HLRF infiltrates into shallow alluvium and the regional basement aquifer	The seepage from the HLRF is anticipated to be less contaminated than the heap leach seepage because the bulk of the uranium is leached and the residual is washed prior to deposition on the HLRF. However, sulphuric acid concentrations are still elevated, resulting in low pH and high solubility of metals, including uranium. The seepage could infiltrate and contaminate the groundwater.	A contaminant transport model should be developed to simulate seepage of leachates into the underlying strata and also to simulate the flow direction and extent of a possible plume under the hydrological and chemical conditions. A refined conceptual groundwater model describing the linkages between the sources of contamination (mining operations and mineral waste) and identified receptors is required to understand the nature of the impact (direct, indirect and cumulative). Thereafter the conceptual model will be transformed into a numerical groundwater flow and transport model to establish the water quality and water level variations over time for selected management scenarios. Hydro-geochemical characterisation and modelling of mineral waste and mining residue leach quality is also necessary. Groundwater contaminant transport modelling is used to quantify potential contaminant plume migration over time and to identify the radius of mining influence to develop appropriate management strategies. The model can be used to assess various mitigation and management scenarios and in this way can assess the most cost effective and applicable mitigation measures proposed. The impact of the mine pit and dewatering should also be modelled. Additional drilling and testing of monitoring wells is a necessity.

Key issues	Activity	Measures to avoid
Contamination of groundwater from seepage: seepage pollution sources reach the Swakop River through surface runoff or groundwater flow	The HLP, HLRF, plant, stockpiles and process water ponds are constructed/deposited outside the Swakop River surface water and groundwater catchment but there is the potential of polluting the Swakop River alluvium through groundwater flow towards the Swakop River along deep-reaching faults. The water level in the mine lease area is higher than in the Swakop River and groundwater flow is directed towards the river in the area between the mine pit and the Swakop River.	Additional studies: Additional monitoring boreholes should be drilled, as recommended in the ESIA Groundwater Specialist Input report. It is not likely that contaminated seepage from the HLP and HLRF and the plant area will escape towards the Swakop River, but water-level information in the mining area is scarce and concentrates on the Anomaly A, Oshiveli and other areas where a large number of exploration wells were drilled. The groundwater flow pattern is incomplete and the groundwater divide which separates the Swakop and Tumas River catchments is not properly delineated. Contaminant transport modelling and waste characterisation must be undertaken. Characterisation of the source/pathway/receptor linkages need to take place as part of the conceptual model, to identify impacted receptors and to develop adequate impact mitigation and management plans.
Biodiversity		
Impact on biodiversity at a national level	Mining in a national park.	Limit disturbance to the mining footprint. Avoid damage to sections of the NNNP that are not in the ML. During the design phase, avoid damage of sensitive sites (both from a species and habitat-conservation perspective and from a sense of place perspective) by placing facilities (temporary and permanent) in areas of least impact. As far as possible, use those areas that have already been disturbed and avoid pristine areas. In the undesirable event of uranium deposits being mined in sensitive areas, or the mine footprint extending into these areas, consideration should be given to assisting the park authorities to establish offset areas for biodiversity conservation and for tourism development.
		Additional studies: Long-term monitoring of impacts on vegetation will contribute to the knowledge-base for mining developments in the Namib and other arid zones. A plan for the establishment and regular monitoring of permanent transects should be developed for each area to be mined prior to mining activities. Monitoring could be carried out by environmental staff on the mine, and environmental organisations with local knowledge should be involved in an advisory and assistance capacity for monitoring and restoration.
Impact on biodiversity at a local level	Mine and plant development may infringe on the identified vegetation exclusion zones.	Planning and design of the pit and plant infrastructure should take into account the identified vegetation exclusion zone as identified in the scoping report and additional study conducted on 15 June 2009.

Key issues	Activity	Measures to avoid
	Disturbance footprint created by the mine, including mine works areas, roads, power lines and pipelines.	In all activities, minimise the mine footprint. Minimise large-scale terrain changes and creation of artificial terrain. During the design phase, avoid damage to sensitive ridges, outcrops and washes by locating infrastructure out of these zones. Bannerman has already taken this into account. The current location of the waste rock dumps, heap leach pad and HLRF are all based on both biodiversity and visual impact considerations. Avoid encroachment on / into / over the Swakop River and its associated valleys, including of infrastructures. Do not mine sand in the Swakop River. All large trees in the EPL should be protected as they are habitat islands. Prohibit all unnecessary off-road driving. Prevent unnecessary habitat loss along the full length of all infrastructures (e.g. roads, powerlines, pipelines) associated with Etango. The precautionary principle dictates that no species should be threatened due to ignorance of its status. Additional research should be undertaken of the Husab sand lizard and the unidentified species to better understand their distributions and habitat preferences. Additional research should be undertaken to establish the extent of the Commiphora populations occurring in EPL 3345 so that if mining extends into other parts of the EPL, or if new mining applications are made in the region, the impact can be assessed in the light of previous population losses.
		The restoration potential of many desert habitats is unknown but is expected to be low. Research into ways to restore desert pavement and biological soil crusts is recommended as they are an integral component of the gravel plains, where most of the habitat loss is expected.
Impact on biodiversity at a local level	Human presence, mining activities. Traffic, noise and presence of people will all serve to drive wildlife away from the immediate area (predominantly large animals such as gemsbok, zebra, ostrich and bustards, but also smaller animals that occupy local territories).	Avoid impacts on animals using the Swakop River by ensuring that Bannerman's servitudes (pipelines, power lines and roads) do not cross through this area. All deliveries to site should be via the C28 and not via Goanikontes on the D1991.
Impact on biodiversity at a local level	Restriction of movement of nomadic species. Nomadic species are restricted as they cannot cross barriers such as pipelines, fences, etc.	Permanent structures such as the waste rock dumps and HLRF should not be built in the path of well-established movement corridors. This should be taken into account during the design phase. Major washes are often popular movement corridors and development should be avoided as far as possible in these habitats.

Key issues	Activity	Measures to avoid
Impact on biodiversity at a local level	Obstruction to surface water flows may result in changes to drainage patterns.	Plan for episodic flood events. Only consider the abstraction or use of water from the Swakop Aquifer after the findings of the numerical groundwater model and the findings of the SEA assessed. Avoid encroachment on / into / over the Swakop River and its associated valleys, including of infrastructures. During the design phase, care should be taken to avoid placing infrastructure in or across washes. As far as possible washes should be kept open and unrestricted to allow sporadic water flow to move through the environment.
Introduction of alien invasive floral species will out-compete indigenous flora and associated invertebrates.	Increased access and traffic in riverbed.	Control access to mining area, including along Swakop.
Visual (see **Appendix 2** for already implemented avoidance measurements.)		
Additional infrastructure such as main access gate, mine service road, pipelines and power lines, main HV switchyard, explosives store, etc.	The maximum height of the additional infrastructure will be 20 m. The viewshed extent will be moderate as collectively these buildings and servitudes will create an industrial landscape which conflicts with the wilderness sense of place and the visual landscape of a national park.	High visual impact would be generated from the vehicles and the dust of trucks and cars transporting goods to and from the mine. Dust generated by these vehicles needs to be addressed either by tarring the C28 or by implementing a dust retardant. It should also be recognised that a railway line, which can operate at night, would reduce the visual impact associated with heavy trucks. The negative side of this is that it places more infrastructure within the NNNP, which further impacts the wilderness sense of place. To restrict unauthorised access and vehicle tracks from the D1991 to elevated viewing areas to the west of the mine, a cable fence slung from low posts needs to be constructed. The cable should be 10 to 20 m in from the road so as to be a visible deterrent without being visually intrusive.
Sense of place		
Loss of sense of place due to degradation of natural environment, including a loss of habitats, animals and plants	Mining and processing as a whole, including those activities that arise to support the mine (e.g. increased traffic from transport vehicles). This includes indirect impacts such as those arising from more people living in and using the area.	Limit disturbance to the mining footprint area only. Avoid damage to sections of the NNNP that are not in the ML. During the design phase, avoid damage of sensitive sites (both from a species and habitat-conservation perspective and from a sense of place perspective) by placing facilities (temporary and permanent) in areas of least impact.
		As far as possible, use those areas that have already been disturbed and avoid pristine areas. In the undesirable event of uranium deposits being mined in sensitive areas, or the mine footprint extending into these areas, consideration should be given to assisting the park authorities to establish offset areas for biodiversity conservation and for tourism.

9.2 IMPACTS TO BE MINIMISED

Key issues	Activity	Minimisation measures
Surface water		
Surface water flow is restricted due to establishment of mine infrastructure and cannot flow downstream	All mining and processing infrastructure such as buildings and dumps.	Establish storm water diversion berms around the mine so that clean storm water falling outside of the mine is allowed to flow unimpeded downstream. The design should be such that all of the flow is not diverted into a couple of channels as this will create a too rapid surface flow and will result in localised erosion. The surface water should be allowed to flow as naturally as possible down the remaining washes.
Geohydrology		
Abstraction of groundwater: water supply from the Swakop River alluvium	Groundwater from the Swakop River is used for dust suppression in the mine pit and on hauling roads, as well as for drill rigs, wash-down bays and explosive manufacture during mining operation. The water level in the Swakop River drops due to excessive abstraction and downstream users are affected.	In addition to water, alternative dust-suppression chemicals should be used.
Contamination of groundwater from seepage: acidic seepage water from the heap leach pad contaminates the shallow alluvium (washes) and the regional paleochannel/ basement aquifer	The heap leach pads (HLP) are irrigated with acidified water for dissolution of uranium. If not properly lined, the leach water can infiltrate into the subsurface and reach the groundwater table within the basement and palaeochannel aquifers. The leach is highly concentrated uranium and at low pH, uranium species are extremely mobile. Depending on the seepage volumes and the permeability of the sub-surface rocks, the pollution plume can reach far and leave the mine lease towards the general flow direction of the groundwater.	The entire HLP must be prepared with a pad-construction base (compacted sub-base) and lined according to an appropriately engineered solution designed to prevent any seepage into the sub-surface and taking into account best practice standards. Bannerman is considering using a multi-layered geotextiles/HDPE liner, including cushion-layer system for protection during stacking and from vehicles. A drainage system and leak-detection system must be installed.
Contamination of groundwater from seepage: contaminated seepage from the HLRF infiltrates into shallow alluvium and the regional basement aquifer	The seepage from the HLRF is typically less contaminated than the heap leach seepage because the bulk of the uranium is leached and the residual is washed prior to deposition on the HLRF. However, sulphuric acid concentrations are still elevated, resulting in low pH and high solubility of metals, including uranium. The seepage could infiltrate and contaminate the groundwater.	The leach residue should be thickened (dewatered) prior to deposition to reduce the potential for seepage. Like the HLP, the HLRF should be lined according to an appropriately engineered solution designed to prevent any seepage into the groundwater and taking into account best practice standards. A drainage system and leak-detection system should be installed. It is envisaged that drainage from the HLRF will be collected in a lined leach residue emergency pond with sufficient storage capacity. Effluent from the emergency pond must be recycled back to the plant for reuse or treated and discharged in a controlled manner. If the latter method is chosen, a treatment plant will need to be installed and an effluent discharge permit acquired.

Key issues	Activity	Minimisation measures
Contamination of groundwater from seepage: seepage from the plant and acid tanks contaminates groundwater	Contaminated process water leaks from the processing plant and infiltrates into underlying rock strata, contaminating the groundwater.	Process areas within the plant with the potential for contaminated seepage must be lined with waterproof concrete and/or geotextiles to capture contaminated seepage. The sulphuric acid unloading and storage area must be suitably bunded and serviced by the sulphuric acid storage area sump and pump, which transfers any spillage to the process water ponds. The bunded area and pumping capacities must be large enough to recover sulphuric acid in case of a tank burst.
Contamination of groundwater from seepage: seepage from the process water ponds contaminates groundwater	The process water ponds leak and activated seepage water contaminates the groundwater.	The ponds must be lined according to an appropriately engineered solution designed to prevent any seepage into the groundwater and taking into account best practice standards.
Contamination of groundwater from seepage: seepage from stockpiles contaminates groundwater	The stockpiles are planned to be partly within the groundwater catchment of the Swakop River. The stockpiles usually have higher ore grades and contain water with elevated uranium levels. Unlined stockpiles would allow the infiltration of seepage into the basement rock aquifer. Far and deep-reaching fault zones exist on the faulted contact between the Palmenhorst Dome and overlying strata and will enhance the flow towards the Swakop River.	Coarse ore stockpiles and the ROM stockpiles should be lined. See also the mitigation measures for waste rock dump surface water runoff.
Air quality		
Annual average PM10 health impact: highest daily average PM10 health impacts, average daily dustfall impacts	Dust creation from vehicle movement on unpaved road.	(a) Reducing the extent of unpaved roads, e.g. paving. (b) Traffic control measures, e.g. restricting traffic volumes, reducing vehicle speeds. (c) Binding the surface material or enhancing moisture retention. 90% control efficiency through the application of chemical surfactants and 75% control efficiency of in-pit haul roads through water spraying.
Ozone-depleting gases		Source ozone-free air conditioners, refrigerators, etc.
Biodiversity		
Impact on biodiversity at a national level	Mining in a national park.	Minimise the impact of large numbers of people on the national park.

Key issues	Activity	Minimisation measures
Impact on biodiversity at a local level	Disturbance footprint created by the mine, including mine works areas, roads, power lines and pipelines.	During all phases, minimise the size of the disturbance footprint. Place strict limits on movements of earthmoving machinery. If the mine pit is extended to the Oshiveli and Onkelo ore deposits, very careful consideration will be required to minimise the loss of parts of the rocky mountain slopes (Habitat C) and the valley (Habitat D2) which needs to be the subject of a new ESIA.
Impact on biodiversity at a local level	Human presence, mining activities. Traffic, noise and presence of people will all serve to drive wildlife away from the immediate area (predominantly large animals such as gemsbok, zebra, ostrich and bustards, but also smaller animals that occupy local territories).	Minimise disturbance of wildlife by ensuring that Bannerman's employees and contractors do not go beyond the mine site boundary. Minimise disturbance from noise by designing the quietest operation possible. If implemented, the noise management measures mentioned in the noise assessment will help to reduce the overall environmental noise. Monitor for poaching activities in the vicinity of Etango.
Impact on biodiversity at a local level	Restriction of movement of nomadic species, i.e. nomadic species are restricted as they cannot cross barriers such as pipelines, fences, etc.	Limit fencing to those areas of the mine and plant where access must be controlled (e.g. packing house) or where animals need to be prevented from entering (e.g. water dams). Pipelines that are laid above ground should have 10 m-wide earth ramps built over them at strategic points, ie known animal migration routes, or should have sections buried in order to create crossing points for nomadic animals. Animal crossings should be constructed in such a way that vehicles are prevented from using them. At closure, remove all fences, pipelines and other obstructions.
Impact on biodiversity at a local level	Improved access to the area along roads and infrastructure servitudes might cause an increase in poaching and illegal collection of plants and animals.	The construction camp must be fenced in and recreational facilities should be provided. If workers have a whole day or more off work, they should be transported back to their residences. Security must be vigilant and monitoring must take place for poaching and illegal collection of plants and animals.
Impact on biodiversity at a local level	Habitat degradation by vehicle tracks. Exploration activities, construction activities, opening up of new areas of the mine lease.	Ensure that new tracks are laid out so as to minimise damage to plants and desert pavement. Tracks must be clearly demarcated and if necessary turning circles must be provided.
Impact on biodiversity at a local level	Obstruction to surface water flows may results changes to drainage patterns.	Where it is impossible to avoid washes, storm-water diversions should be designed to allow clean storm water to flow past the infrastructure and feed downstream communities. Care should be taken not to alter the gradient significantly as this will alter stream flow characteristics and could cause water erosion.

Socio-economic		
Impacts of inward migration of employees, family members and job seekers	Recruitment for Bannerman and its contractors. **Performance targets**: >90% Namibian recruitment; >80% unskilled and semi-skilled workforce recruitment from Erongo Region; >15% female recruitment.	Establish a recruitment policy that gives preference to residents of Swakopmund, Walvis Bay and Arandis, particularly to women, and sets minimum education requirements, e.g. Grade 10 school leavers who pass an English and Maths test. Establish recruitment points at town council offices in Swakopmund, Walvis Bay and Arandis. Build up local skills before operations begin by working with local training establishments. Establish training programmes for specific posts that enable local people to acquire skills and employment at the Etango Project. Tender criteria for contractors to include training of local workforce.
Pressure on availability and adequacy of education services	Recruitment of staff from outside the Erongo Region. **Performance target**: Fund the building of at least five new classrooms.	Initiate direct dialogue with the MoE to develop private-public partnerships in building new classrooms and other essential infrastructure. Fund the construction of three classrooms at government primary schools and two classrooms at government secondary schools.
Pressure on availability and adequacy of housing	Recruitment of staff from outside the Erongo Region.	Keep town councils and central government informed of anticipated employee numbers during construction and operation phases.
Access to neighbouring farms	Closure of extension of D1991 across pit.	Plan with neighbours an alternative access route, possibly through the mine-operating area.
Visual		
Heap leach residue facility (HLRF) and its machinery	The HLRF is expected to be about 25m in height. With the mobile conveyor on top, it will have a maximum height of 50m – one of the highest structures on the mine site.	The machinery of the heap leach residue facility stacker will generate high levels of contrast. The possibility of another method of stacking which does not require a 25m machine should be investigated.
Noise		
Disturbance caused by noise	Operation of diesel-powered equipment and general transport to and from the mine.	Use of quality new equipment with low noise-emission levels. Regular maintenance, including silencer systems. Planning of transport routes and erection of noise screens where necessary/possible.
	Primary, secondary and tertiary crushing. Operation of processing plant. Operation of conveyor.	Where possible, enclosure of noisy equipment and processes.
Increase in noise levels	Operation of diesel-powered equipment and general transport to and from the mine.	Use of quality new equipment with low noise-emission levels. Regular maintenance, including silencer systems.
	Primary, secondary and tertiary crushing. Operation of processing plant. Operation of conveyor.	Where possible, enclosure of noisy equipment and processes.

Sense of place		
Loss of sense of place due to noise impacts	Mining and processing as a whole, including those activities that arise to support the mine (e.g. increased traffic from transport vehicles).	Minimise transport by road. Investigate transport by rail. Use quality new equipment with low noise-emission levels.
	Primary, secondary and tertiary crushing. Operation of processing plant. Operation of conveyor.	Where possible, enclosure of noisy equipment and processes.
Audibility – sense of place	Transport operation.	Minimise transport by road. Investigate transport by rail.
Loss of sense of place due to visual impact	Mining and processing as a whole, including those activities that arise to support the mine (e.g. increased traffic from transport vehicles).	To ensure that the wilderness and its associated sense of place remain intact to some extent, no mining landscape should be visible from the tourist viewpoints.
Loss of sense of place due to archaeology impacts	Mining and processing as a whole, including those activities that arise to support the mine (e.g. increased traffic from transport vehicles) and exploration activities.	Induct exploration geologists so that they can recognise and avoid damage to archaeological sites.
Natural-resource consumption		
Depletion of natural resources	Fuel consumption of all equipment on site and transport to and from the mine.	Monitor fuel consumption during all phases.
	Electricity consumption of all equipment on site and transport to and from the mine.	Monitor electricity consumption during all phases. Investigate electricity saving measures.
Waste		
Waste-disposal management plan	Disposal of all types of waste – non-hazardous, hazardous and radioactive.	Develop a waste management plan. Minimise waste creation as much as possible. Investigate recycling options.

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR THE CONSTRUCTION PHASE

It is the responsibility of management to ensure that the mitigation measures identified for the construction phase are considered and addressed.

The overall objective of the construction management plan is to avoid unnecessary environmental damage while establishing the construction site area. The work area must be clearly demarcated. A clear construction layout plan showing all construction activity and working areas is in place, and has been discussed with the relevant authorities and agreed upon. The chapters below state the mitigation measures for each aspect, as well as the applicable Namibian legislation to be adhered to.

10.1 GEOLOGY AND SOILS

Although geology and soils have not been addressed in the assessment chapter (**Chapter 8**, **Volume I**), the following mitigation measure shall be conducted prior to construction.

10.1.1 Mitigation and management – soils

Key issue	Activity	Mitigation measures
Soil conservation	Destruction of topsoil (soil crust)	Set aside topsoil if any is encountered that will be necessary for rehabilitation and restoration activities during the mine closure phase.

10.2 GEOHYDROLOGY (SURFACE AND GROUNDWATER)

10.2.1 Applicable legislation

Through the Water Act, No. 54 of 1956 and the Water Amendment Act, No. 22 of 1985, the Department of Water Affairs of the Ministry of Agriculture, Water and Forestry is made responsible for the use, allocation, control and conservation of Namibia's surface and groundwater resources. This act remains in force until the new Water Resources Management Act, No. 24 of 2004 (currently under amendment) is ratified. It makes provision for the protection of river catchments, the drilling of boreholes and the construction of wells. It also controls effluent discharge, outlines regulations that govern the use of water, and exercises certain aspects of water-quality and water-pollution monitoring.

The Swakop River as a public stream is part of the water-control area for which DWA needs to grant abstraction permits for the utilisation of groundwater from the river bed. Under the Water Resource Management Act of 2004, the entire country is a water-control area and abstraction permits are needed for all new groundwater development projects.

10.2.2 Mitigation and management – surface water

Key issue	Activity	Mitigation measures
Storm water falling on site becomes contaminated and has the potential to pollute areas downstream/ off site	All infrastructure associated with the construction of the mine and plant, in particular those housing hazardous materials, wastes or effluents.	Ensure that all storm water flowing on site is diverted to pollution-control ponds, where it is either used for dust suppression during construction or left to evaporate. If Bannerman intends to discharge treated storm water, a discharge permit will be required.

10.2.3 Mitigation and management – emissions to groundwater: industrial and domestic waste

Legal requirements
The Water Act, No. 54 of 1956 governs the use and disposal of water. The DWA issues permits for effluent disposal for the refinery and the sewage treatment plants.

10.2.4 Mitigation and management – groundwater monitoring

An initial groundwater monitoring system has been set up. However, this system needs to be amended prior to construction to ensure that all areas are included on which mine infrastructure and thus potential pollution sources are created. This needs to be addressed in the planning and design phase to avoid and minimise the identified impacts (see **Chapter 9**).

Legal requirements
The protection of Namibia's ground water resources is governed by the Water Act, No. 54 of 1956. Section 23 of the act stipulates that pollution of private and public water, including groundwater, is an offence and that if pollution does occur it must be cleaned up at the polluter's expense.

Permits are required to extract groundwater and to discharge effluent into surface or groundwater systems. Water may not be discharged into the environment unless it has been treated and meets the Industrial Effluent Discharge standards.

10.3 AIR QUALITY

10.3.1 Applicable legislation

Namibia has adopted the South African air-pollution legislation for air-quality control in the form of the Atmospheric Pollution Prevention Ordinance, No. 11 of 1976. Based on the stipulations of this act, the following parts are applicable:

Part II	Controls of noxious or offensive gases
Part III	Atmospheric pollution by smoke
Part IV	Dust control
Part V	Air pollution by fumes emitted by vehicles

This ordinance does not include any ambient air standards with which compliance is necessary, but the Chief Air Pollution Control Officer (CAPCO) provides air-quality guidelines for consideration during the issuing of Air Pollution Certificates. These guidelines have been provided for a number of criteria pollutants; namely sulphur dioxide, oxides of nitrogen, carbon monoxide, ozone, lead and particulate matter.

There are no Namibian standards for ambient air quality. However, Bannerman will adopt a set of internationally recognised standards against which to compare its emissions.

Table 13 below lists the evaluation criteria for the Etango Project. See Chapter 8.4.1 of the ESIA report (Volume 1) for further details.

Table 13 Proposed evaluation criteria for the Etango Project

Pollutant	Averaging period	Selected criteria	Country of origin
PM10	24-hour mean (µg/m³)	$50_{(a)}$	WHO AQG and EC limit
		$75_{(b)}$	Proposed SA standard
	Annual mean (µg/m³)	20	WHO AQG and EC 2010 limit
		40	Proposed SA standard
Dust fallout	30-day average ($mg/m^2/day$)	600	SA SANS residential action limit
		350	German limit in general areas

(a) Not to be exceeded more than 35 times per calendar year.
(b) Not to be exceeded more than four times per calendar year.

As Namibia is a signatory to both the Montreal Protocol and the United Nations Framework Convention on Climate Change (1992), Bannerman will work to honour the commitments made by Namibia to meet the objectives set out in these protocols.

10.3.2 Mitigation and management – air quality

No mitigation measures were provided for the construction period as all potential impacts were rated **medium** and not exceeding any of the above-stated criteria.

10.4 BIODIVERSITY

The most noticeable impact of mining is the alteration of the land, much of which is permanent. Disturbance of land results in visual impacts, alteration in land-use potential and disturbances to biodiversity. As far as possible, Bannerman has endeavoured to avoid disturbance of sensitive areas (see **Chapter 9**) and to minimise the disturbance footprint (**Chapter 9**). Bannerman's mitigation commitments for those parcels of land that are to be disturbed are described in **Chapter 9.1**. In this way, Bannerman expects to ensure that both the intrinsic value and the long-term economic potential of the area is maintained.

10.4.1 Applicable legislation

The following Acts need to be adhered to:

The Nature Conservation Ordinance, No. 14 of 1975 stipulates that hunting of fauna and collection of fauna and/or endangered or protected flora may not take place in a nature reserve without a permit.

The Forestry Act, No. 72 of 1968 prohibits interference with protected plants. Permits are required from the Directorate of Forestry to destroy protected plant species.

Policy for Prospecting and Mining in Protected Areas and National Monuments (MET, MME, National Heritage Commission) 1996.

Namib Naukluft National Park rules and regulations.

Namibia is a signatory to the Convention on Biological Diversity, 1992 (Rio Convention) and as such Bannerman is obliged to help meet the objectives set out in the Namibian Biodiversity Action Plan.

10.4.2 Mitigation and management

Key issue	Activity	Mitigation measures
Habitat loss: habitat, including plants. Invertebrates and small vertebrate animals that live there will be destroyed in all the areas where infrastructure is constructed	Disturbance footprint created by the mine, including mine works areas, roads, power lines and pipelines.	Fence/demarcate the boundary of the proposed footprint during the construction phase to ensure that unnecessary damage does not take place. Prior to stripping and clearing, rescue and relocate selected plants (such as aloes, *Hoodia and, Commiphora oblanceolata*). This must be done in conjunction with the NBRI. Prior to disturbance of an area in which trees occur, the area should be checked to ensure that Martial eagle and Lappet-faced vulture are not breeding there. If a nest is found on the construction site, construction must be halted until specialists have been consulted. Rescue and relocation is not recommended for small vertebrates as it is impractical and ineffective.
		Develop a restoration plan in conjunction with a restoration ecologist and important stakeholders such as MET. Undertake progressive restoration which should start during the operation phase. Apply adaptive management to improve restoration approaches.
Poaching and illegal collection of plants and animals	Improved access to area along roads and infrastructure servitudes.	Work with MET to strengthen law-enforcement activities through the Honorary Warden system. Discipline transgressors in accordance with the Namibian law and company policy.
Degradation in plant and biological soil-crust productivity	Dust fallout from activities such as earth-moving, crushing, screening and vehicle movement on gravel roads, and from wind erosion of dumps and stockpiles.	Effective dust-suppression measures must be implemented on site. As far as possible dust retardants (e.g. tar, salt roads or a dust-a-side-type product) should be used on all access roads. Water is not an effective dust suppressant for access and haul roads and is considered a waste of a valuable and scarce resource. Monitoring of dust levels around site and off site should be done, and dust-suppression activities adjusted as necessary in response to the findings.
Habitat degradation by vehicle tracks	Construction activities, opening up of new areas of the mine lease.	Site track discipline should be strictly enforced on the Etango site. All tracks to be rehabilitated as soon as they are no longer needed. Bannerman already has a rehabilitation procedure in place as part of is exploration programme. This should be applied on the Etango site as well. Monitor rehabilitated sites to establish whether ecosystem functioning is being restored over time. If not, adapt rehabilitation approach to improve effectiveness. Monitor illegal off-road driving by staff and the public in the vicinity of the mine. Actively collaborate with MET to re-establish the Honorary Warden system to strengthen law-enforcement activities in the park.
Pollution from fuels, oils, hazardous chemicals, radioactive substances and litter	Construction activities give rise to environmental pollutants, usually as a result of spills	Implement a strong anti-litter and clean-surroundings policy. All domestic waste to be disposed of in waste bins that have lids and are stored behind a fence so as to prevent scavenging. All domestic waste bins to have lids so as to reduce the likelihood of windborne litter. Site, access roads and general environment in proximity to the mine to be regularly inspected for litter and cleaned up.

Key issue	Activity	Mitigation measures
	or accidents, storage of hazardous contaminants in open facilities to which animals are attracted, and litter.	Spillage management procedures need to be developed for all reagents used on site. Managing spillages along the access route must be included in these procedures. Geohydrological expertise should advise on appropriate detection and avoidance mechanisms for contamination of groundwater reserves. Spills to be cleaned immediately and contaminated soils and water to be remediated or treated. Radiation safety procedures to be strictly enforced. All waste to be disposed of in appropriate waste-disposal facilities (e.g. specific facilities designed for hazardous wastes).
Attraction of wildlife to contaminated water sources	Establishment of open water sources.	Fence off all created open-water sources during construction using a fine wire mesh to ensure that both large and small animals cannot gain access. Mend pipeline leaks and clean up spills immediately. Establish leakage-detection systems for all pipelines.
Introduction of alien invasive floral species, which will out-compete indigenous flora and associated invertebrates.	Increased access and traffic in riverbed.	Eradicate alien invasive vegetation within mining area.

10.5 SOCIO-ECONOMY

10.5.1 Applicable legislation

The following Acts apply:

Regulations relating to the Health and Safety of Employees at Work (promulgated in terms of Section 101 of the Labour Act, No. 6 of 1992 (GN156, GG 1617 of 1 August 1997).

Regulations that establish a comprehensive labour law for all employers and employees (Labour Act, No. 11 of 2007).

The Affirmative Action (Employment) Act, No. 29 of 1998.

10.5.2 Mitigation and management

The following measures are recommended in addition to those detailed for the planning and design phase regarding giving local preference for employment and maximising contracts with SMEs (**Chapter 9.2**).

It is assumed that the construction employees who live elsewhere will not bring their children with them and therefore there will not be a high increase in demand for education.

Key issue	Activity	Economic enhancement and mitigation measures
Minimise inward migration	Recruitment of construction workforce.	(See **Chapter 9.2**). Contractors should commit to Bannerman's recruitment and employment policies relevant for this objective.

Key issue	Activity	Economic enhancement and mitigation measures
Direct, indirect and induced economic benefits	Employment and procurement of goods and services.	Pay attractive salaries/wages and benefits. Have excellent management policies. Promote training of local and regional contractors. Promote SME development. Use small-scale contractors and labour-intensive work where possible. Promote 'buy Namibian' products.
Housing of construction workers	Establishment and management of construction camp on site.	The following provisions should be made: Fencing of construction camp. Hygienic accommodation with good ablution and sanitary facilities that are emptied regularly; condoms freely available. No alcohol allowed on site. No informal vending allowed on site. Maximise use of locally based SMEs for service provision. Tight security on gate to prevent unauthorised access to mine. Transport for workers to and from the site as appropriate. No open fires, even if firewood is supplied. No collection of animals or plants. No firearms.
Health	Employment benefits: health.	Clinic facilities on site, including free VCT for HIV and TB. Peer-education programme for HIV/AIDS and TB for all shifts. Wellness programme.
Crime which targets the NNNP and neighbouring farms		Investigate whether its practicable to expand the brief of mine security to support the MET and neighbours in patrolling beyond the mine area. Repeatedly inform the public that no workers will be recruited at the site gate.
Negative impact on tourism and local livelihoods	Loss of sense of space in NNNP and at moon landscape.	Work with the tourism industry to identify and promote alternative tourism opportunities in or around Swakopmund and the national park. Work with government and other mining companies to look for appropriate offsets. Consider alternative uses for neighbours' tourism facilities, e.g. to be used as accommodation for construction management.
Road safety	Gravel roads used by locals, tourists and mine vehicles.	Bannerman should investigate the feasibility of contributing to the tarring of the C28 from the mine site turnoff to the B2 for the safety of all road users.

10.6 ARCHAEOLOGY

Bannerman commits to:

- avoid as far as practicable the disturbance of known or unknown archaeological/palaeontological sites; and
- ensure that archaeological or historical sites are not destroyed without the necessary permission being granted by the National Monuments Council (NMC) or equivalent.

10.6.1 Legal requirements

The National Heritage Act, No. 27 of 2004 governs the management of heritage sites in Namibia.

10.6.2 Mitigation and management

Key issue	Activity	Mitigation measures
Disturbance of site QRS 89/1located at minor granite outcrop. They are Low-density surface scatters (<1pc/m^2) with Later Stone Age and Middle Stone Age artefact debris of mainly hydrothermal vein quartz and chert. The archaeological site forms part of an identifiable local distribution or group.	Open-cast mining – the creation of the open pit will result in a probable threat from inadvertent disturbance due to proximity of development.	Apply to the National Heritage Council for a permit to destroy sites lying within the area of mining when the layout of the surface works has been decided.
Disturbance of site QRS 89/2 and QRS 89/3 located at minor granite outcrops. They are Low-density surface scatters (<1pc/m^2) with Later Stone Age and Middle Stone Age artefact debris of mainly hydrothermal vein quartz. The archaeological site forms part of an identifiable local distribution or group.	Open-cast mining – the creation of the open pit will result in a probable threat from inadvertent disturbance due to proximity of development.	Apply to the National Heritage Council for a permit to destroy sites lying within the area of mining when the layout of the surface works has been decided.
Disturbance of site QRS 89/4 located at a minor granite outcrop. It is a Low-density surface scatter (<1pc/m^2) with Later Stone Age and Middle Stone Age artefact debris of mainly hydrothermal vein quartz and chert. The archaeological site forms part of an identifiable local distribution or group.	Open-cast mining – the creation of the open pit will result in total destruction of this site.	Apply to the National Heritage Council for a permit to destroy sites lying within the area of mining.

10.7 VISUAL

10.7.1 Legal requirements

In order to comply with the Visual Resource Management requirements it is necessary to clarify which planning policies govern the property (Etango Project site) to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the visual character and sense of place of the area. The Class I visual resource management class (VRM) that has been assigned to the landscapes in the NNNP is based on various Namibian policies and plans, as no single law or plan exists governing visual impacts. The proposed landscape modifications should be viewed in the context of these policies and plans.

Environmental Management Act, No. 7 of 2007

The purpose of the Environmental Management Act (EMA) is to 'give effect to Article 95 (l) and 91 (c) of the Namibian Constitution by:

- establishing general principles for the management of the environment and natural resources and promoting the co-ordinated and integrated management of the environment, where environment refers not only to the natural environment – being land, water and air, all organic and inorganic material and all living organisms – but to the

human environment – being the landscape and natural, cultural, historical, aesthetic, economic and social heritage and values.

Namibia Minerals Policy (MME)

The minerals policy recognises that mining projects are short- to medium-term initiatives and as such should not jeopardise the potential for long-term sustainable development in tourism.

Policy for Prospecting and Mining in Protected Areas and National Monuments (MET, MME, National Heritage Commission, 1996)

This policy specifically addresses mining and prospecting activities in environmentally sensitive areas. Many of Namibia's protected areas have considerable mineral potential, and prospecting in protected areas has been taking place for years, often resulting in the loss of key ecological characteristics and the tourism potential of these protected areas. In order to reconcile the objectives of mineral exploitation and environmental protection, the policy identifies the need to minimise the negative impacts of prospecting or mining activities on the environment.

National policies and plans

Namibia Vision 2030

Namibia Vision 2030 is a document that lays out a long-term vision for the country and is considered to be one of the most important initiatives undertaken since the drafting of the Constitution (http://www.npc.gov.na/vision/pdfs/Preface.pdf). In this plan it is recognised that natural environments are disappearing quickly. Consequently, the solitude, silence and natural beauty that many areas in Namibia provide are becoming sought-after commodities and should be regarded as valuable natural assets. Preserving these assets is fundamental to developing tourism as a sustainable economic sector. Tourism has more potential as a sustainable industry than virtually any other form of economic development in Namibia (pg. 29).

While the importance of mining is also identified in this plan, growth of the mining sector cannot undermine the resources that underpin tourism potential in Namibia.

SEA for the coastal areas of the Erongo and Kunene Regions (MET)

The Namibian coastal Strategic Environmental Assessment (SEA) for the Kunene and Erongo Regions is an initiative of the Namibian Government through MME that seeks to inform political and technical decision-makers at local, regional and national levels on integrated coastal management and has been integral in the formulation of a coastal management white paper. The SEA recognises that a thriving economy cannot be built on a bankrupt environment, and Namibia's biodiversity and unique sense of place should not be diminished by this transition.

Draft MDP for Namib Skeleton Coast National Park

Although the overall NSCNP has not yet been proclaimed, the MDP represents the policies and intentions of the MET, the Ministry of Fisheries and Marine Resources (MFMR) and their partners for this area; hence it is relevant when considering mining in the park. The plan stipulates that 'No prospecting and mining activities will take place in Key Biodiversity Areas. All prospecting and mining activities in other areas are planned, managed and decommissioned using best practice, taking into account long-term national benefits… so as to minimise negative environmental and socio-economic impacts'.

10.7.2 Mitigation and management

Key issues	Activity	Mitigation measures
Construction camp	Will house approximately 800-1 500 people. Will be constructed using prefabricated buildings, all of which will be single storey. Viewshed extent will be low to moderate depending on where the camp is situated.	Construction housing needs to be painted in a variation of matching desert colours based on hues of grey (RAL 1001/RAL 1019). The roof material should be medium-grey in colour. Shadows need to be created around the houses using wide eaves or pergolas.
Open-pit mining	The final pit void is expected to be 1 km x 3 km x 400 m. The void will not be visible from the KOPs (viewshed extent = zero) but will be highly visible from the air and might impact on air-based tourist activities.	Apply dust suppression on haul roads.
Blasting	Plumes of dust and rock created during blasting events can extend up to 250 m into the air, although on average they extend 150 m into the air and can be seen from far away. Depending on atmospheric conditions, dust plumes can remain visible for up to 15-20 minutes (based on Rössing dust study). The viewshed extent is therefore high.	Blasting should take place in the afternoon when the atmospheric haze is more intense. Blasting vibration and dust would affect the sense of place and it is recommended that, working in conjunction with the tourism industry and Interested and Affected Parties (IAPs), specific days of the week are identified for blasting. This would allow tourists to experience the area without the visual intrusion of the blasting plume and vibration.
Coarse ore stockpile	During the construction phase, the machinery associated with the coarse ore stockpile will be erected. Although this is fairly large machinery, the viewshed extent from the KOPs is expected to be low.	Large machinery needs to be painted a grey-brown desert colour to help reduce the degree of contrast generated.
Heap leach pad and associated machinery	The stacking and removal of ore at the heap leach pad will be undertaken by a very large stacker-reclaimer that will move up and down the heap leach pad on mobile conveyors. The approximate size of the heap leach pad with its machinery is 60 m x 110 m. The heap leach pad will be stacked to a maximum height of 7 m but the machinery is 25 m tall. The viewshed extent is moderate.	Large machinery needs to be painted a grey-brown desert colour to help reduce the degree of contrast generated.

Key issues	Activity	Mitigation measures
Night operations	Light from the process plant and associated infrastructure and from mining vehicles will modify the night landscape significantly. The viewshed extent is therefore high.	All lighting is to be kept to a minimum within the requirements of safety and efficiency. Where such lighting is deemed necessary, low-level lighting, shielded to reduce light spillage and pollution, should be used. No external up-lighting of any parts of the structures, including the stacks, should be allowed. Security and perimeter lighting should also be shielded so that no light falls outside the area needing to be lit. Overly tall light poles are to be avoided. No naked light sources are to be directly visible from a distance, except for aircraft-warning lights. All necessary aircraft-warning lights are to be installed as per government requirements. Only reflected light should be visible from outside the site.
Creation of wind-blown dust from all mining activities, driving on gravel roads and from fugitive dust	Dust generated from mining and processing activities has the potential to reduce visibility and diminish tourist's visual experience of the landscape.	Dust suppression methods should be implemented.
Processing plant and associated infrastructure such as offices and workshops	The process plant and its associated infrastructure will occupy a footprint of approximately 114 800 m^2. The viewshed extent of this landscape modification is expected to be high as is the impact on the wilderness sense of place.	Within the limits of engineering feasibility, structures should be as low as possible on the ground. A brick structure with rough plaster is recommended. Natural desert colours close to a medium-grey brown should be utilised for all structures. Construction activities may involve cranes, etc. which will be difficult to control for visual intrusion but are short-term. Large machinery needs to be painted a grey-brown desert colour to help reduce the degree of contrast generated. Earthworks: If it is geotechnically and financially feasible, the platforms should be levelled predominantly by means of cut rather than by balancing both cut and fill. The excess fill could then be used to create a large berm around the processing plant, thus reducing the visibility of the C28 and D1914 receptors. The berm should be 4 to 5 m in height and should undulate and meander to look more like a natural hill than an engineered structure. The slopes of berms should not exceed 1:4 so that erosion is minimised and the appearance of 'natural' slopes is emphasised. A landscape architect should be appointed to work with the engineers in creating an affordable but natural-looking environment.
Heap leach residue facility machinery	This machinery will be about 25 m in height. It will be erected during the construction phase. It is large machinery, thus from the KOPs the viewshed extent is expected to be medium.	Large machinery needs to be painted a grey-brown desert colour to help reduce the degree of contrast generated.

Key issues	Activity	Mitigation measures
Additional infrastructure such as main access gate, mine service road, pipelines and power lines, main HV switchyard, explosives store, etc.	The maximum height of the additional infrastructure will be 20 m. The viewshed extent will be moderate as collectively these buildings and servitudes will create an industrial landscape which conflicts with the wilderness sense of place and the visual landscape of a national park.	Power lines should be erected as close to existing roads and other visual disturbances as possible and, if possible, constructed using wooden poles. Pipelines need to be of a good muted colour which would reduce levels of contrast. All surfaces should be painted subdued earth tones to blend into the surroundings. For larger surfaces such as roofs and storage tanks, a medium brown-grey should be tested and then used if suitable for its ability to blend into the desert surroundings. Bright colours such as reds, greens, whites and blues should be avoided except for required industry-safety markings. The fuel and other pipelines are to be painted grey unless set in a trench, in which case muted colours can be used. The use of facebrick should be avoided, and glass surfaces should be shielded to avoid glare and reflections. No backlit or neon signage is to be allowed. Signage should be limited to what is necessary and colours should not dominate but should blend with the surroundings to maintain sense of place.

10.8 NOISE

10.8.1 Legal requirements

Although legislation covering the health and safety aspects of noise exists, no environmental noise regulations have yet been published in Namibia. Therefore, the noise standards and guidelines of other countries and institutions will have to be applied.

In South Africa, the document that addresses the issues concerning environmental noise is SANS 10103:2008. It has recently been thoroughly revised and brought in line with the guidelines of the World Health Organisation (WHO). The standard provides:

- The maximum average ambient noise levels during the day and night, respectively, to which different types of districts may be exposed. For rural residential areas these limits are:
  - Day (06:00 to 22:00): 45 dBA
  - Night (22:00 to 06:00): 35 dBA
- The expected community reactions to increases in general ambient noise levels, where:
  - An increase of 0 dBA or less will not cause any response from a community.
  - An increase of between 0 dBA and 10 dBA will elicit 'little' community response with 'sporadic complaints'. However, between 5 dBA and 15 dBA the strength of the response will gradually change to 'medium' with 'widespread complaints'. For a person with average hearing acuity, an increase of less than 3 dBA in the general ambient noise level will not be noticeable. The contour describing an increase of 3 dBA is, therefore, a very useful significance indicator.
  - Between 5 dBA and 15 dBA an increase will elicit a 'medium' community response with 'widespread complaints'. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an increase of more than 15 dBA, the community reaction will be 'strong' with 'threats of community action'.
  - For an increase of between 10 dBA and 20 dBA, the community response will gradually increase in strength to 'strong' with 'threats of community action'.
- Detailed procedures for the measurement of noise levels.

SANS 10103:2008 does not address conservation wilderness areas. Nevertheless, it is recommended that this standard be applied, as adherence to these thresholds will see Bannerman operating within the limits of international best practice.

10.8.2 Mitigation and management

Key issue	Activity	Mitigation measures
Disturbance caused by noise	Operation of diesel-powered equipment. Transport .	Use of quality new equipment with low noise-emission levels. Regular maintenance, including silencer systems.
Increase in noise levels	Operation of diesel-powered equipment. Transport.	Use of quality new equipment with low noise emission levels. Regular maintenance, including silencer systems.
Noisy single events	Blasting.	Inform tourist operators and neighbours of blasting times.
	Reverse hooters.	Use strobe lights during the night.
	'Bucket slams' and similar events.	Train operators to prevent events.

10.9 SENSE OF PLACE

10.9.1 Legal requirements

No legislation pertaining to sense of place exists in Namibia.

10.9.2 Mitigation and management

Key issue	Activity	Mitigation measures
Loss of sense of place due to noise impacts	Construction activities e.g. increased traffic from transport vehicles and starting of mining.	Noise from reverse hooters – use strobe lights during the night. Train operators to prevent slamming of the bucket when loading ore. Inform tourist operators and neighbours of blasting times.
Loss of sense of place due to archaeology impacts	Construction and the commencement of mining, including further exploration.	Induct exploration geologists so that they can recognise and avoid damage to archaeology sites. Wherever possible, demarcate (and if necessary fence off) sites to prevent inadvertent damage.

10.10 OVERALL MANAGEMENT ASPECTS DURING CONSTRUCTION

10.10.1 Remote environments

The mine will have an impact on environments well beyond the mine lease boundary and include the roads leading to and from the mine, the towns of Swakopmund and Walvis Bay, and the places during construction. The issues that affect remote environments include:

- consumption of goods such as electricity, diesel and manufactured materials which cause pollution of remote environments;

- spillages on access roads/railway lines/in the ocean during the transport of goods such as diesel and cement to site; and
- degradation of the Namib Naukluft National Park from construction-related activities and accidents.

Legal requirements
No Namibian legislation exists regarding the use of **electricity or diesel**. NamPower operates the local sub-stations under the Electricity Act 2 of 2000 and Regulations of 2001. Namibia is a signatory to the UNFCCC (Climate Change convention). Namibia is obliged to put programmes in place to meet the objectives of the convention. Industry will need to align itself with these objectives.

There is no legislation pertaining specifically to the **consumption of manufactured materials** except for that which refers to the transport, storage, safe use and disposal of hazardous materials such as the Hazardous Substances Ordinance, No. 14 of 1974.

The mining of **sand and gravel** is not controlled by the Minerals (Prospecting and Mining) Act, No. 13 of 1990. Opening of borrow pits is usually controlled by municipal by-laws. In the NNNP, the opening of borrow pits outside of the Etango mine lease will need to be negotiated with MET.

10.10.2 Mitigation and management

Key issue	Activity	Mitigation measures
Electricity		
Consumption of electricity	Construction work.	Minimise electricity consumption.
Hydrocarbons (diesel and petrol)		
Transportation of fuel	Transportation contractors transporting fuel to site.	Conduct routine inspections of the contracted fuel-supply company to ensure compliance with legal and Bannerman requirements.
Fuel consumption	All construction that uses diesel or petrol.	Identify ways to minimise fuel consumption. Monitor fuel consumption during the construction phase.
Fuel spillages	Transportation contractors transporting fuel to site.	Develop and implement a maintenance plan for all fuel-storage equipment on site. Inspect contracted fuel-delivery company's equipment to ensure that it is up to standard for the delivery and dispensing of fuel. Ensure that the contractor has all the necessary hazardous protection equipment for people and the environment in the advent of a spill. Develop a spill-management procedure, including the clean-up of hydro-carbon spills. Purchase and place spill kits in all areas where fuel is dispensed and stored, and train staff to use them. Verify fuel-transport company's spill containment (emergency clean-up) plan and spill clean-up agreement with sub-contractor.
Safe disposal and rehabilitation of hydrocarbon-contaminated soils and water	All vehicles and equipment or facilities from which fuel pollution can occur.	Develop and implement a hydrocarbon remediation procedure that explains how to deal with the treatment of contaminated environments (soil and water).
Monitoring of hydrocarbon spills		Ensure that checking for hydrocarbon spills is included in the daily inspections. Report spillages as per the incident management procedure.

Key issue	Activity	Mitigation measures
Water – see Chapters 9 and 10: Hydrology		
Consumption of sand and gravel during the construction phase		
Consumption of sand and gravel from borrow pits located off site	Construction activities.	Ensure that Bannerman undertakes an ESIA for all proposed borrow-pit sites. Ensure that all borrow-pit sites are managed in accordance with Bannerman's standards. Ensure all borrow-pit sites are rehabilitated once Bannerman has finished using them.
Manufactured goods (reagents, equipment, etc.)		
Transport of hazardous materials	Transportation contractors transporting goods to site.	Conduct routine inspections of the supply companies transporting hazardous materials to and from site to ensure compliance to legal and Bannerman requirements and that the contractor has all the necessary hazardous protection equipment for people and the environment in the advent of a spill.
Handling and storage of hazardous materials	Transportation contractors.	Review contractor offloading procedure and monitor compliance to this procedure as well as legal and Bannerman's requirements. Develop a procedure for the approval, receipt, review, handling, storage and use of hazardous materials on site.
Spillage of reagents and other chemicals	Walvis Bay harbour, access roads/rail to site, mine site.	Report spillages and clean them up immediately.
Pollution of Walvis Bay and Swakopmund		
Disposal of solid domestic waste at the Swakopmund or Walvis Bay landfills	Construction activities.	No landfill site or untreated sewerage disposal is allowed on site. Ensure that domestic waste is only deposited at properly managed land fill sites. If the municipal landfill sites do not meet Bannerman's disposal standards, then work with the municipality to improve compliance.
Disposal of solid and liquid hazardous waste (excluding radioactive waste) at the Walvis Bay hazardous waste-disposal site	Construction activities.	Ensure that all hazardous waste (excluding radioactive waste) is disposed of at the Walvis Bay hazardous waste-disposal site and that receipts are kept as records. Ensure that no radioactive waste leaves the mine site. All radioactive waste must be safely disposed of on the mine site.
Degradation of the Namib Naukluft National Park		
Cumulative impact on regional biodiversity	Construction activities.	Liaise with the Chamber of Mines regarding the impact of construction for uranium mining on biodiversity on a regional scale.
Offsetting residual biodiversity impacts	Construction activities.	If necessary, undertake a systematic assessment of potential offsets and determine and identify appropriate options for Bannerman.
Stakeholder and shareholder confidence	Construction activities.	Involve stakeholders during construction.

10.10.3 Emissions to land – pollutants (solid and liquid) that contaminate the soil

Hazardous wastes include products such as fuels, chemicals, lubricating oils, hydraulic and brake fluid, paints, solvents, acids, detergents, resins, solids from sewerage and sludge. Many of these substances require special collection and handling. There is a hazardous disposal site at Walvis Bay (the designation is based on the South African system) and non-radioactive hazardous waste will be disposed of at this facility or at other appropriate facilities (e.g. sludge will be taken to the municipal sewage works). A contracted waste removal company transports the waste from Bannerman to the designated hazardous disposal facility.

Non-hazardous waste is domestic waste (food and office waste) and industrial waste (wood, containers and bags) that is non-radioactive. Non-radioactive non-hazardous waste will be disposed of at either at the Swakopmund or Walvis Bay landfill site by a contracted waste-removal company.

All waste that has become radioactive will not be taken off site. A temporary waste disposal site will be identified and used during the construction phase.

Legal requirements
The Minerals (Prospecting and Mining) Act, No. 33 of 1992 for Namibia requires details regarding pollution control and waste management but refers specifically to **mineralised waste** (dumps and heap leach disposal).

Non-mineralised waste includes hazardous and non-hazardous waste which may be disposed of to land or to water.

With respect to emissions to land, the following applies:

- The Labour Act, No. 6 of 1992 specifies that hazardous waste must be disposed of without risk to the health of any person or to the environment.
- The Hazardous Substances Ordinance, No. 14 of 1974 refers to the transport, storage, safe use and disposal of hazardous materials.
- The Public Health Act, No. 36 of 1919 states that no person may allow the existence of a nuisance or other condition liable to be injurious or dangerous to health on any land owned or occupied by them, including pollution from refuse.
- The Minerals (Prospecting and Mining) Act, No. 33 of 1992 regulates pollution control and waste management within mining-licence areas.
- The Water Act, No. 54 of 1956 governs the use and disposal of water. The Ministry of Agriculture, Water and Forestry (MAWF) issues permits for effluent disposal for the plant (industrial) and sewage treatment plant (domestic).
- Namibia is a signatory to the Basel Convention which deals with the trans-boundary movement of hazardous material.

10.10.4 Spillage management

Spillages may arise as part of normal day-to-day operations. The nature, source and reasons for a spill are many but regardless of the size or toxicity of the substance(s) involved, all spills must be managed. **On-site spills** may arise during construction and from the offices and sewage plant in the form of domestic effluent and littering (solid spills).

Reagents and diesel are transported to the construction site by road so the potential for **off-site spills** exists. In addition, non-hazardous and hazardous waste is transported off site to the appropriate landfill for disposal, as well as final product to the container terminal at the port of Walvis Bay. If this material is not properly transported, the potential for littering (solid spills) exists. **Table 15** outlines how spillages will be managed at Bannerman.

Legal requirements
The Petroleum Products and Energy Act, No. 13 of 1990 and Petroleum Products Regulations 2000 control the use and disposal of petroleum-related products. Companies transporting, storing or dispensing fuels require a licence. Spills in excess of 200 l must be reported to the Minister of Mines and Energy.

The Minerals (Prospecting and Mining) Act, No. 33 of 1992 stipulates that the ML holder is liable for spilling, pollution, loss or damage. The ML holder must (a) report spilling, pollution, loss or damage, and (b) take steps, at its own expense, to remediate.

Key issue	Activity	Mitigation measures
Hydrocarbons (diesel and petrol)		
Handling and storage of fuel	Fuel transporting companies, fuel-farm contractor.	**Mitigate**: Review contractor offloading procedure. Conduct routine inspections of the fuel farm to ensure compliance with legal and Bannerman requirements.

11 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR THE OPERATION PHASE

It is the responsibility of management to ensure that the mitigation measures identified for the operation phase are considered and addressed.

11.1 GEOHYDROLOGY (SURFACE AND GROUNDWATER)

11.1.1 Legal requirements

Through the Water Act, No. 54 of 1956 and the Water Amendment Act, No. 22 of 1985, the Department of Water Affairs of the Ministry of Agriculture, Water and Forestry is made responsible for the use, allocation, control and conservation of Namibia's surface and groundwater resources. This Act remains in force until the new Water Resources Management Act, No. 24 of 2004 (currently under amendment) is ratified. It makes provision for the protection of river catchments, the drilling of boreholes, and the construction of wells. Furthermore, it controls effluent discharge, outlines regulations that govern the use of water, and exercises certain aspects of water-quality and water-pollution monitoring.

The Swakop River as a public stream is part of the water-control area for which DWAF needs to grant abstraction permits for the utilisation of groundwater from the river bed. Under the new Water Resource Management Act, the entire country will become a water-control area and abstraction permits will need to be granted for all new groundwater development projects, including mine exploration boreholes.

11.1.2 Mitigation and management – surface water

Key issue	Activity	Mitigation measures
Storm water falling on site becomes contaminated and has the potential to pollute areas downstream/ off site	All infrastructure associated with the mine and plant, in particular those housing hazardous materials, wastes or effluents.	Ensure that all storm water flowing on site is diverted to pollution-control ponds, where it is either used for dust suppression during construction or left to evaporate. If Bannerman intends to discharge treated storm water, a discharge permit will be required.

11.1.3 Mitigation and management – emissions to groundwater – industrial and domestic waste

Legal requirements

The Water Act (54 of 1956) governs the use and disposal of water. The DWA issues permits for effluent disposal for the processing plant and the sewage-treatment plants.

11.1.4 Mitigation and management – groundwater monitoring

The groundwater monitoring system needs to be assessed prior to operations to ensure that all areas are included on which mine infrastructure and thus potential pollution sources exist.

Legal requirements

The protection of Namibia's groundwater resources is governed by the Water Act, No. 54 of 1956. Section 23 of the Act stipulates that pollution of private and public water, including

groundwater, is an offence, and that if pollution does take place it must be cleaned up at the polluter's expense.

Permits are required to extract groundwater and to discharge effluent into surface or groundwater systems. Water may not be discharged into the environment unless it has been treated and meets the Industrial Effluent Discharge standards.

Key issue	Activity	Mitigation measures
Water supply from the Swakop River alluvium	Water requirement for the processing plant.	No water is abstracted from the Swakop River (see **Chapter 9**).
Surface runoff from waste rock dumps flows in washes to the Swakop River and infiltrates into shallow alluvium	After sporadic rainfall events, surface runoff from the waste rock dumps leaches uranium and contaminates the shallow alluvium and drains into the Swakop River.	Perimeter drains and sediment traps should be constructed around the pit and waste dump areas as well as around the ROM pad to manage local water runoff and to ensure merging of the runoff into storm-water ponds. Rock-lined drains should be constructed to ensure excess runoff is controlled and directed to sediment traps.
Surface runoff from the HLRF infiltrates into shallow alluvium and deeper groundwater	The leach residual contains water and sulphuric acid that allow the mobilisation of uranium and other metals, which are still present within the waste material. After sporadic rainfall events, surface runoff from the HLRF could be washed into the shallow alluvium and percolate into basement rocks, thereby polluting the aquifer.	Surface runoff water must be contained. The bund walls should be designed to capture the flow of an exceptionally high rainfall event, i.e. 100 mm in 24 hours. The chemical and mineralogical composition of the leach residual is not known at this stage and therefore neither is the contamination potential. It is however assumed that sulphuric acid and mobile uranium species are still present. Thus, Bannerman should ensure that the design is based on a zero effluent discharge target.
Acidic seepage water from the heap leach pad contaminates the shallow alluvium (washes) and the regional paleochannel/ basement aquifer	The heap leach pads are irrigated with acidified water for dissolution of uranium. If not properly lined, the leach water can infiltrate into the subsurface and reach the groundwater table within the basement and palaeochannel aquifers. The leach is highly concentrated uranium and at low pH, uranium species are extremely mobile.	The entire HLP must be prepared with a pad-construction base (compacted sub-base) and lined according to an appropriately engineered solution designed to prevent any seepage into the sub-surface and taking into account best practice standards. Bannerman is considering using a multi-layered geotextiles/HDPE liner, including cushion-layer system, for protection during stacking and from vehicles. A drainage system and leak-detection system must be installed. Monitoring wells must be installed on the perimeter of the heap leach pad to detect any seepage into the groundwater. Depending on the seepage volumes and the permeability of the sub-surface rocks, the pollution plume can reach far and leave the mine lease towards the general flow direction of the groundwater.
Contaminated seepage from the HLRF infiltrates into shallow alluvium and the regional basement aquifer	The seepage from the HLRF is supposed to be less contaminated than the heap leach seepage because the bulk of the uranium is leached and the residual is washed prior to deposition on the HLRF. However, sulphuric acid concentrations are still	The leach residue should be thickened (dewatered) prior to deposition to reduce the potential for seepage. Like the HLP, the HLRF must be lined according to an appropriately engineered solution designed to prevent any seepage into the groundwater and taking into account best practice standards. A drainage system and leak-detection system must be installed. It is envisaged that drainage from the HLRF will

Key issue	Activity	Mitigation measures
	elevated, resulting in low pH and high solubility of metals, including uranium. The seepage could infiltrate and contaminate the groundwater.	be collected in a lined leach residue emergency pond with sufficient storage capacity. Effluent from the emergency pond must be recycled back to the plant for reuse or treated and discharged in a controlled manner. If the latter is chosen, a treatment plant will need to be installed and an effluent discharge permit acquired. Monitoring wells must be installed for seepage detection.
Seepage from the plant and acid tanks contaminates the groundwater	Contaminated process water leaks from the processing plant and infiltrates into underlying rock strata and contaminates the groundwater.	Process areas within the plant must be lined with waterproof concrete and/or geotextiles to capture contaminated seepage. The sulphuric acid unloading and storage area must be suitably bunded and serviced by the sulphuric acid storage area sump and pump, which transfers any spillage to the process-water ponds. The bunded area and pumping capacities must be large enough to recover sulphuric acid in case of a tank burst. Monitoring wells should be installed for seepage detection.
Seepage from the process water ponds contaminates the groundwater	The process water ponds leak and activated seepage water contaminates the groundwater.	The ponds must be lined according to an appropriately engineered solution designed to prevent any seepage into the groundwater and taking into account best practice standards. Downstream monitoring wells should be installed to measure potential seepage from ponds and plant. Liners must be regularly checked for leaks.
Seepage from the stockpile contaminates groundwater	The stockpiles are planned to be partly within the groundwater catchment of the Swakop River. The stockpiles usually have higher ore grades and contain water with elevated uranium levels. Unlined stockpiles would allow the infiltration of seepage into the basement rock aquifer. Far and deep-reaching fault zones exist on the faulted contact between the Palmenhorst Dome and overlying strata and will enhance the flow towards the Swakop River.	Coarse ore stockpiles and the ROM stockpiles should be lined. See also the mitigation measures for waste rock dump surface water runoff.
Groundwater sink caused by mine pit	The stage 1 pit will be >150 m deep and achieve a pit floor 20 m below the Swakop River water level, and a groundwater sink might occur. Groundwater flows towards the mine pit, lowering the groundwater table in the region, thereby affecting groundwater users downstream of the Swakop River.	Suitable monitoring wells should be installed to monitor water-level changes in the surroundings, including the Swakop River. Initial inflow rates are estimated to be between 100 and 1000 m^3/day, with most of it being evaporated on the pit walls. The inflow could probably be captured by sump pumps and stored for re-use, e.g. for dust suppression.

11.2 AIR QUALITY

11.2.1 Applicable legislation

Namibia has adopted the South African air pollution legislation for air-quality control in the form of the Atmospheric Pollution Prevention Ordinance, No. 11 of 1976. Based on the stipulations of this Act, the following parts are applicable:

Part II	Controls of noxious or offensive gases
Part III	Atmospheric pollution by smoke
Part IV	Dust control
Part V	Air pollution by fumes emitted by vehicles

This Act does not include any ambient air standards with which to comply, but the Chief Air Pollution Control Officer (CAPCO) provides air-quality guidelines for consideration during the issuing of Air Pollution Certificates. These air-pollution guidelines have been provided for a number of criteria pollutants; namely, sulphur dioxide, oxides of nitrogen, carbon monoxide, ozone, lead and particulate matter.

There are no Namibian standards for ambient air quality. However, Bannerman will adopt a set of internationally recognised standards against which to compare its emissions.

Table 14 below lists the evaluation criteria for the Etango Project. See Chapter 8.4.1 of the ESIA report (Volume 1) for further details.

Table 14 Proposed evaluation criteria for the Etango Project

Pollutant	Averaging period	Selected criteria	Country of origin
PM10	24-hour mean (µg/m³)	$50_{(a)}$	WHO AQG and EC limit
		$75_{(b)}$	Proposed SA standard
	Annual mean (µg/m³)	20	WHO AQG and EC 2010 limit
		40	Proposed SA standard
Dust fallout	30-day average ($mg/m^2/day$)	600	SA SANS residential action limit
		350	German limit in general areas

(a) Not to be exceeded more than 35 times per calendar year.
(b) Not to be exceeded more than four times per calendar year.

As Namibia is a signatory to both the Montreal Protocol and the United Nations Framework Convention on Climate Change, 1992, Bannerman will work to honour the commitments made by Namibia to meet the objectives set out in these protocols.

11.2.2 Mitigation and management

Key issue	Activity	Mitigation measures
Annual average PM10 health impact	Blasting	No mitigation.
	Crushing and screening	Dust-extraction hoods with scrubbers (75% reduction in dust emissions). Additional fabric filters (83% reduction in dust emissions).
	Drilling	Dust extraction filters on drilling machinery (99% reduction in dust emission).
	Materials handling, e.g. tipping	Difficult to mitigate.
	Unpaved road	(a) Reducing the extent of unpaved roads, e.g. paving; (b) traffic control measures, e.g. restricting traffic volumes,

Key issue	Activity	Mitigation measures
		reducing vehicle speeds; and (c) binding the surface material or enhancing moisture retention. 90% control efficiency through the application of chemical surfactants and 75% control efficiency of in-pit haul roads through water spraying.
	Wind erosion	Natural crusting (30% reduction in dust emissions).
Highest daily average PM10 health impacts	Blasting	No mitigation.
	Crushing and screening	Dust-extraction hoods with scrubbers (75% reduction in dust emissions).
	Drilling	Water sprays (70% reduction in dust emissions).
	Materials handling	Water sprays to keep material off-loaded from trucks and conveyors wet (50% reduction in dust emissions).
	Unpaved road	(a) Reducing the extent of unpaved roads, e.g. paving; (b) traffic control measures, e.g. restricting traffic volumes, reducing vehicle speeds; and (c) binding the surface material or enhancing moisture retention. 90% control efficiency through the application of chemical surfactants and 75% control efficiency of in-pit haul roads through water spraying.
	Wind erosion	Natural crusting (30% reduction in dust emissions).
Average daily dustfall impacts	Blasting	No mitigation.
	Crushing and screening	Dust-extraction hoods with scrubbers (75% reduction in dust emissions).
	Drilling	Water sprays (70% reduction in dust emissions).
	Materials handling	Water sprays to keep material off-loaded from trucks and conveyors wet (50% reduction in dust emissions).
	Unpaved road	(a) Reducing the extent of unpaved roads, e.g. paving; (b) traffic control measures, e.g. restricting traffic volumes, reducing vehicle speeds; and (c) binding the surface material or enhancing moisture retention. 90% control efficiency through the application of chemical surfactants and 75% control efficiency of in-pit haul roads through water spraying.
	Wind erosion	Natural crusting (30% reduction in dust emissions).

11.3 BIODIVERSITY

The most noticeable impact of mining is the alteration of the land, much of which is permanent. Disturbance of land results in visual impacts, alteration in land-use potential and disturbances to biodiversity. As far as possible, Bannerman has endeavoured to avoid disturbance of sensitive areas (see **Chapter 9**) and to minimise the disturbance footprint (**Chapter 9**). Bannerman's mitigation commitments for those parcels of land that are to be disturbed are described below in the mitigation table. In this way, Bannerman expects to ensure that damage to both the intrinsic value and long-term economic potential of the area is minimised.

To understand biodiversity one should appreciate all of its components. It is not only about the species of plants and animals and the different habitats in which they live (biodiversity patterns) but also about the way that factors such as wind, water, steepness of slope and presence of pollinators affect the habitats and the species living in them (ecosystem processes).

Understanding biodiversity can help not only to maximise conservation of fauna and flora but to ensure that the ecosystem services such as nutrient cycling, soil formation and primary

production are not disturbed, for without these services the primary land users of the area, namely conservation and eco-tourism, would become impossible. **Chapter 9.1** and **9.2** outline Bannerman's commitments to biodiversity management.

11.3.1 Applicable legislation

The following Acts need to be adhered to:

The Nature Conservation Ordinance, No. 14 of 1975 stipulates that hunting of fauna and collection of fauna and/or endangered or protected flora may not take place in a nature reserve without a permit.

The Forestry Act, No. 72 of 1968 prohibits interference with protected plants. Permits are required from the Directorate of Forestry to destroy protected plant species.

Policy for Prospecting and Mining in Protected Areas and National Monuments (MET, MME, National Heritage Commission, 1996).

Namib Naukluft National Park rules and regulations.

Namibia is a signatory to the Convention on Biological Diversity, 1992 (Rio Convention) and as such Bannerman is obliged to help meet the objectives set out in the Namibian Biodiversity Action Plan.

11.3.2 Mitigation and management

Key issue	Activity	Mitigation measures
Mining in a national park	All construction and mining activities.	It is recommended that progressive rehabilitation and restoration of ecosystems be undertaken and that this commences as early on in the LOM as possible. Rehabilitation efforts should be undertaken in conjunction with park staff. Old exploration trenches and old drill sites located within Bannerman's EPL should be rehabilitated. Once exploration activities have been completed in a section of the EPL, the tracks should be restored. Rescue and relocation of various species of protected plants should be considered, in collaboration with NBRI. A restoration fund that is part of the overall rehabilitation fund should be established to fund restoration research, implementation and monitoring at Etango.
Poaching and illegal collection of plants and animals	Improved access to the area along roads and infrastructure servitudes.	Collection of firewood should be prohibited anywhere in the EPL during any phase of the project. Ensure tight control of movements and activities on and around site. Maintain vigilance for suspicious night activities or shots along access roads and surrounding tracks. Work with MET to strengthen law-enforcement activities through the Honorary Warden system. Discipline transgressors in accordance with the law and company policy.

Key issue	Activity	Mitigation measures
Degradation in plant and biological soil-crust productivity	Dust fallout from activities such as earth moving, crushing, screening and vehicle movement on gravel roads, and from wind erosion of dumps and stockpiles.	Effective dust-suppression measures must be implemented on site. As far as possible, use dust retardants (e.g. tar, salt roads or dust-a-side-type product) on all access roads. Monitoring of dust levels around site and off site should be done and dust-suppression activities adjusted as necessary in response to the findings.
Habitat degradation by vehicle tracks	Exploration activities opening up of new areas of the mine lease.	Ensure that new tracks are laid out so as to minimise damage to plants and desert pavement. Tracks must be clearly demarcated and, if necessary, turning circles provided. On the Etango site and the greater EPL, track discipline should be strictly enforced. All tracks to be rehabilitated as soon as they are no longer needed. Bannerman already has a rehabilitation procedure in place as part of is exploration programme. This should be applied on the Etango site as well. Monitor rehabilitated sites to establish if ecosystem functioning is being restored over time. If not, adapt a rehabilitation approach to improve effectiveness. Monitor illegal off-road driving by staff and the public in the vicinity of the mine. Actively collaborate with MET to re-establish the Honorary Warden system to strengthen law-enforcement activities in the park.
Pollution from fuels, oils, hazardous chemicals, radioactive substances and litter	Mining and processing activities give rise to environmental pollutants, usually as a result of spills or accidents, storage of hazardous contaminants in open facilities to which animals are attracted, and litter.	Implement a strong anti-litter and clean-surroundings policy. All domestic waste to be disposed of in waste bins that have lids and are stored behind a fence so as to prevent scavenging. All domestic waste bins to have lids so as to reduce the likelihood of windborne litter. Access roads and general environment in proximity to the mine site should be regularly inspected for litter, and cleaned up. Spillage-management procedures need to be developed for all reagents used on site. Managing spillages along the access route must be included in these procedures. Geohydrological expertise should advise on appropriate detection and avoidance mechanisms for contamination of groundwater reserves. Spills to be cleaned immediately and contaminated soils and water to be remediated or treated. Radiation safety procedures to be strictly enforced. All waste to be disposed of in appropriate waste-disposal facilities (e.g. specific facilities designed for hazardous wastes).
Attraction of wildlife to contaminated water sources	Establishment of effluent ponds, e.g. emergency and raffinate ponds.	Fence off all effluent ponds using a fine-wire mesh to ensure that both large and small animals cannot gain access. Mend pipeline leaks and clean up spills immediately. Monitor for bird fatalities and, if necessary, install bird deterrents. Establish leakage-detection systems for all pipelines.

Key issue	Activity	Mitigation measures
Introduction of alien invasive floral species will out-compete indigenous flora and associated invertebrates.	Increased access and traffic in riverbed.	Eradicate alien invasive vegetation within mining area.

11.4 SOCIO-ECONOMY

11.4.1 Legal requirements

The following Acts need to be adhered to:

Regulations relating to the Health and Safety of Employees at Work (promulgated in terms of Section 101 of the Labour Act, No. 6 of 1992 (GN156, GG 1617 of 1 August 1997).

Regulations that establish a comprehensive labour law for all employers and employees (Labour Act, No. 11 of 2007).

The Affirmative Action (Employment) Act, No. 29 of 1998.

11.4.2 Mitigation and management

Key issue	Activity	Mitigation measures
Inward migration	Recruitment policy and practices.	See **Chapter 9.2**. Preferential employment of men and women able to prove residence in Swakopmund, Walvis Bay and Arandis. Skills training to enable men and women with Grade 10 and English proficiency to be eligible for employment. Employees recruited from outside the Erongo Region should be encouraged to bring their partners with them (to reduce the spread of HIV infection due to multiple partners).
Pressure on availability and adequacy of education services, shortage of teachers and classrooms resulting in overcrowding and double shifts	Employment benefits: education.	Negotiate with the MoF to ensure that some mining revenue is directed to specific education services in the Erongo Region. Conduct a survey of employees to monitor levels of inward migration and the need for schooling and housing. Build new classrooms and other essential education infrastructure (see **Chapter 9.2**) for at least the numbers of children brought into the region as a result of the mine. Contribute to the existing teacher and learner education-support programme that promotes the core subjects of Maths, English and Science.
Impact on availability and adequacy of affordable housing, shortage of affordable housing, increase in prices	Employment benefits: housing	Provide housing allowances to enable workers to rent, buy or build adequate housing. Plan to support employees of long-standing to own their house. Resist development of mine-housing blocks.

Key issue	Activity	Mitigation measures
Health	Employment benefits: health	Provide clinic facilities on site, including free VCT for HIV and TB. Establish a comprehensive wellness programme that prioritises a workplace programme for HIV/AIDS and TB, targeting employees, their families and their communities.
Community development	Social responsibility.	Capacitate local SMEs to supply goods and services to Bannerman and its contractors. Support town councils' action plans, e.g. support public-private partnerships that encourage a sense of community and that combat social ills, e.g. construct multi-purpose community centres. Engage with the Ministry of Health and Social Services and private medical facilities to identify options for support to the health services.
Reduction in tourism in Swakopmund due to loss of sense of place in NNNP	Mining in NNNP.	Promote educational and tourism value of mine, e.g. school visits, open days. Work with the tourism industry to identify and promote alternative tourism opportunities in or around Swakopmund and the national park. New signboards explaining how to access the Welwitschia flats by returning to the C28 and taking the next turnoff to the flats. Work with government and other mining companies to look for appropriate offsets. Consider alternative uses for neighbours' tourism facilities.

11.5 ARCHAEOLOGY

Bannerman commits to:

- avoid, as far as it is practicable, the disturbance of known or unknown archaeological/palaeontological sites; and
- ensure that archaeological or historical sites are not destroyed without the necessary permission being granted by the National Monuments Council (NMC) or equivalent.

11.5.1 Legal requirements

The National Heritage Act, No. 27 of 2004 governs the management of heritage sites in Namibia.

11.5.2 Mitigation and management

Key issue	Activity	Mitigation measures
Sites located within the Etango project site		
Disturbance of site QRS 89/1located at minor granite outcrop. They are Low-density surface scatters (<1pc/m^2) with Later Stone Age and Middle Stone Age artefact debris of mainly hydrothermal vein quartz and chert. The archaeological site forms part of an identifiable local distribution or	Open-cast mining – the creation of the open pit will result in a probable threat from inadvertent disturbance due to proximity of development	Apply to the National Heritage Council for a permit to destroy sites lying within the area of mining when the layout of the surface works has been decided.

Key issue	Activity	Mitigation measures
group.		
Disturbance of site QRS 89/2 and QRS 89/3 located at minor granite outcrops. They are Low-density surface scatters (<1pc/m^2) with Later Stone Age and Middle Stone Age artefact debris of mainly hydrothermal vein quartz. The archaeological site forms part of an identifiable local distribution or group.	Open-cast mining – the creation of the open pit will result in a probable threat from inadvertent disturbance due to proximity of development.	Apply to the National Heritage Council for a permit to destroy sites lying within the area of mining when the layout of the surface works has been decided.
Disturbance of site QRS 89/4 located at a minor granite outcrop. It is a Low-density surface scatters (<1pc/m^2) with Later Stone Age and Middle Stone Age artefact debris of mainly hydrothermal vein quartz and chert. The archaeological site forms part of an identifiable local distribution or group.	Open-cast mining – the creation of the open pit will result in total destruction of this site.	Apply to the National Heritage Council for a permit to destroy sites lying within the area of mining.
Sites found on EPL 3345 but outside of the Etango Project site		
Archaeology associated with the southern portion of the EPL 3345. The distribution of archaeological sites on EPL 3345 is relatively sparse but shows strong associations with specific terrain conditions. The late Pleistocene sites on the gypcrete gravel plains south of the Swakop River are generally in primary archaeological context and have been integrated with the surface lag which forms an extensive desert pavement. The sites do not appear to include any locally dense artefact scatters, so their research value is limited.		To reduce the vulnerability of archaeological sites to disturbance or destruction, the site-position data on the accompanying GIS files should be integrated with the project-management system. As far as possible, exploration work should avoid these sites as well as any other archaeological sites that may come to light in the course of exploration. Where exploration work will inevitably encroach on archaeological sites, the client will have to obtain clearance from the National Heritage Council. New finds should similarly be reported to the Heritage Council. Investigate the selection of lithic raw-material sources in the southern section of the EPL.
Archaeology associated with the northern portion of the EPL 3345. Mid- to late Holocene sites on the Namib peneplain north of the Swakop River generally conform to the pattern of seed-digging related occupation documented elsewhere in the surrounding area. The northern sites include one of the two chert sources on EPL 3345 and there are chert artefacts on a number of the seed-digging sites. These can provide a useful opportunity to examine the movement of chert as a high-value raw material between a small number of sources and a larger		To reduce the vulnerability of archaeological sites to disturbance or destruction, the site-position data on the accompanying GIS files should be integrated with the project-management system. As far as possible, exploration work should avoid these sites as well as any other archaeological sites that may come to light in the course of exploration. Where exploration work will inevitably encroach on archaeological sites, the client will have to obtain clearance from the National Heritage Council. New finds should similarly be reported to the Heritage Council.

Key issue	Activity	Mitigation measures
number of base-camp sites in the area.		Phase 2 mitigation work is recommended on site QRS 89/27. This should entail detailed mapping of the site, as well as AMS dating of organic material to determine the age of the site. The mitigation work should be integrated with the larger research programme on the archaeology of seed digging in the Namib and on the sourcing of chert as a lithic raw material.

11.6 VISUAL

11.6.1 Legal requirements

In order to comply with the Visual Resource Management requirements it is necessary to clarify which planning policies govern the property (Etango Project site) to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the visual character and sense of place of the area. The Class I visual resource management class (VRM) that has been assigned to the landscapes in the NNNP is based on various Namibian policies and plans because no single law or plan exists governing visual impacts. The proposed landscape modifications should be viewed in the context of these policies and plans.

Environmental Management Act, No. 7 of 2007

The purpose of the Environmental Management Act is to give effect to Article 95 (l) and 91 (c) of the Namibian Constitution by:

- establishing general principles for the management of the environment and natural resources and promoting the co-ordinated and integrated management of the environment, where environment refers not only to the natural environment – being land, water and air, all organic and inorganic material and all living organisms – but to the human environment – being the landscape and natural, cultural, historical, aesthetic, economic and social heritage and values.

Namibia Minerals Policy (MME)

The Minerals Policy recognises that mining projects are short to medium-term initiatives and that they must not jeopardise the potential for long-term sustainable development in tourism.

Policy for Prospecting and Mining in Protected Areas and National Monuments (MET, MME, National Heritage Commission, 1996)

This policy specifically addresses mining and prospecting activities in environmentally sensitive areas. Many of Namibia's protected areas have considerable mineral potential, and prospecting in protected areas has been taking place for years, often resulting in the loss of key ecological characteristics and tourism potential of these protected areas. In order to reconcile the objectives of mineral exploitation and environmental protection, the policy identifies the need to minimise the negative impacts of prospecting or mining activities on the environment.

National policies and plans

Namibia Vision 2030

Namibia Vision 2030 is a document that lays out a long-term vision for the country and is considered to be one of the most important initiatives undertaken since the drafting of the

Constitution (http://www.npc.gov.na/vision/pdfs/Preface.pdf). In this plan it is recognised that natural environments are disappearing quickly. Consequently, the solitude, silence and natural beauty that many areas in Namibia provide are becoming sought-after commodities and should be regarded as valuable natural assets. Preserving these assets is fundamental to developing our tourism as a sustainable economic sector. Tourism has more potential as a sustainable industry than virtually any other form of economic development in Namibia (pg. 29).

While the importance of mining is also identified in this plan, growth of the mining sector cannot undermine the resources that underpin tourism potential in Namibia.

SEA for the coastal areas of the Erongo and Kunene Regions (MET)

The Namibian coastal Strategic Environmental Assessment (SEA) for the Kunene and Erongo Regions is an initiative of the Namibian Government through MME that seeks to inform political and technical decision-makers at local, regional and national levels on integrated coastal management and has been integral in the formulation of a coastal management white paper. The SEA recognises that a thriving economy cannot be built on a bankrupt environment, and Namibia's biodiversity and unique sense of place should not be diminished by this transition.

Draft MDP for Namib Skeleton Coast National Park

Although the overall NSCNP is not yet proclaimed, the MDP represents the policies and intentions of the MET, the Ministry of Fisheries and Marine Resources (MFMR) and their partners for this area, hence it is relevant when considering mining in the park. The plan stipulates that 'No prospecting and mining activities will take place in Key Biodiversity Areas. All prospecting and mining activities in other areas are planned, managed and decommissioned using best practice, taking into account long term national benefits....so as to minimise negative environmental and socio-economic impacts'.

11.6.2 Mitigation and Management

Key issue	Activity	Mitigation measures
Open-pit mining	The final pit void is expected to be 1 km x 3 km x 400 m. The void will not be visible from the KOPs (viewshed extent = zero) but will be highly visible from the air and might impact on air-based tourism activities.	No mitigation measures available.
Blasting	Plumes of dust and rock created during blasting events can extend up to 250 m into the air, although on average they extend 150 m into the air and can be seen from far away. Depending on atmospheric conditions, dust plumes can remain visible for up to 15-20 minutes (based on Rössing dust study). The viewshed extent is therefore high.	Blasting should take place in the afternoon when the atmospheric haze is more intense. Blasting vibration and dust would affect sense of place. It is recommended that, working in conjunction with the tourist industry and Interested and Affected Parties (IAPs), specific days of the week are identified for blasting. This would allow tourists to experience the area without the visual intrusion of the blasting plume and vibration.

Key issue	Activity	Mitigation measures
Coarse ore stockpile	The maximum height of the coarse ore stockpile is expected be 35 m, with a diameter of approximately 60 m. The size of the stockpile will vary as ore is added (temporary storage) or removed for treatment. The viewshed extent is moderate.	No mitigation measures available.
Heap leach pad and associated machinery	The stacking and removal of ore at the heap leach pad will be undertaken by a very large stacker-reclaimer that will move up and down the heap leach pad on mobile conveyors. The approximate size of the heap leach pad with its machinery is 60 m x 110 m. The heap leach pad will be stacked to a maximum height of 7 m, but the machinery is 25 m tall. The viewshed extent is moderate.	No measures available for heap leach pad. Desert colours for all, including machinery.
Night operations	Light from the process plant and associated infrastructure and from mining vehicles will modify the night landscape significantly. The viewshed extent is therefore high. Reducing point light source is best practice and reduces the industrial effect. However, in all likelihood there will be background glow which is very hard to reduce. Given the current dark sky of the NNNP, as well as the wilderness sense of place, the impact of the glow will still be high.	All lighting is to be kept to a minimum within the requirements of safety and efficiency. Where such lighting is deemed necessary, low-level lighting, shielded to reduce light spillage and pollution, should be used. No external up-lighting of any parts of the structures, including the stacks, should be allowed. Security and perimeter lighting should also be shielded so that no light falls outside the area needing to be lit. Overly tall light poles are to be avoided. No naked light sources are to be directly visible from a distance (except for aircraft-warning lights). Only reflected light should be visible from outside the site. All necessary aircraft-warning lights are to be installed as per the government requirements.
Creation of wind-blown dust from loading and hauling, screening and crushing, driving on gravel roads, and from fugitive dust	Dust generated from mining and processing activities has the potential to reduce visibility and diminish tourist's visual experience of the landscape	Dust suppression methods implemented.
Processing plant and associated infrastructure such as offices and workshops	The process plant and its associated infrastructure will occupy a footprint of approximately 114 800 m^2. The viewshed extent of this landscape modification is expected to be high, as is the impact on the wilderness sense of place.	No additional mitigation measures to those implemented in the construction phase are needed, i.e. natural desert colours associated with the surrounding natural landscape should be utilised for all structures. Visual intrusion of taller structures into the natural desertscape creates high levels of contrast. The height of any structure associated with the processing plant should not exceed 30 m.

Key issue	Activity	Mitigation measures
		Large machinery needs to be painted a grey-brown desert colour to help reduce the degree of contrast generated. Within safety limits, lights at night need to be strictly controlled and lighting should be directed downward and the point source shielded.
Heap leach residue facility (HLRF) and its machinery	The HLRF is expected to be about 25 m in height. With the mobile conveyor on top it will have a maximum height of 50 m, one of the highest structures on the mine site.	Large machinery needs to be painted a grey-brown desert colour to help reduce the degree of contrast generated.
Run of mine (ROM) pad	The ROM pad will be constructed with waste rock and will occupy an area of approximately 21 000 m^2. Ore stockpiles and the primary crusher will be placed on top of the ROM pad. The final height of the ROM pad with infrastructure on top is expected to be 40 m. The viewshed extent of this facility is moderate.	No mitigation available.
Waste rock dumps (WRD) – east and west	Two WRDs will be constructed, one to the east of the open pit and the other to the west. The final height of the WRDs is expected to be 70 m. Each dump will cover an area of 554Ha. The linear outline, as well as the colour elements of the WRDs create high levels of contrast, and the size and scale generate a very large viewshed extent.	The shape of the WRDs needs to be rounded so as to reduce the level of contrast generated by the corners and straight lines created by the sides of the WRD. The rounding of the shapes would need to be progressively undertaken during the operation phase, as to reshape after the LOM would be too costly. It is also recommended that dumping should take place from east to west, and a screening wall constructed from each level to restrict visibility of dumping machinery located on top of the dump as seen from the D1914. The strong diagonal lines created by the sides of the WRD or heap leach residue facility generate high levels of contrast. It is recommended that the angle of the WRD and heap leach residue facility be approximately 22°. Dust generation needs to be strictly implemented. It is recommended that during the LOM, no part or activity associated with the WRD should be visible from the moon landscape. A monitoring programme needs to be set up as part of the ESMP to implement this recommendation. Within the parameters of safety, lights at night need to be strictly controlled during the operation phase. Partial backfill into the pit where feasible and once sterilisation drilling has been confirmed.
Additional infrastructure such as main access gate, mine service road, pipelines and power lines, main HV switchyard,	The maximum height of the additional infrastructure will be 20 m. The viewshed extent will be moderate as collectively these buildings and servitudes will create an industrial landscape	The section of the D1991 after the turnoff to Goanikontes should be removed to stop interested persons, without using the visual intrusion of a gate. This area should be naturally landscaped to appear that the road only goes to Goanikontes. The other section of the D1991 which is

Key issue	Activity	Mitigation measures
explosives store, etc.	which conflicts with the wilderness sense of place and the visual landscape of a national park.	accessed via the D1914 is also an important tourist route as it leads to the old WW1 tank track, etc. A recognised end to the road needs to be created with a turning circle. The circle needs to be created away from any mine fence and the remaining unused road between the proposed turning circle and the mine security area should be removed and landscaped to natural forms.

11.7 NOISE

Localised noise is generally a safety and health issue and is managed as such (see health and safety management plan). **Remote noise** is noise that is heard some distance from its source of origin and is usually the product of numerous noise sources. Often one source (e.g. a machine) does not generate sufficient noise to create an impact, but the cumulative effect of numerous sources may be sufficient to create a local and remote impact. Although the mine lease is situated in a remote part of Namibia, it is located in close proximity to the Swakop farmers and to a popular tourist view point for the moon landscape.

11.7.1 Legal requirements

Although legislation covering the health and safety aspects of noise exists, no environmental noise regulations have yet been published in Namibia. Therefore, the noise standards and guidelines of other countries and institutions will have to be applied.

In South Africa, the document that addresses the issues concerning environmental noise is SANS 10103:2008. It has recently been thoroughly revised and brought in line with the guidelines of the World Health Organisation (WHO). The standard provides:

- The maximum average ambient noise levels during the day and night to which different types of districts may be exposed. For rural residential areas these limits are:
  - Day (06:00 to 22:00): 45 dBA
  - Night (22:00 to 06:00): 35 dBA
- The expected community reactions to increases in general ambient noise levels, where:
  - An increase of 0 dBA or less will not cause any response from a community.
  - An increase of between 0 dBA and 10 dBA will elicit 'little' community response with 'sporadic complaints'. However, between 5 dBA and 15 dBA the strength of the response will gradually change to 'medium' with 'widespread complaints'. For a person with average hearing acuity, an increase of less than 3 dBA in the general ambient noise level will not be noticeable. The contour describing an increase of 3 dBA is, therefore, a very useful significance indicator.
  - Between 5 dBA and 15 dBA an increase will elicit a 'medium' community response with 'widespread complaints'. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an increase of more than 15 dBA, the community reaction will be 'strong' with 'threats of community action'.
  - For an increase of between 10 dBA and 20 dBA, the community response will gradually increase in strength to 'strong' with 'threats of community action'.
- Detailed procedures for the measurement of noise levels.

SANS 10103:2008 does not address conservation wilderness areas. Nevertheless, it is recommended that this standard be applied, as adherence to these thresholds will see Bannerman operating within the limits of international best practice.

11.7.2 Mitigation and management

Key issue	Activity	Mitigation measures
Disturbance caused by noise	Operation of diesel-powered equipment.	Use of quality new equipment with low noise-emission levels. Regular maintenance, including silencer systems.
	Primary, secondary and tertiary crushing.	Where possible, enclosure of noisy equipment and processes.
	Operation of processing plant.	
	Operation of conveyor.	
	Transport operation	Planning of transport routes and erection of noise screens where necessary/possible.
Increase in noise levels	Operation of diesel-powered equipment.	Use of quality new equipment with low noise-emission levels. Regular maintenance, including silencer systems.
	Primary, secondary and tertiary crushing.	Where possible, enclosure of noisy equipment and processes.
	Operation of processing plant.	
	Operation of conveyor.	
	Transport operation	Planning of transport routes and erection of noise screens where necessary/possible.
Noisy single events	Blasting.	Inform tourist operators and neighbours of blasting times.
	Reverse hooters.	Use strobe lights during the night.
	'Bucket slams' and similar events.	Train operators to prevent events.
Audibility – sense of place	Operation of diesel-powered equipment.	Nothing can be done to prevent audibility.
	Primary, secondary and tertiary crushing.	Where possible, enclosure of noisy equipment and processes.
	Operation of processing plant.	
	Operation of conveyor.	
	Blasting.	Nothing can be done to prevent audibility. Inform tourist operators and neighbours of blasting times.
	Reverse hooters.	Use strobe lights during the night.
	'Bucket slams'.	Train operators to prevent events.
	Transport operation.	Avoid transport by road. Investigate transport by rail.

11.8 SENSE OF PLACE

11.8.1 Legal requirements

No legislation pertaining to sense of place exists in Namibia.

11.8.2 Mitigation and management

Key issue	Activity	Mitigation measures
Loss of sense of place due to noise impacts	Operation activities, e.g. increased traffic from transport vehicles and starting of mining.	Noise from reverse hooters - use strobe lights during the night. Train operators to prevent slamming the bucket when loading ore. Inform tourist operators and neighbours of blasting times.

Key issue	Activity	Mitigation measures
Loss of sense of place due to archaeology impacts	Operation and mining including further exploration.	Induct exploration geologists so that they can recognise and avoid damage to archaeology sites. Wherever possible, demarcate (and if necessary fence off) sites to prevent inadvertent damage.

11.9 OVERALL MANAGEMENT ASPECTS DURING OPERATION

11.9.1 Remote environments

The mine will have an impact on environments well beyond the mine lease boundary and include the roads leading to and from the mine, the towns of Swakopmund and Walvis Bay, and the places where reagents and electricity are mined and processed. The issues that affect remote environments include:

- consumption of goods such as electricity, diesel, reagents and manufactured materials which causes pollution of remote environments;
- spillages on access roads/railway lines/in the ocean during the transport of goods such as diesel and reagents to site;
- pollution of Swakopmund and Walvis Bay from mining-related wastes and spills; and
- degradation of the Namib Naukluft National Park from mining-related activities and accidents.

Legal requirements

No Namibian legislation exists regarding the use of **electricity or diesel**. NamPower operates the local sub-stations under the Electricity Act, No. 2 of 2000 and Regulations of 2001. Namibia is a signatory to the UNFCCC (Climate Change Convention). Namibia is obliged to put programmes in place to meet the objectives of the convention. Industry will need to align itself with these objectives.

There is no legislation pertaining specifically to the **consumption of manufactured materials** except for those that refer to the transport, storage, safe use and disposal of hazardous materials such as the Hazardous Substances Ordinance, No. 14 of 1974.

The mining of **sand and gravel** is not controlled by the Minerals (Prospecting and Mining) Act, No. 13 of 1992. Opening of borrow pits is usually controlled by municipal by-laws. In the NNNP, the opening of borrow pits outside of the Etango ML will need to be negotiated with MET.

11.9.2 Mitigation and management

Key issue	Activity	Mitigation measures
Electricity		
Consumption of electricity	All mining and processing activities that require electricity.	Minimise electricity consumption by using clean renewable energy wherever feasible.
Hydrocarbons (diesel and petrol)		
Transportation of fuel	Transportation contractors transporting fuel to site.	Conduct routine inspections of the contracted fuel-supply company to ensure compliance with legal and Bannerman's requirements.
Fuel consumption	All mining and processing activities that use diesel or petrol.	Identify ways to minimise fuel consumption. Monitor fuel consumption during the construction and operation phases.

Key issue	Activity	Mitigation measures
Fuel spillages	Transportation contractors transporting fuel to site.	Develop and implement maintenance plan for all fuel-storage equipment on site. Inspect contracted fuel-delivery company's equipment to ensure that it is up to standard for the delivery and dispensing of fuel. Ensure that the contractor has all the necessary hazardous protection equipment for people and the environment in the advent of a spill. Develop a spill management procedure, including the clean up of hydro-carbon spills. Purchase and place spill kits at all areas where fuel is dispensed and stored and train staff to use them. Verify fuel-transport company's spill containment (emergency clean-up) plan and spill clean-up agreement with sub-contractor.
Safe disposal and rehabilitation of hydrocarbon contaminated soils and water	All vehicles and equipment or facilities from which fuel pollution can occur.	Develop and implement a hydrocarbon remediation procedure that explains how to deal with the treatment of contaminated environments (soil and water).
Monitoring of hydrocarbon spills		Ensure that checking for hydrocarbon spills is included in the daily inspections. Report spillages as per the incident management procedure.
Water – see **Chapter 9** and **10: Hydrology**		
Consumption of sand and gravel during the construction phase		
Consumption of sand and gravel from borrow pits located off site	Construction activities.	Ensure that Bannerman undertakes an ESIA for all proposed borrow-pit sites. Ensure that all borrow-pit sites are managed in accordance with Bannerman's standards. Ensure all borrow pits are rehabilitated once Bannerman has finished using them.
Manufactured goods (reagents, equipment, etc.)		
Transport of hazardous materials	Transportation contractors transporting goods to site.	Conduct routine inspections of the supply companies transporting hazardous materials to and from site to ensure compliance with legal and Bannerman requirements and ensure that the contractor has all the necessary hazardous-protection equipment for people and the environment in the advent of a spill.
Handling and storage of hazardous materials	Transportation contractors.	Review contractor offloading procedure and monitor compliance with this procedure, legal and Bannerman requirements. Develop a procedure for the approval, receipt, review, handling, storage and use of hazardous materials on site.
Spillage of reagents and other chemicals	Walvis Bay harbour, access roads/rail to site, mine site.	Report spillages and clean them up immediately.
Pollution of Walvis Bay and Swakopmund		
Disposal of solid domestic waste at the Swakopmund or Walvis Bay landfill	Mining and processing activities.	Ensure that domestic waste is only deposited at properly managed land-fill sites. If the municipal landfill sites do not meet Bannerman's disposal standards, then work with the municipality to improve compliance, or investigate establishing a domestic-waste dump on site.

Key issue	Activity	Mitigation measures
Disposal of solid and liquid hazardous waste (excluding radioactive waste) at the Walvis Bay hazardous waste disposal site	Mining and processing activities.	Ensure that all hazardous waste (excluding radioactive waste) is disposed of at the Walvis Bay hazardous waste disposal site and that receipts are kept as records. Ensure that no radioactive waste leaves the mine site. All radioactive waste must be safely disposed of on the mine site.
Degradation of the Namib Naukluft National Park		
Cumulative impact on regional biodiversity	Mining and processing activities.	Liaise with the Chamber of Mines regarding the impact of uranium mining on biodiversity at a regional scale. Engage with MET regarding mining in protected areas and regarding other impacts that might be exacerbated by more people living in the area and impacting on the park.
Offsetting residual biodiversity impacts	Mining and processing activities.	If necessary, undertake a systematic assessment of potential offsets and determine and identify appropriate options for Bannerman.
Stakeholder and shareholder confidence	Mining and processing activities.	Involve stakeholders during all phases of biodiversity planning (namely planning, implementation, monitoring and review).

11.9.3 Emissions to land – pollutants (solid and liquid) that contaminate the soil

Hazardous wastes include products such as fuels, chemicals, lubricating oils, hydraulic and brake fluid, paints, solvents, acids, detergents, resins, solids from sewerage and sludge. Many of these substances require special collection and handling. There is a hazardous disposal site at Walvis Bay (the designation is based on the South African system) and non-radioactive hazardous waste will be disposed of at this facility or at other appropriate facilities (e.g. sludge will be taken to the municipal sewage works). A contracted waste-removal company will transport the waste from the mine to the designated hazardous disposal facility.

Non hazardous waste is domestic waste (food and office waste) and industrial waste (wood, containers and bags) that is non-radioactive. Non-radioactive non-hazardous waste will be disposed of either at the Swakopmund or Walvis Bay landfill site by a contracted waste-removal company.

All waste that has become radioactive will not be taken off site. The final disposal during operation has yet to be established.

Legal requirements

The Minerals (Prospecting and Mining) Act, No. 33 of 1992 for Namibia requires details regarding pollution control and waste management but refers specifically to **mineralised waste** (dumps and tailings).

Non-mineralised waste includes hazardous and non-hazardous waste, which may be disposed of to land or to water.

With respect to hazardous waste the following applies:

- The Labour Act, No. 6 of 1992 specifies that hazardous waste must be disposed of without risk to the health of any person or to the environment.

- The Hazardous Substances Ordinance, No. 14 of 1974 refers to the transport, storage, safe use and disposal of hazardous materials.
- The Public Health Act, No. 36 of 1919 states that no person may allow the existence of a nuisance or other condition liable to be injurious or dangerous to health on any land owned or occupied by them, including pollution from refuse.
- The Minerals (Prospecting and Mining) Act, No. 33 of 1992 regulates pollution control and waste management within mining-licence areas.
- The Water Act, No. 54 of 1956 governs the use and disposal of water. The Ministry of Agriculture, Water and Forestry (MAWF) issues permits for effluent disposal for the plant (industrial) and sewage-treatment plant (domestic).
- Namibia is a signatory to the Basel Convention which deals with the trans-boundary movement of hazardous material.

11.9.4 Spillage management

Spillages may arise as part of normal day-to-day operations. The nature, source and reasons for a spill are many, but regardless of the size or toxicity of the substance(s) involved, all spills must be managed. **On-site spills** may arise from the process plant, in the form of reagents, slurry or industrial effluent, from mining in the form of hydrocarbon spills, and from the offices and sewage plant in the form of domestic effluent and littering (solid spills).

Reagents and diesel will be transported to the mine by road, so the potential for **off-site spills** exists. In addition, non-hazardous and hazardous waste is transported off site to the appropriate landfill for disposal, as well as final product to the container terminal at the port of Walvis Bay. If this material is not properly transported, the potential for littering (solid spills) exists. **Chapter 9.2** outlines how spillages will be managed at Bannerman.

Legal requirements

The Petroleum Products and Energy Act, No. 13 of 1990 and Petroleum Products Regulations 2000 control the use and disposal of petroleum-related products. Companies transporting, storing or dispensing fuels require a licence. Spills in excess of 200 l must be reported to the Minister of Mines and Energy.

The Minerals (Prospecting and Mining) Act, No. 33 of 1992 stipulates that the ML holder is liable for spilling, pollution, loss or damage. The ML holder must (a) report spilling, pollution, loss or damage; and (b) take steps, at own expense, to remediate.

Key issue	Activity	Mitigation measures
Hydrocarbons (diesel and petrol)		
Handling and storage of fuel	Fuel-transporting companies, fuel farm contractor.	**Mitigate**: Review contractor offloading procedure. Conduct routine inspections of the fuel farm to ensure compliance with legal and Bannerman requirements.

12 ENVIRONMENTAL MANAGEMENT PLAN FOR DECOMMISSIONING AND POST CLOSURE

Bannerman is committed to producing a mine closure plan (MCP) (which will include a restoration plan) and to establishing a financial provision (eg bonding or trusts) for rehabilitation and mine closure. Mine-closure planning will address the removal of infrastructure, the restoration of the environment and provision for social closure. Bannerman will work closely with its stakeholders to develop a suitable MCP. A draft mine closure framework is provided in **Appendix 5**.

Restoration work will commence during the operational phase and will be conducted on a continuous basis throughout the mine's life. This will provide an opportunity to test and improve restoration techniques. It will also ensure that the area of disturbed land at mine closure and the associated restoration costs are reduced.

The MCP should lay the groundwork for the mine to engage with local, regional and national stakeholders to plan for the future socio-economic and environmental consequences of mine closure. Continued stakeholder involvement which focuses on the long-term future of the mining area is strongly recommended throughout the LOM.

Mine-closure actions should occur in five broad phases, being:

- the design phase of the mine;
- during full mining operations;
- once closure seems highly likely;
- during decommissioning and closure; and finally
- once the mine has closed down.

The plan should make recommendations regarding how to safeguard future public health, safety, resources, land-use options and the environment to minimise adverse socio-economic and environmental impacts of mine closure.

Closure planning is a dynamic process as changes may occur in legislation, mining operations, rehabilitation technologies, research procedures and costs. The process itself needs to be part of the planning agenda of mine management as well as of other stakeholders.

12.1 Legal requirements

The following legislation makes reference to mine closure:

- Minerals Policy of Namibia, 2002
- Namibia's Environmental Assessment Policy for Sustainable Development and Environmental Conservation, 1994
- General Environmental Assessment Guidelines for Mining (Onshore and Off-shore) Sector of Namibia, 2000
- Policy for the Conservation of Biotic Diversity and Habitat Protection, 1994
- The Minerals (Prospecting and Mining) Act, No. 33 of 1992
- The Environmental Management Act, No. 7 of 2007
- Water Act, No. 54 of 1956
- The Atmospheric Pollution Prevention Ordinance, No. 11 of 1976

- Labour Act, No. 11 of 2007, Labour Act, No. 6 of 1992 : Regulations relating to the Health and Safety of employees at work.

12.2 Mitigation and management

Key issue	Activity	Mitigation measures
Surface water		
Surface water flow is restricted due to establishment of mine infrastructure and cannot flow downstream	All mining and processing infrastructure such as buildings and dumps.	Establish storm water diversion berms around the mine so that clean storm water falling outside of the mine is allowed to flow unimpeded downstream. The design should be such that all of the flow is not diverted into a couple of channels as this will make the energy of the surface flow too high and will result in localised erosion. The surface water should be allowed to flow as naturally as possible down the remaining washes.
Storm water floods the mine pit	After mine closure, the pit remains an open hole and exceptional high rainfall could lead to partial flooding.	Protection bunds should remain in place. A surface catchment/rain fall/runoff model should be conducted in order to quantify possible volumes and to plan mitigation measures accordingly.
Storm water falling on site becomes contaminated and has the potential to pollute areas downstream/off site	All infrastructure associated with the mine and plant, in particular those housing hazardous materials, wastes or effluents.	Ensure that all storm water flowing on site is diverted to pollution-control ponds where it is treated before being discharged. If Bannerman intends to discharge treated storm water, a discharge permit will be required.
Geohydrology		
Surface runoff from the HLRF infiltrates into shallow alluvium and deeper groundwater	The leap leach residue facility (HLRF) will remain beyond mine closure, being subject to wind and water erosion. Long-term mobilisation of uranium and seepage into groundwater is a possible threat.	The HLRF should be capped and properly shaped to minimise erosion and surface runoff. The surface water/rainfall capture system should be functional beyond mine closure.

Key issue	Activity	Mitigation measures
Contaminated seepage from the HLRF infiltrates into shallow alluvium and the regional basement aquifer	The seepage from the HLRF is expected to be less contaminated than the heap leach seepage because the bulk of the uranium is leached and the residual is washed prior to deposition on the HLRF. However, sulphuric acid concentrations are still elevated, resulting in low pH and high solubility of metals, including uranium. The seepage could infiltrate and contaminate the groundwater.	Monitoring must continue post closure for a period of time specified in the mine closure plan. The construction of cut-off trenches and/or recovery wells must be carried out in the case seepage has infiltrated into the alluvial sediments or basement rocks. An aftercare plan and fund should be in place to deal with seepage should it occur post closure.
Seepage pollution sources reach the Swakop River through surface runoff or groundwater flow	As stockpiles and HLRF would remain permanently, there is a potential of polluting the Swakop River alluvium through groundwater flow towards the Swakop River along deep-reaching faults. The water level in the mine lease area is higher than in the Swakop River and groundwater flow is directed towards the river in the area between the mine pit and the Swakop River.	Monitoring must continue post closure for a period of time specified in the mine closure plan. Cut-off trenches and/or recovery wells must be constructed to prevent any seepage infiltrating the alluvial sediments or basement rocks. An aftercare plan and fund should be in place to deal with seepage should it occur post closure.

Key issue	Activity	Mitigation measures
Groundwater sink caused by mine pit	The mine pit will not be fully backfilled and will remain permanently open, resulting in a long-term groundwater sink. Due to low inflow rates and high potential evaporation it is expected that groundwater that seeps into the pit will evaporate rather than fill up the mine pit. The Anomaly A mine pit is 3 km away from the Swakop River but the Oshiveli and Onkelo prospects are closer, and the situation must again be assessed in a separate ESIA if the mine pit is extended to these areas.	If at mine closure there is seepage into the mine pit, then an investigation will need to be carried out to ascertain from where it is coming and how best to manage it. One possible mitigation measure might be to shape the pit floor so that seepage is captured in a number of holding areas for evaporation. Monitoring wells should be maintained after mine decommissioning.
Air quality		
Dust generation		Experience from other projects shows that most of the dust generating activities are no longer in place once operation has ceased. One could apply the same rating as during the construction phase for the duration of the commissioning.
Biodiversity		
Habitat loss	Disturbance footprint created by mine decommissioning, including mine works areas, roads.	**Restoration**: Restore the disturbance footprint to the pre-defined end land use (if any) and in accordance with the restoration plan. Monitor effectiveness of restoration efforts and modify approaches, where applicable.
	Disturbance to fauna.	At mine closure, ensure that the final land use (if any) is returned as close as possible to its pre-mining state, which is relatively pristine desert without barriers to hamper movement of animals.
Poaching and illegal collection of plants and animals	Decommissioning contractors.	Security must be vigilant, with monitoring for poaching and illegal collection of plants and animals during decommissioning. Collection of firewood should be prohibited anywhere in the EPL during any phase of the project. Ensure tight control of movements and activities on and around site.
Degradation in plant and biological soil-crust productivity		Dust levels around site and off site should be monitored, and dust suppression activities adjusted as necessary in response to the findings.

Key issue	Activity	Mitigation measures
Habitat degradation by vehicle tracks		All tracks to be rehabilitated as soon as they are no longer needed. Bannerman already has a rehabilitation procedure in place as part of is exploration programme. This should be applied on the Etango site as well. **Monitor**: Monitor rehabilitated sites to establish if ecosystem functioning is being restored over time. If not, adapt rehabilitation approach to improve effectiveness. Monitor illegal off-road driving by staff and the public in the vicinity of the mine. Actively collaborate with MET to re-establish the Honorary Warden system to strengthen law-enforcement activities in the park.
Pollution from fuels, oils, hazardous chemicals, radioactive substances and litter	Decommissioning activities give rise to environmental pollutants, usually as a result of spills or accidents, storage of hazardous contaminants in open facilities to which animals are attracted, and litter.	Implement a strong anti-litter and clean-surroundings policy. All domestic waste to be disposed of in waste bins that have lids and are stored behind a fence so as to prevent scavenging. All domestic waste bins to have lids so as to reduce the likelihood of windborne litter. Litter to be regularly cleaned up from site, access roads and general environment in proximity to the mine. Spillage-management procedures need to be developed for all reagents used on site. Managing spillages along the access route must be included in these procedures. Spills to be cleaned up immediately and contaminated soils and water to be remediated or treated. Radiation-safety procedures to be strictly enforced. All waste to be disposed of in appropriate waste-disposal facilities (e.g. specific facilities designed for hazardous wastes).
Socio-economy		
Decline in economic development at mine closure and afterwards	Loss of jobs and opportunities. Reduced business turnover of suppliers and service industries.	Develop a mine closure plan during the design phase, in a participatory process involving key stakeholders. Communicate the closure plan to stakeholders as early as possible.
	Loss of employment. Repossession of homes and belongings. Increase in social ills. Dying towns.	Mitigation measures as suggestions for closure plan: Ensure that skills upgrading during employment at mine are documented and accredited where possible so skills are recognised with future employers. Encourage town councils to diversify their economic activities. Fund skills training for alternative economic development opportunities, if appropriate.
Visual		
Eyesores	Processing plant and associated structures/machinery.	Removal of all the structures and machinery and the shaping of some of the higher contrast-generating features to create more rounded and flatter shapes more commonly associated with the desert landscape.

Key issue	Activity	Mitigation measures
Open-pit mining	The final pit void is expected to be 1 km x 3 km x 400 m. The void will not be visible from the KOPs (viewshed extent = zero) but will be highly visible from the air and might impact on air-based tourism activities.	Consider building a berm around the pit to screen it from public view and for security reasons.
Coarse ore stockpile	The maximum height of the coarse ore stockpile is expected be 35 m, with a diameter of approximately 60 m. The size of the stockpile will vary as ore is added (temporary storage) or removed for treatment. The viewshed extent is moderate.	Remove the coarse ore stockpile by transferring any remaining ore to the pit. Landscape and restore the disturbed area.
The heap leach pad and associated machinery	The stacking and removal of ore at the heap leach pad will be undertaken by a very large stacker-reclaimer that will move up and down the heap leach pad on mobile conveyors. The approximate size of the heap leach pad with its machinery is 60 m x 110 m. The heap leach pad will be stacked to a maximum height of 7 m but the machinery is 25 m tall. The viewshed extent is moderate.	The heap leach pad should be removed. The footprint area should be landscaped to blend in with the surrounding topography, and restored.
Night operations	Light from the process plant and associated infrastructure and from mining vehicles will modify the night landscape significantly. The viewshed extent is therefore high.	During decommissioning, operations should not take place during the night. All lighting needs to be removed.

Key issue	Activity	Mitigation measures
Creation of wind-blown dust from loading and hauling, screening and crushing, driving on gravel roads and from fugitive dust	Dust generated from decommissioning activities has the potential to reduce visibility and diminish tourists' visual experience of the landscape.	No mitigation possible.
Processing plant and associated infrastructure, such as offices and workshops	The process plant and its associated infrastructure will occupy a footprint of approximately 114º800 m^2. The viewshed extent of this landscape modification is expected to be high, as is the impact on the wilderness sense of place.	Removal of all machinery and structures and natural shaping of transformed landscape, followed by restoration. All smaller borrow pits or dumps on site must be 'cleaned up' and the damaged areas landscaped and restored. The ground where processing plants were located should be decontaminated and then covered by the earth used for the berm and landscaped into a natural form in alignment with the natural hydrological patterns. It is vital that a properly managed and externally controlled trust fund (or other financial provision such as bonding) is set up during the operational phase to ensure that sufficient funds are available to implement the rehabilitation and mitigations required for closure.
Heap leach residue facility (HLRF)	The HLRF with the mobile conveyor on top will have a maximum height of 50 m – one of the highest structures on the mine site. Without the mobile conveyor on top, the HLRF will reach a maximum height of 25 m.	Removal of all machinery and structures and natural shaping of transformed landscape, followed by restoration. The steep side walls of the heap leach residue facility need to be flattened out and shaped according to the landscaping plan defined at closure. It is recommended that the angle of the WRD and heap leach residue facility be approximately 22°. The heap leach residue facility should be covered with a layer of rock to retard wind erosion.
Run of mine (ROM) pad	The ROM pad will be constructed with waste rock and will occupy an area of approximately 21 000 m^2. Ore stockpiles and the primary crusher will be placed on top of the ROM pad. The final height of the ROM pad with infrastructure on top is expected to be 40 m. The viewshed extent of this facility is moderate.	Removal of all machinery and structures. Reshape the ROM pad so that it blends in with the surrounding topography, and restore.
Waste rock dumps (WRD) – east and west	Two WRDs will be constructed, one to the east of the open pit and the other to the west. The final height of the WRDs is expected to be 70 m. Both dumps will cover a combined area of 880 Ha. The linear outline and	Consider partial backfilling of the pit with waste rock if feasible and once sterilisation drilling has been confirmed. The edges created by the crest of the waste rock dumps will need to be shaped into a more rounded form so that they fit in better with the landscape. It is recommended that the angle of the WRD and heap leach residue facility be approximately 22°. A suitably qualified visual practitioner needs to be incorporated into a monitoring programme to assist in the definition of the closure plan and to ensure that the recommendations are adequately implemented and that

Key issue	Activity	Mitigation measures
	the colour elements of the WRDs create high levels of contrast and the size and scale generate a very large viewshed extent.	landscaping and rehabilitation mitigations have been fulfilled. All components of the infrastructure used during operation must be removed. The site must be visually 'cleaned up' so as to portray an uncluttered landscape.
Additional infrastructure such as main access gate, mine service road, pipelines and power lines, main HV switchyard, explosives store, etc.	The maximum height of the additional infrastructure will be 20 m. The viewshed extent will be moderate as collectively these buildings and servitudes will create an industrial landscape which conflicts with the wilderness sense of place and the visual landscape of a national park.	It is vital that adequate measures are undertaken to ensure that sufficient funds are available for proper closure. All components of the infrastructure and access road not utilised during post closure must be removed and shaped to natural forms. All water reservoirs and pipelines need to be removed and the resultant earth modifications shaped to natural forms.
Noise		
Disturbance caused by noise	Operation of diesel-powered equipment.	Use of quality new equipment with low noise-emission levels. Regular maintenance, including silencer systems.
	Transport.	No additional mitigation measures required.
Increase in noise levels	Operation of diesel-powered equipment.	Use of quality new equipment with low noise-emission levels. Regular maintenance, including silencer systems.
	Transport.	No additional mitigation measures required.
Noisy single events	Reverse hooters.	No mitigation as there will be no activity at night during mine closure.
	'Bucket slams' and similar events.	Train operators to prevent events.
Audibility – sense of place	Operation of diesel-powered equipment.	Nothing can be done to prevent audibility.
	Reverse hooters.	No mitigation as there will be no activity at night during mine closure.
	'Bucket slams'.	Train operators to prevent events.
	Transport.	Use rail instead of road transport.

13 INSPECTING, AUDITING AND REPORTING ON COMPLIANCE

Inspections to gauge compliance with the management plan and procedures will be conducted regularly. Auditing of the Environmental Management System (EMS), legal requirements and the management programmes will be conducted by both internal and external audit teams to ensure that Bannerman is meeting its commitments and striving for continuous improvement.

14 NEW PROJECTS/ADDITIONS/TECHNOLOGY OR PROCESS CHANGES

When new projects, expansions or changes to process are envisaged, Bannerman will, if necessary, commission environmental assessments and append the original ESIA. Changes occurring within the original scope of the original EAR will result in a review and update of the ESMP only. If changes are beyond the scope of the original EAR, an ESIA will be commissioned and the new ESIA appended to the original ESIA. The ESMP will then also be updated.

In early December 2009 Bannerman announced the completion of its Final PFS. The results of the Final PFS are detailed in **Chapter 4.11** of the ESIA report (Volume I). In summary, the key differences between the Draft Interim PFS and the Final PFS are:

(a) The Draft Interim PFS is based on the February 2009 mineral resource estimate whereas the Final PFS is based on the July 2009 mineral resource estimate.

(b) The Draft Interim PFS considered a mine design which incorporated only the Anomaly A ore body whereas the Final PFS proposes a mine design which incorporates the Anomaly A, Oshiveli and Onkelo ore bodies;

(c) The Final PFS considers two different processing options:

  (i) The heap leach processing option (which is the option considered by the Draft Interim PFS and hence this ESIA and ESMP); and

  (ii) tank-based leaching of a high-grade flotation concentrate.

Bannerman is conducting further test work in respect of the two processing options, and intends to engage a tailings containment specialist to conduct a Tailings Storage Facility Study. Bannerman expects to make a decision on the preferred option in the first quarter of 2010.

In mid 2010 Bannerman will provide an ESIA Revision 1 for public consultation and lodgement with the MET. The ESIA Revision 1 will assess the impacts of the Final PFS, including the extended pit design and the selected processing option. See [**Chapter x**] of the ESIA report (Volume I) for a discussion of the approach Bannerman has taken and further information on the ESIA Revision 1.

Appendix 1

Extract from Regulations Relating to Nature Conservation (No. 240)

OFFICIAL GAZETTE

EXTRAORDINARY

OF SOUTH WEST AFRICA

WINDHOEK Wednesday 25 August 1976 No. 3556 (amended as at 23 October 1997)

CONTENTS

Government Notice

The following Government Notice is published for general information.

No. 240

REGULATIONS RELATING TO NATURE CONSERVATION

The Executive Committee has, under and by virtue of the provisions of section 84 of the Nature Conservation Ordinance, 1975 (Ordinance 4 of 1975) made the following regulations:

DEFINITIONS

1. In these regulations, unless the context otherwise indicates –

" controlled game product" means a controlled game product as defined in Section 1 of the Controlled Game Products Proclamation, 1980 (Proclamation AG 42 of 1980)

"Naukluft Mountain Zebra Park" means the Naukluft Mountain Zebra Park as described in paragraph 8 of the Schedule to Proclamation 19 of 1968;

"professional hunter" means a person who is registered as a professional hunter in terms of these regulations;
"inland waters" means all waters excluding the sea;

"block reservations" means reservations of accommodation for 16 or more persons of 1 year and older or of five or more accommodation units;

"relative" means in connection with the owner or lessee of a farm or land. the parent, child, uncle, aunt, nephew or niece and brother or sister of such owner or lessee;

"boat" means any device which has been designed or is used for sailing in or on water but does not include a raft;

Ai-Ais Hot Springs
Gross Barmen Hot Springs

CHAPTER II
REGULATIONS RELATING TO GAME PARKS
GENERAL REGULATIONS APPLICABLE TO ALL GAME PARKS

9. Without the written approval of the Executive Committee no person except an officer of the Nature Conservation and Tourism Division of the Administration, acting directly in the execution of his duties or in the exercising of his powers, shall in a game park -

(a) drive a vehicle at any place other than a road which is indicated by a road sign;

(b) drive a vehicle on a road in respect of which, in any manner whatsoever, it is indicated that it is closed;

(c) drive a vehicle faster than 60 kilometres per hour on any road outside any camping site or rest camp:(., Provided that the provisions of this paragraph shall not be applicable to any proclaimed thoroughfare in the Namib Desert Park or the Skeleton Coast Park;

(d) drive a vehicle faster than 20 kilometres per hour within the terrain of any officially designated camping site or rest camp;

(e) drive or park a vehicle in such a way that it causes inconvenience to any other person;

(f) throw away a burning or smouldering object or put or leave it at a place where it may possibly ignite another object or cause such object to be ignited;

(g) roll or throw a stone from any mountain or height or allow it to be thus rolled or thrown;

(h) relieve himself anywhere except in the sanitary conveniences provided therefor;

(i) make any fire at any place other than at the officially designated fire-places provided for that purpose;

(j) make an exceptionally large fire at the officially designated fire-places;

(k) throw away, put or leave refuse or rubbish at any place other than in the containers provided therefor;

(l) contaminate drinking water in any manner whatsoever;

(m) tamper with any water installation;

(n) wash clothes or any other object in the water of any lagoon, dam, river or any other water-course;

(o) use soap or any other washing agent for any purpose whatsoever in the water of a lagoon, dam, river or any other water-course;

(p) throw stones, rubbish, bottles, tins, refuse., oil or any other offensive or dangerous object material or liquid into the water of a lagoon, dam, river or other water-course or allow it to land therein;

(q) present public entertainment or collect money from the public;

(r) trade or distribute any pamphlet, book, handbill or any other written or printed document;

(s) organise, hold or address any meeting or assembly;

(t) at any time make in the opinion of the officer in charge, unnecessary or undue noise or cause or allow such noise to be made, which may disturb any other person or the game;

(u) do or allow anything which may constitute a nuisance or hindrance to the public;

(v) take an unsealed fire-arm or air gun in; and

(w) draw a caravan at places or on roads where it is prohibited as indicated by notice boards.

10. No person shall, without the permission of the Executive Committee, subject to such conditions as it may deem fit -

(a) take photos or films for commercial purposes in a game park;

(b) make use of blinds or hides in a game park.

11. Any person entering a game park shall, if it is practically possible, report immediately to the nearest officer attached to the management of that game park.

12. Any person who enters a game park shall comply with the Conditions on which leave to enter that game park and reside therein was granted to him and shall obey any legal order given to him by an officer.

13. No person aged 16 years or younger shall be admitted to a game park, unless he is accompanied by an adult who shall be held responsible for him/her.

14. (1) Any person who makes use of or occupies Administration property in a game park shall, to the satisfaction of the officer under whose control such property is, take reasonable and proper care when using or occupying such property and shall leave or return it in the same condition in which he received it.

(2) If any such property is damaged it shall be reported immediately to the officer under whose control it is, and the compensation determined by him shall be paid immediately.

15. No person shall remove anything whatsoever from any accommodation referred to in regulation 14.

16. Tickets or receipts issued as proof of payment for accommodation or camping sites, any service rendered or any article which has been supplied by an officer in a game park shall be retained by the person to whom it was issued until he leaves the game park and shall be produced to an officer on request.

17. No person shall occupy a camping site or accommodation unless such camping site or accommodation has been allocated to him by an officer.

18. Accommodation and camping sites in game parks shall be vacated before 10h00 on the day following the last day for which it was reserved.

19. No person shall give any tip or intoxicating liquor to a camp servant.

20. No person shall leave a defect vehicle or the wreck of a vehicle in a game park for a period of longer than 7 days after the vehicle became defect or was involved in an accident: Provided that the Administration may remove such defect vehicle or wreck after the expiration of such period and recover the cost involved from the owner thereof.

21. No person shall enter that part of a game park where the residence of an officer or employee of the Administration is situated or camp or stay there without the permission of the officer in charge of the nearest rest camp or another officer authorised by him to grant such permission.

22. (1) An officer in a game park who bears the rank of nature conservator or tourist officer or higher rank may order any person who, in his opinion, commits or has committed an offence in that game park or has, in the opinion of such officer, given offence to another person, to leave that game park and such person shall leave that game park immediately thereafter.

(2) Any person who has been ordered in terms of subregulation (1) to leave a game park, may not enter a game park within a period of six months thereafter except under and by virtue of the special authorisation of the Executive Committee which shall only be granted after consideration of a complete report on the order which was given in terms of subregulation (1) and the incident which led to it.

23. (1) Any person entering a game park does so wholly at his own risk.

(2) The Administration shall not be liable for any damage suffered on account of injuries to persons, whether fatal or not, which occurred in any manner whatsoever in a game park.

(3) The Administration shall not be liable for any loss of or damage to property suffered in a game park or caused on account of fire, theft, the neglect or design of any person or through the action of any animal in a game park.

(4) The provisions of subregulations (2) and (3) above do not indemnify the Administration against the negligent or wilful action of officers of the Nature Conservation and Tourism Division in the execution of their duties.

24. For the purposes of the provisions of section 18(2) of the Ordinance, the Namib Desert Park has been declared a prescribed game park and all proclaimed roads therein prescribed routes.

25. (1) No hitch-hiker shall enter a game park.

(2) If a hitch-hiker enters a game park despite the prohibition in subregulation (1) and without the knowledge of the Administration, the person who brings such hitch-hiker into such game park, shall be fully responsible for such hitch-hiker and shall take care that such hitch-hiker is properly accommodated as long as he sojourns in such game park and that such hitch-hiker leaves the game park before or simultaneously with him.

25A (1) No person shall, except in an emergency, land or take off in a game park in any aircraft or helicopter except on a landing field designated by the Secretary for ~~Agriculture and~~ Nature Conservation and subject to such conditions as he may determine.

(2) No person, except an officer or employee acting on the authority of the said Secretary, shall fly over a game park at an altitude of less than 1000 metres, except for the purpose of lawfully landing therein or lawfully taking off therefrom.

SPECIAL REGULATIONS RELATING TO CERTAIN GAME PARKS

A. DAAN VILJOEN GAME PARK

26. (1) Without the written approval of the Executive Committee, no person, except an officer, shall enter the game park at any time between sunset and sunrise: Provided that any person who reserved accommodation in the game park for longer than one night, may enter the game park until 22h00.

(2) Without the written approval of the Executive Committee no person shall -

(a) enter the game park by motor cycle, scooter or power-driven cycle;

(b) within the game park

(c) gather fire wood;

(d) sail with anything on the dams or swim therein;

(e) enter dangerous places where it is prohibited by means of notice boards;

27. Any person without permission to stay overnight in the game park, shall leave the game park before 24h00.

B. NAMIB DESERT PARK

28. Without the written permission of the Executive Committee, no person except an officer acting directly in the execution of his duties or the exercise of his powers shall -

(a) drive a vehicle between 21b00 and 05h00 on any road in the Namib Desert Park which is not a proclaimed thoroughfare;

(b) (i) visit Sandvis or be or stay there at any time between 20h00 and 05h00;

(ii) visit Sandvis overland or in a vehicle which is not four-wheel-driven, or which is not specially equipped for travel in heavy sand or with a carrying capacity of more than 1400 kilogram or go further south with a vehicle than the point indicated by means of notice boards;

(c) gather Firewood in the Namib Desert Park;

(d) throw away or place or get rid of fish, any part of a fish, fish bait, refuse or rubbish at any other place or by any other means than by placing it in the holders or refuse bins provided therefor unless by putting it on a vehicle and removing it from the game park;

(e) break a bottle at any place in the Namib Desert Park or cause or allow It to break and leave the pieces there;

(f) place, leave or throw out books or lines with bait at any place in the Namib Desert Park for any purpose other than that of angling;

(g) from the beach at Sandvis -

(i) catch fish with any kind of net or for commercial purposes;

(ii) catch Fish except by means of a fishing rod and reel;

(iii) use more than one fishing rod per angler or more than two hooks per line;

(iv) angle in the lagoon;

(v) catch and keep, give away, present, sell, display for sale or be in possession of any fish of the kinds which are mentioned hereunder, which is smaller than the size mentioned for that kind of fish and if fish smaller than the size referred to is caught, it shall be placed back into the sea without delay and without causing any further injuries:

Dassie, Black tail or Kolstert (Diplodus sargus) : 15 cm
Shad or Chad (Pomatoinus saltator) : 30 cm Galjoen (Coracinus capensis) : 20 cm Geelbek or Cape Salmon (Atractoscion aequidens) : 40 cm

Hottentot (Pachvmetopon blochii) : 22 cm Kabeljou, Cob or Kob or Salmon-Bass (Argirosoinus hololepidotus) : 40 cm Mullett (Mugil spp.) : 15 cm
Snoek (Thyrsites atun) : 60 cm
Sole (Super) (Austroglosus micro lepis): 30 cm
Stockfish (Merliiccius capensis) : 50 cm
White Steenbras (Lithognathus aureti) : 30 cm
White Stumpnose (Rhabdosargus spp.) : 20 cm
Garrick (Lichia amia) : 38 cm

(h) (i) collect or remove any mussels or "polycheate' worms or blood worms from Sandvis;

(ii) use a boat or raft on the lagoon at Sandvis.

29. No person except an officer acting directly in the execution of his duties or the exercise of his powers shall visit the research station at Gobabeb without the written permission of the Executive Committee.

30. A document indicating that a person has the permission referred to in section 18(1) of the Ordinance to visit Sandvis shall at all times be in his possession while he visits Sandvis and shall, on request, be shown to an officer.

C. ETOSHA NATIONAL PARK

31. (1) The portion of the Etosha National Park lying to the east of an imaginary north-south line running through the centre of the water hole known as Sringbokfontein shall, subject to the provisions of these regulations, be open to visitors throughout the year.

(2) The tourist season during which the remaining portion of the Etosha National Park may be visited shall begin on the second Friday of March and shall end on the 31st day of October of each year: Provided that the Cabinet may, if it is in its opinion expedient, allow any person able to visit the portion of the Etosha National Park contemplated in this subregulation during the closed season, subject to the conditions he may impose.

32. Without the written permission of the Executive Committee no person except an officer acting directly in the execution of his duties or the exercise of his powers, shall -

(a) stay overnight at any other place in the game park except a rest camp: Provided that if a person must on account of unavoidable circumstances stay overnight at any place in the game park other than a rest camp, it shall be reported at the first possible occasion to an officer;

(b) enter or travel in the Etosha National Park during the period between sunset and sunrise.

(n) if he is camping at Torra Bay, enter the angling area at Terrace Bay unless a permit to visit Terrace Bay has been obtained in advance;

(o) enter the angling area at Terrace Bay by vehicle except on the road constructed for this purpose and which is indicated by a notice board;

(p) opposite the angling area at Terrace Bay move further than one kilometre east of the main thoroughfare;

(q) Spend the night at Terrace Bay in the angling area;

(r) prepare food of any kind in any room (except in a luxury dwelling house at Terrace Bay);

(s) oil water in any manner and for any purpose whatsoever in any room (except in a luxury dwelling house) at Terrace Bay;

(t) fish in any manner other than a rod, reel, line and hook in the Skeleton Coast Park;

(u) use more than two hooks on any line when angling in the Skeleton Coast Park;

(v) in the Skeleton Coast Park angle in any place other than the angling area;

(w) enter the Skeleton Coast Park by motorcycle as described in the Road Traffic Ordinance, 1967 (Ordinance 30 of 1967) or ride a motor-cycle there;

(x) make any fire at any place other than at the officially designated fire places provided for that purpose.

(y) if he is visiting the Unjab-delta, drive a vehicle at any pace within the Unjab-delta or walk at anyplace within the Unjab-delta other than within the area demarcated by notice boards for walking purposes;

(z) if he is visiting the dunes east of the camping area at Torra Bay, drive a vehicle at any other place than within the area demarcated by notice boards for that purpose.

NAUKLUFT MOUNTAIN ZEBRA PARK:

36A. Without the permission of the Executive Committee no person shall enter the game park with a motor cycle, power-driven cycle or scooter.

36B. No person shall-

(a) collect firewood in the game park;

(b) enter the game park before sunrise or leave it after sunset;

(c) overnight at any other place than the officially designated camping site.

Appendix 2

Monitoring Plan for the design phase and construction phase

APPENDIX 2

MONITORING PLAN FOR THE DESIGN PHASE AND CONSTRUCTION PHASE

1 INTRODUCTION

Bannerman Mining Resources (Namibia) (Pty) Ltd is still in the prefeasibility phase of the project. Due to remaining final technical decisions, it is inappropriate to develop detailed compliance monitoring checklists at this stage. The ESIA and ESMP will be revised to take into account changes to the Etango Project as set out in Bannerman's final PFS and these will be submitted to the Namibian authorities by end June 2010. At that stage, the revised documents will include detailed monitoring plans for water, dust, etc., as well as a detailed compliance monitoring checklist for construction and operation. At present the checklists which will ensure that all avoidance, minimisation and mitigation measures are addressed by Bannerman only cover the design and construction phase.

Two checklists have been developed to monitor Bannerman's environmental compliance:

(a) for the design phase conducted by Bannerman and the technical team of the Definite Feasibility Study (**Table 1**); and

(b) for the construction phase monitoring the contractors and workforce at the Etango construction site (**Table 2**).

The monitoring plan ensures that the mitigation measures stated in the Environmental and Social Management Plan are established and implemented.

Additionally it is too early in the prefeasibility study process for Bannerman to have developed an organogram for the construction and operational phases of the project. As such, a management plan and the associated monitoring checklists have little value unless someone takes responsibility for ensuring that it is implemented. Thus, a column will be added to the checklist in the revised ESMP.

The responsibility to incorporate and to address the avoidance and minimisation measures stated in the ESMP during the design phase of the project, i.e. definite feasibility study, lies with the Project Director and will be audited by the appointed environmental consultant.

Monthly monitoring reports should be compiled with an annual audit to be conducted by an independent consultant to ensure that these have been addressed.

Table 1: Monitoring checklist to ensure that all aspects / key issues raised in the ESMP are implemented during the design phase

Aspect	Key issues / Activity	Analysis / Review	Compliance: Compliant (C), partially (P), non compliant (NC)	Mitigation of non-compliance
Surface water	Storm water floods the plant area and transports pollutants downstream from the mine lease	A hydrological model has been developed. Information regarding what measures are required to prevent flooding of the plant area has been incorporated into the plant design.		
	Surface water flow is restricted due to establishment of mine infrastructure and cannot flow downstream	Storm water diversion berms around the mine have been established so that clean storm water falling outside of the mine is allowed to flow unimpeded downstream. The design of the storm water diversion berms ensures that all of the flow is not diverted into a couple of channels as this will create a too rapid surface flow and will result in localised erosion. The surface water is allowed to flow as naturally as possible down the remaining washes.		
Geohydrology	Groundwater monitoring system	The groundwater monitoring system includes all areas on which mine infrastructure and thus potential pollution sources will be created. All monitoring/test boreholes are sampled for radionuclides and a well-defined baseline has been established and interpreted prior to any mining activities. The numerical model has been used to optimise the position of monitoring wells and the frequency of sampling. The sampling protocol, frequency, and parameters to be analysed are in place.		
	Abstraction of groundwater: Water supply from the Swakop River alluvium	The outcome of the groundwater study of the Swakop and Khan River system conducted by the SEA consultant has been used to calculate the overall water balance of the river system. Recommendations of this study have been used to decide whether additional abstraction by Bannerman		

		from the Swakop River in the Goanikontes compartment will affect irrigation farmers on small holdings downstream, and to what extent. Potential groundwater abstraction depends on these results.		
		A numerical groundwater model has been conducted by Bannerman for the planned abstraction area (construction phase only).		
		The recommendation of the ESMP that water should rather be used from the LHU or Rössing pipelines (i.e. NamWater from the Omdel aquifer) has further been investigated.		
	Abstraction of groundwater: Water supply from the paleochannel aquifer	Groundwater from the paleochannel is not being used for dust suppression and other measures.		
	Contamination of groundwater from runoff: Surface runoff from waste rock dumps flows in washes to the Swakop River and infiltrates into shallow alluvium	The northern extent of the waste rock dumps is limited to the natural ridge line/watershed in order to allow surface water flow in a southern direction only, away from the Swakop River catchment.		
	Contamination of groundwater from seepage: Acidic seepage water from the heap leach pad contaminates the shallow alluvium (washes) and the regional paleochannel/basement aquifer	The design of the entire HLP shows that the HLP is prepared with a pad-construction base (compacted sub-base) and lined according to an appropriately engineered solution designed to prevent any seepage into the sub-surface and taking into account best practice standards. Bannerman has considered using a multi-layered geotextiles/HDPE liner, including cushion-layer system for protection during stacking and from vehicles. A drainage system and leak-detection system has been installed.		

	Contamination of groundwater from seepage: Contaminated seepage from the HLRF infiltrates into shallow alluvium and the regional basement aquifer	A contaminant transport model has been developed to simulate seepage of leachates into the underlying strata and also to simulate the flow direction and extent of a possible plume under the hydrological and chemical conditions. The leach residue is thickened (dewatered) prior to deposition to reduce the potential for seepage. The HLRF is lined according to an appropriately engineered solution designed to prevent any seepage into the groundwater and taking into account best practice standards. A drainage system and leak-detection system has been installed. Drainage from the HLRF is collected in a lined leach residue emergency pond with sufficient storage capacity. Effluent from the emergency pond is recycled to the plant for reuse or treated and discharged in a controlled manner. If the latter method is chosen, a treatment plant has been installed and an effluent discharge permit acquired.		
	Contamination of groundwater from seepage: Seepage pollution sources reach the Swakop River through surface runoff or groundwater flow	Additional monitoring boreholes have been drilled, as recommended in the ESIA Groundwater Specialist Input report. The groundwater flow pattern is completed and the groundwater divide which separates the Swakop and Tumas River catchments has been properly delineated. A numerical groundwater model of the mining licence area has been developed to gain a proper understanding of groundwater flow within the basin, paleochannel and Swakop River aquifers. The impact resulting from pit dewatering has been modelled. Additional drilling and testing of monitoring wells within the mine area have been established.		

	Contamination of groundwater from seepage: Seepage from the plant and acid tanks contaminates groundwater	A commitment has been made that the process areas within the plant with the potential for contaminated seepage will be lined with waterproof concrete and/or geotextiles to capture contaminated seepage. A commitment has been made that the sulphuric acid unloading and storage area will be suitably bunded and serviced by the sulphuric acid storage area sump and pump, which transfers any spillage to the process water ponds. The bunded area and pumping capacities will be large enough to recover sulphuric acid in case of a tank burst.		
	Contamination of groundwater from seepage: Seepage from the process water ponds contaminates groundwater	A commitment has been made that the ponds are lined according to an appropriately engineered solution designed to prevent any seepage into the groundwater and taking into account best practice standards.		
	Contamination of groundwater from seepage: Seepage from stockpiles contaminates groundwater	A commitment has been made that the coarse ore stockpiles and the ROM stockpiles are lined.		
Air quality	Annual average PM10 health impact Highest daily average PM10 health impacts Average daily dustfall impacts Dust creation from vehicle movement on unpaved road	The extent of unpaved roads is kept to a minimum. A commitment has been made that traffic control measures, e.g. restricting traffic volumes, reducing vehicle speeds will bee implemented. Possibilities of binding the surface material or enhancing moisture retention have been investigated and will be implemented.		
	Ozone-depleting gases	A commitment has been made that ozone-free air conditioners, refrigerators, etc will be used during construction and operation.		
Biodiversity Impact on biodiversity at a national level	Mining in a national park	A commitment has been made that disturbance resulting from the mining footprint is kept to a minimum. Damage to sections of the NNNP that are not in the ML will be avoided. During the design phase, the potential damage of		

		sensitive sites (both from a species and habitat-conservation perspective and from a sense of place perspective) has been avoided by placing facilities (temporary and permanent) in areas of least impact. As far as possible, areas that have already been disturbed will be used and pristine areas have been avoided. In the undesirable event of uranium deposits being mined in sensitive areas, or the mine footprint extending into these areas, consideration has been given to assisting the park authorities to establish offset areas for biodiversity conservation and for tourism development. A commitment has been made that the construction camp will be fenced in and recreational facilities will be provided. Workers which have a whole day or more off work, will be transported back to their town residences or Swakopmund.		
		Additional studies have been commissioned: Long-term monitoring of impacts on vegetation will contribute to the knowledge-base for mining developments in the Namib and other arid zones. A plan for the establishment and regular monitoring of permanent transects has been developed for each area to be mined prior to mining activities. Monitoring could be carried out by environmental staff on the mine, and environmental organisations with local knowledge should be involved in an advisory and assistance capacity for monitoring and restoration.		
Impact on biodiversity at a local level	Mine and plant development may infringe on the identified vegetation exclusion zones	Planning and design of the pit and plant infrastructure has taken into account the identified vegetation exclusion zone as identified in the ESIA.		
	Disturbance footprint created by the mine, including mine works areas, roads, power lines and pipelines	During the design phase, damage to sensitive ridges, outcrops and washes has been avoided by locating infrastructure out of these zones. Bannerman has already taken this into account. The current location of the waste rock dumps, heap leach pad and HLRF are all based on both biodiversity and visual impact		

		considerations. Damage to the Swakop River habitat and its associated valleys has been avoided by ensuring that servitudes do not cross through this habitat. All large trees in the EPL are protected as they are habitat islands. The precautionary principle dictates that no species should be threatened due to ignorance of its status. Additional research has been commissioned, e.g. Husab sand lizard and unidentified species, to better understand their distributions and habitat preferences. Additional research has been commissioned to establish the extent of the Commiphora populations occurring in EPL 3345 so that if mining extends into other parts of the EPL, or if new mining applications are made in the region, the impact can be assessed in the light of previous population losses.		
		The restoration potential of many desert habitats is unknown but is expected to be low. Research has been commissioned into ways to restore desert pavement and biological soil crusts as they are an integral component of the gravel plains, where most of the habitat loss is expected. If the mine pit is extended to the Oshiveli and Onkelo ore deposits, very careful consideration has been given to minimise the loss of parts of the rocky mountain slopes (Habitat C) and the valley (Habitat D2) which needs to be the subject of a revised ESIA.		
Impact on biodiversity at a local level	Human presence, mining activities Traffic, noise and presence of people will all serve to drive wildlife away from the immediate area (predominantly large animals such as gemsbok, zebra, ostrich and bustards, but also smaller animals that occupy local territories)	Impacts on animals using the Swakop River have been avoided by ensuring that Bannerman's servitudes (pipelines, power lines and roads) do not cross through this area. All deliveries to site are and will be via the C28 and not via Goanikontes on the D1991. Disturbance of wildlife is minimised by ensuring that Bannerman's employees and contractors do not go beyond the mine site boundary.		

		Disturbance from noise is minimised by designing the quietest operation possible. If implemented, the noise management measures mentioned in the noise assessment will help to reduce the overall environmental noise. Poaching activities in the vicinity of Etango is monitored and offenders are taken to the authorities.		
Impact on biodiversity at a local level	Restriction of movement of nomadic species Nomadic species are restricted as they cannot cross barriers such as pipelines, fences, etc	Permanent structures such as the waste rock dumps and HLRF will be built taking into account well-established movement corridors. Major washes are often popular movement corridors and development should be avoided as far as possible in these habitats. Fencing of the mine and plant areas is limited where access must be controlled (e.g. packing house) or where animals need to be prevented from entering (e.g. water dams). Pipelines that are laid above ground have 10 m-wide earth ramps built over them at strategic points, ie known animal migration routes. Animal crossings will be and have been constructed in such a way that vehicles are prevented from using them.		
Impact on biodiversity at a local level	Improved access to the area along roads and infrastructure servitudes might cause an increase in poaching and illegal collection of plants and animals	The construction camp on site is fenced in. Security plans for the construction site are in place, e.g. prevent poaching and illegal collection of plants and animals.		
Impact on biodiversity at a local level	Habitat degradation by vehicle tracks Exploration activities, construction activities, opening up of new areas of the mine lease	New tracks are laid out so as to minimise damage to plants and desert pavement. Tracks are clearly demarcated and if necessary turning circles are provided.		
Impact on biodiversity at a local level	Obstruction of surface water flows may result in changes to drainage patterns	Abstraction or use of water from the Swakop Aquifer has only been considered after the findings of the numerical groundwater model and the findings of the SEA are taken into account. Mine infrastructure is not located in or across washes. As far as possible washes have been kept open and unrestricted to		

		allow sporadic water flow to move through the environment. Where it is impossible to avoid washes, storm-water diversions have been designed to allow clean storm water to flow past the infrastructure and feed downstream communities. Care has been taken not to alter the gradient significantly as this will alter stream flow characteristics and could cause water erosion.		
Socio-economic	Impacts of inward migration of employees, family members and job seekers Recruitment for Bannerman and its contractors **Performance targets**: > 90% Namibian recruitment; > 80% unskilled and semi-skilled workforce recruitment from Erongo Region; > 15% female recruitment	A recruitment policy has been established that gives preference to residents of Swakopmund, Walvis Bay and Arandis, particularly to women, and sets minimum education requirements, e.g. Grade 10 school leavers who pass an English and Maths test. Recruitment points at town council offices in Swakopmund, Walvis Bay and Arandis have been established. Local skills build up programmes are in place before operations begin by working with local training establishments. Training programmes have been established for specific posts that enable local people to acquire skills and employment at the Etango Project. Tender criteria for contractors to include training of local workforce are in place.		
	Pressure on availability and adequacy of education services Recruitment of staff from outside the Erongo Region **Performance target**: Fund the building of at least five new classrooms	A direct dialogue with the MoE to develop private-public partnerships in building new classrooms and other essential infrastructure has been initiated. The funding to construct three classrooms at government primary schools and two classrooms at government secondary schools has been allocated.		
	Pressure on availability and adequacy of housing Recruitment of staff from outside the Erongo Region	Town councils and central government are informed of anticipated employee numbers during construction and operation phases.		

	Access to neighbouring farms Closure of extension of D1991 across pit	An alternative access route, possibly through the mine-operating area has been planned with neighbours.		
Visual	Additional infrastructure such as main access gate, mine service road, pipelines and power lines, main HV switchyard, explosives store, etc	The maximum height of the additional infrastructure will be 20 m.		
		Dust generated by vehicles driving to and from the mine has been addressed either by tarring the C28 or by implementing a dust retardant. The option to establish a railway line has been investigated. Unauthorised access and vehicle tracks from the D1991 to elevated viewing areas to the west of the mine have been addressed and measures are in place.		
Noise	Disturbance caused by noise Operation of diesel-powered equipment and general transport to and from the mine	Use of quality new equipment with low noise-emission levels. Regular maintenance, including silencer systems. Planning of transport routes and erection of noise screens where necessary/possible.		
	Primary, secondary and tertiary crushing Operation of processing plant Operation of conveyor	Where possible, noisy equipment and processes will be enclosed.		
	Increase in noise levels Operation of diesel-powered equipment and general transport to and from the mine	Use of quality new equipment with low noise-emission levels. Regular maintenance, including silencer systems.		
	Primary, secondary and tertiary crushing Operation of processing plant Operation of conveyor	Where possible, noisy equipment and processes will be enclosed.		

Loss of **sense of place** due to degradation of natural environment, including a loss of habitats, animals and plants	Mining and processing as a whole, including those activities that arise to support the mine (e.g. increased traffic from transport vehicles) This includes indirect impacts such as those arising from more people living in and using the area	Disturbance is limited to the mining footprint area only. Damage to sections of the NNNP that are not in the ML has been avoided. During the design phase, damage of sensitive sites (both from a species and habitat-conservation perspective and from a sense of place perspective) have been avoided by placing facilities (temporary and permanent) in areas of least impact. As far as possible, areas that have already been disturbed are used and pristine areas are avoided. In the undesirable event of uranium deposits being mined in sensitive areas, or the mine footprint extending into these areas, consideration has been given to assisting the park authorities to establish offset areas for biodiversity conservation and for tourism.		
Loss of **sense of place** due to visual impacts	Mining and processing as a whole, including those activities that arise to support the mine (e.g. increased traffic from transport vehicles)	Ensure that the wilderness and its associated sense of place remain intact to some extent; no mining landscape is visible from the tourist viewpoints.		
Loss of **sense of place** due to noise impacts	Mining and processing as a whole, including those activities that arise to support the mine (e.g. increased traffic from transport vehicles)	The use of rail instead of road transport has been investigated. A commitment has been made to use quality new equipment with low noise-emission levels.		
	Primary, secondary and HPGR Operation of processing plant Operation of conveyor	Noisy equipment and processes will be enclosed.		
Loss of **sense of place** due to archaeology impacts	Mining and processing as a whole, including those activities that arise to support the mine (e.g. increased traffic from transport vehicles) and exploration activities	Exploration geologists are inducted so that they can recognise and avoid damage to archaeological sites.		
Depletion of natural resources	Fuel consumption of all equipment on site and transport to and from the mine	Fuel consumption monitoring plans have been developed.		

	Electricity consumption of all equipment on site and transport to and from the mine	Electricity consumption plans for all phases have been developed. Electricity saving measures have been investigated and will be introduce to the operation.		
Waste-disposal management plan	Disposal of all types of waste – non-hazardous, hazardous and radioactive	A waste management plan has been developed. Waste creation is minimised as much as possible. Recycling options have been investigated.		

Table 2: Monitoring checklist to ensure that all aspects / key issues raised in the ESMP are implemented during the construction phase

Aspect / Key issues	Schedule	Mitigation measures	Compliance: Compliant (C), partially (P), non compliant (NC)	Mitigation of non-compliance
Degradation of the Namib Naukluft National Park Cumulative impact on regional biodiversity	Ongoing	Liaise with the Chamber of Mines regarding the impact of construction for uranium mining on biodiversity on a regional scale.		
Offsetting residual biodiversity impacts	Ongoing	Undertake a systematic assessment of potential offsets and determine and identify appropriate options for Bannerman.		
Policies, plans and systems	Beginning construction Prior to operation Prior to operation	An environmental policy that outlines the company's commitment to proactive environmental management has been developed and has been communicated to all people on site. A social policy that outlines the company's commitment to the proactive management of socio-economic issues has been developed and has been communicated to all people on site. Applicable Namibian legal requirements and applicable international conventions to which Namibia is a signatory are met. Where no Namibian legislation exists, Bannerman has determined the most suitable industry practice that is relevant and applicable for the Southern African and uranium-mining context. An EMS, for its operational phase, which will meet the ISO 14001 requirements as soon as practicable during the operational phase has been established and is maintained. An environmental risk assessment has been conducted. Action plans are in place to address the risks that are identified. Monitoring, auditing and continual improvement of the EMS is undertaken as required by the ISO standard. A communications system has been established by which all interested and affected parties may communicate their concerns or comments regarding Bannerman's activities and receive, in return, a reasonable response from Bannerman's management. All employees, contractors, partners, service suppliers and any other visitors to site are inducted on, and expected to adhere to, the commitments made in this ESMP.		

	Beginning construction	An incident-reporting and investigation system has been established. Emergency-response procedures are in place and reviewed frequently. A mine closure plan in accordance with the draft Namibian mine closure framework developed by the CoM has been developed. The mine closure plan covers both biophysical and socio-economic issues. Financial provision (e.g. bonds or trusts) for rehabilitation is in place and reviewed and updated annually.		
Contractors	Prior to construction	Environmental compliance standards are included in **tender documents**. Contractors will need to describe how they intend to meet these requirements. They will also have the opportunity to clarify any uncertainties prior to appointment, thus allowing for the necessary budgetary allowances for implementation of all ESMP specifications. Environmental compliance requirements are included in all **contracts**. As a minimum, the conditions stipulated in the ESMP shall be met by all of Bannerman's contractors. Bannerman will seek to include in the contract penalties for non-compliance, which will result in a penalty and/or constitute a breach of contract, depending on the severity of the non-compliance. All contracting companies that have the potential to damage the environment have appointed their **own environmental coordinator** or designated the responsibility to one of their senior managers on site to implement the requirements set out in the ESMP. Bannerman has approved this nomination. All contractors that have the potential to damage the environment have provided the Bannerman environmental department with a **method statement** outlining how that company intends to comply with the ESMP. The method statement provides details regarding operating procedures, roles and responsibilities, timeframes of activities, and reporting. The contractors have ensured that all staff members, sub-contractors and suppliers understand and adhere to the ESMP. The contractor has ensured that sub-contractors and suppliers are also contractually bound to adhere to the ESMP.		
Training Programmes	Prior to construction	An **environmental induction programme** for staff, contractors and visitors has been developed. **Environmental awareness materials** to provide staff and contractors for discussion during tool-box talks, staff meetings, etc. have been developed **Relevant staff and contractors** have been trained in the implementation of environmental procedures and work instructions.		
Employee Health and	Ongoing	Everybody on site is familiar with the SHE requirements.		

Safety		The SHE requirements have been introduced to the workforce. An AIDS awareness campaign is in place. Medical facilities are established on site. Clinic facilities are on site, including free VCT for HIV and TB. Peer-education programme for HIV/AIDS and TB for all shifts. Wellness programme.		
Community interaction	Prior to construction	Annual meetings are held with the following stakeholders or their representatives: • The Governor of the Erongo Region • Swakopmund Town Council • Walvis Bay Town Council • Arandis Town Council • Coastal Tourism Association of Namibia • Neighbouring farmers. Regular meetings with representatives of the Ministry of Environment and Tourism to monitor activities in the national park are conducted. Regular meetings with the Ministry of Mines and Energy are conducted. A forum through which the wider public and those who registered as IAPs can remain involved has been created.		
Development of Access Road and Mine Road Network	Before and during construction of roads Check for off road tracks on an ongoing basis	The exclusion zones have been avoided in the road network construction plan. Plants of conservation importance have been relocated. Turning places are defined and incorporated into road network layout. Roads are clearly marked. Road design has catered for flash flooding across stream channels. Bannerman has investigated the feasibility of tarring the C28 from the mine site turnoff to the B2 for the safety of all road users. No off road tracks are experienced. No littering is observed next to the road.		
Construction and Management of camp	Before establishment of construction camp and for the	The layout plan for the construction camp has considered all aspects in the ESMP and mitigation measures are in place (e.g. dust). The construction housing is painted in a variation of matching desert colours based on hues of grey (RAL 1001/RAL 1019). The roof material is medium-		

	duration of the construction period	grey in colour. Shadows have been created around the houses using wide eaves or pergolas. The sewage and water from the ablution facilities are appropriately managed. Waste collection facilities are provided at strategic points. Recreational facilities have been established (e.g. workers have been consulted what they like to have.) Paydays are staggered to prevent an excess number of people descending to Swakopmund at any one time. No littering has been observed. No open fires have been made.		
Borrow pit and initial mining	Before start of the construction phase	EIAs have been undertaking for all proposed borrow-pit sites. All borrow-pit sites are managed in accordance with Bannerman's standards. All borrow-pit sites are rehabilitated once Bannerman has finished using them. Known species of conservation importance have been saved. Dust suppression methods are in place. Explosives are stored and managed according to law. Vehicles are staying on the marked tracks.		
Waste Management	Before contractors and workforce arrives at the construction site and for the duration of the construction period	A waste management system has been designed and implemented. Introduction programmes have be carried out to familiarise contractors and workers with the waste management system. Waste collection facilities are erected at strategic points. All waste collection facilities are wind proof. No littering has been observed anywhere on the construction site.		
Management of Hazardous substances	Before contractors and workforce arrives at the construction site and for the duration of the construction	Contractor offloading procedure and compliance with this procedure as well as legal and Bannerman requirements are monitored. A procedure for the approval, receipt, review, handling, storage and use of hazardous materials on site is developed and in place. Contractors and workforce are introduced to the hazardous waste management system. Bunding and other protective measures are installed where hazardous		

	period.	material is handled. All hazardous substances used on site are categorized and information on how to manage/neutrallise accidental spills or ingestion is kept. Protective clothing provided to personnel working with hazardous material. Contract companies are trying to substitute hazardous substances with bio-degradable products as far as possible. No spills of hazardous material are observed on site. Bunding and other protective measures are not damaged. No staff members have been observed not wearing protective clothing.		
Fuel Depot	During construction of fuel depot, operational and decommissionin g	A fuel management system meeting the SHE policy requirements is implemented. The fuel depot meets the required SABS 089 standards. An EMP for the delivery of fuel is in place. Clean up facilities for minor product spills are provided.		
Geohydrology Storm water falling on site becomes contaminated and has the potential to pollute areas downstream/ off site	Prior to construction and ongoing	All storm water flowing on site is diverted to pollution-control ponds, where it is either used for dust suppression during construction or left to evaporate. If Bannerman intends to discharge treated storm water, a discharge permit has been obtained.		
Biodiversity Habitat loss Habitat, including plants, invertebrates and small vertebrate animals that live there will be destroyed in all the areas where infrastructure is constructed	Prior to construction and ongoing	The boundary of the proposed footprint during the construction phase is fenced/demarcated to ensure that unnecessary damage does not take place. Prior to stripping and clearing, selected plants (such as aloes, Hoodia and, Commiphora oblanceolata) have been rescued and relocated. This has been done in conjunction with the NBRI. Prior to disturbance of an area in which trees occur, the area has been checked to ensure that martial eagle and lappet-faced vulture are not breeding there. If a nest has been found on the construction site, construction has been halted until specialists have been consulted. A restoration plan in conjunction with a restoration ecologist and important stakeholders such as MET has been developed.		
Biodiversity Poaching and illegal collection of plants and animals	Prior to construction and ongoing	Bannerman closely works with MET to strengthen law-enforcement activities through the Honorary Warden system. Transgressors are disciplined in accordance with the Namibian law and company policy.		

Biodiversity Degradation in plant and biological soil- crust productivity	Prior to construction and ongoing	Effective dust-suppression measures are implemented on site. A dust monitoring plan is in place. As far as possible dust retardants (e.g. tar, salt roads or a dust-a-side-type product) are used on all access roads.		
Biodiversity Habitat degradation by vehicle tracks	Prior to construction and ongoing	Site track discipline has been strictly enforced on the Etango site. All tracks are rehabilitated as soon as they are no longer needed. Bannerman already has a rehabilitation procedure in place as part of its exploration programme. This should be applied on the Etango construction/operation site as well. Rehabilitated sites are monitored to establish whether ecosystem functioning is being restored over time. If not, rehabilitation approach to improve effectiveness has been adapted. Illegal off-road driving by staff and the public in the vicinity of the mine is monitored and action to rectify the situation has been taken. Bannerman actively collaborates with MET to re-establish the Honorary Warden system to strengthen law-enforcement activities in the park.		
Biodiversity Pollution from fuels, oils, hazardous chemicals, radioactive substances and litter	Prior to construction and ongoing	An anti-litter and clean-surroundings policy is implemented. All domestic waste is disposed of in waste bins that have lids and are stored behind a fence so as to prevent scavenging. All domestic waste bins have lids so as to reduce the likelihood of windborne litter. Site, access roads and general environment in proximity to the mine is regularly inspected for litter and cleaned up. Spillage management procedures have been developed for all reagents used on site. Spillages along the access route are included in these procedures. Spills are cleaned immediately and contaminated soils and water to be remediated or treated. Radiation safety procedures are strictly enforced.		
Biodiversity Attraction of wildlife to contaminated water sources	Prior to construction and ongoing	All created open-water sources during construction are fenced off using a fine wire mesh to ensure that both large and small animals cannot gain access. Pipeline leaks and clean up spills are conducted immediately. A leakage-detection systems for all pipelines is in place.		
Socio-economic Minimise inward migration	Prior to construction and ongoing	Contractors have been committed to Bannerman's recruitment and employment policies relevant for this objective.		

Socio-economic Direct, indirect and induced economic benefits	Prior to construction and ongoing	Appropriate salaries/wages and benefits are paid. Training of local and regional contractors is promoted. SME development is promoted. Small-scale contractors and labour-intensive work is used where possible. 'Buy Namibian' products are promoted.		
Socio-economic Crime which targets the NNNP and neighbouring farms	Prior to construction and ongoing	The brief of mine security has been expanded to support the MET and neighbours including, if feasible, patrolling beyond the mine area. The public is repeatedly informed that no workers will be recruited at the site gate.		
Socio-economic Negative impact on tourism and local livelihoods	Prior to construction and ongoing	Bannerman works with the tourism industry to identify and promote alternative tourism opportunities in or around Swakopmund and the national park. Bannerman works with government and other mining companies to look for appropriate offsets. Alternative uses for neighbours' tourism facilities, e.g. to be used as accommodation for construction management have been considered.		
Archaeology Disturbance of site QRS 89/1, 89/2 and 82/4 located at minor granite outcrop during pit development.	Prior to construction activities	Bannerman has applied to the National Heritage Council for a permit to destroy sites lying within the area of mining when the layout of the surface works has been decided.		
Visual Blasting	Prior to construction and ongoing	Blasting is taking place in the afternoon when the atmospheric haze is more intense. Blasting schedules are agreed upon in conjunction with the tourism industry and Interested and Affected Parties (IAPs) to minimise disturbance to the tourism industry.		
Visual Heap leach pad, heap leach residue facility and associated machinery	Prior to construction and ongoing	Large machinery is painted a grey-brown desert colour to help reduce the degree of contrast generated.		
Visual Night operations	Prior to construction and ongoing	All lighting is kept to a minimum within the requirements of safety and efficiency. Where such lighting is deemed necessary, low-level lighting, shielded to reduce light spillage and pollution, is used. No external up-lighting of any parts of the structures, including the stacks, is allowed.		

		Security and perimeter lighting is shielded so that no light falls outside the area needing to be lit. Overly tall light poles are avoided. No naked light sources are directly visible from a distance, except for aircraft-warning lights. All necessary aircraft-warning lights are installed as per government requirements.		
Noise Disturbance caused by noise and increase of noise levels from operation of diesel-powered equipment and transport	Prior to construction and ongoing	Quality new equipment with low noise-emission levels is used. Regular maintenance, including silencer systems is carried out.		
Noise Noisy single events, blasting, reverse hooters, bucket slams and similar events	Prior to construction and ongoing	Tourist operators and neighbours are informed of blasting times. The use of strobe lights during the night has been considered Operators are trained to prevent 'bucket slams' and other similar events.		
Consumption of electricity	Prior to construction and ongoing	Electricity consumption is minimised.		
Fuel consumption	Prior to construction and ongoing	Ways are investigated and implemented to minimise fuel consumption. Fuel consumption during the construction phase is monitored.		

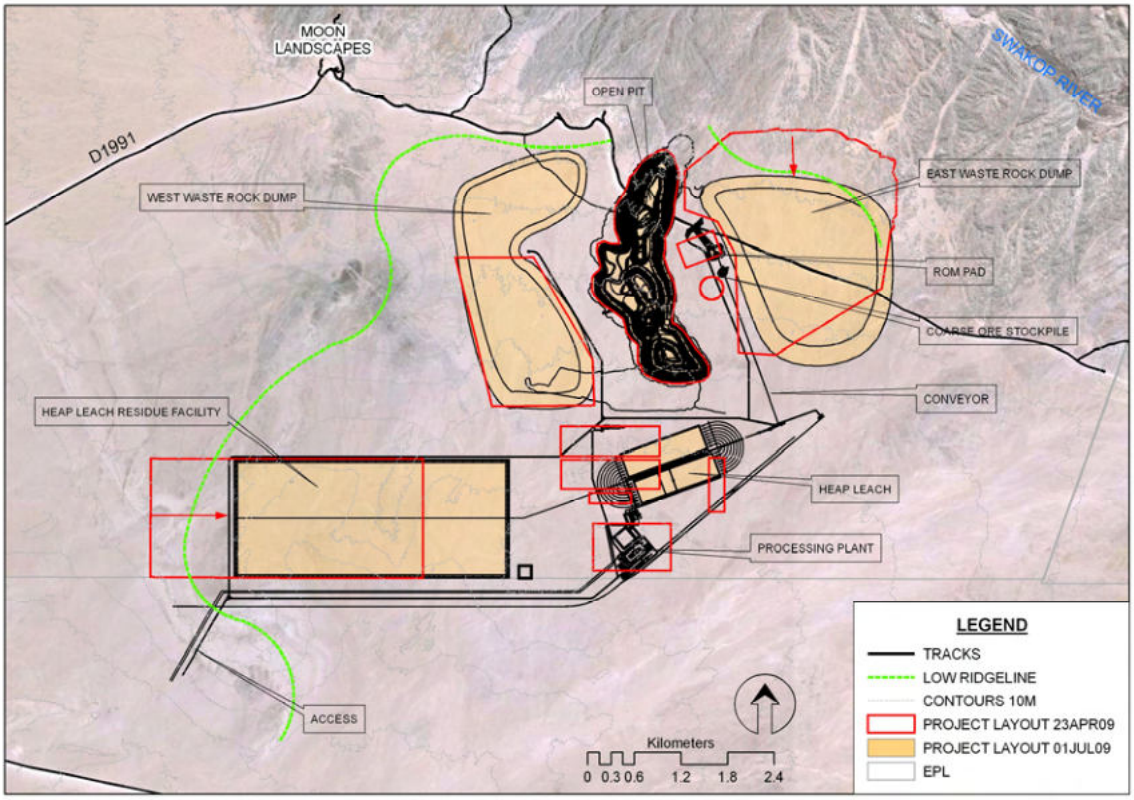
Appendix 3

Visual impact assessment – implemented mitigation measures during the design phase

APPENDIX 3

Visual impact assessment – implemented mitigation measures during the design phase

In order to minimise visual impacts, Bannerman decided to implement an opportunity to change the design and location of infrastructure during the planning phase. These measures are discussed below.



Based on findings from the preliminary visual study, information was provided to the design team at Bannerman to help them reduce the visual impact of the mine. Based on this information, changes were implemented to the layout. As indicated on the above map, the initial layout dated 23 April 2009 is overlaid onto the assessment layout dated 01 July 2009. The changes made took into consideration the low ridgeline to the west and the elevated ground to the north as indicated by the dotted green line on the map. Initially the HLRF was further to the west and protruded beyond the ridgeline. This was amended by moving it to the east which allowed the majority of the activity to be screened from receptors travelling to the Moon Landscapes making use of the D1991. The other significant change was the positioning and height of the East WRD. Initially the dump was further north and into the Swakop River drainage area. In this position of the WRD would have resulted in major visual impact from the Moon Landscapes (height 70m above ground level). Based on the combined viewshed of the northern receptors, a visual envelope height map was generated and provided to the design team; the position of the WRD was moved further south, split and restricted in height. The footprint of the WRDs was also changed to create a rounded shape which generated less contrast to the surrounding landscape. The combined changes to the layout resulted in a significant reduction in the visual impact which, with mitigation, allowed for the protection of the Moon Landscape and the Swakop River landscapes.

Appendix 4

Waste Management Plan for Construction

APPENDIX 4

WASTE MANAGEMENT PLAN FOR CONSTRUCTION

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WASTE MANAGEMENT PLAN FOR CONSTRUCTION

1 INTRODUCTION

Waste generation will be one of the main impacts during the construction phase. It is therefore important to identify and categorise the waste types that will be generated, prior to commencement of the construction phase. Different waste disposal options are discussed and recommendations are made regarding waste management.

Three waste categories are established:

- environmentally sound waste: will not cause any harm (except minor disturbance)
- waste which could possibly cause risks to the environment: may cause environmental harm if not appropriately disposed of
- hazardous waste: not environmentally friendly, may cause major damage to the environment.

It is anticipated that no radioactive waste will be created during construction. The issue of radioactive waste is dealt with in the Etango Project : Radiological Public Impact and Safety Assessment (ERM, 2009).

2 WASTE DISPOSAL OPTIONS

Five possible waste disposal options are identified, which should be investigated for each different waste category before construction begins. Each option is briefly discussed below, and examples are listed of the waste type falling under each option.

<u>The five disposal options are:</u>

(1) Return to the supplier.

(2) Recycle (recycling options are investigated and the recyclable material is transported off site).

(3) Dispose of in the proposed waste rock dump.

(4) Send to authorised landfill.

(5) Store on site in the scrap metal yard.

The first two options require further information in order to determine all possibilities in Namibia.

2.1 Return to the supplier

- All types of oil, fuel and lubricant waste products and containers.
- Chemicals, e.g. paints, reagents, detergents, thinners (liquid and containers).
- Medical waste.

This option will mainly apply to packaging material, such as metal containers, wooden boxes and pallets (wooden and plastic) which can be reused by the supplier. However, material which will be supplied on a periodic basis, such as car batteries, should be provided on an exchange basis.

This option applies also to a number of products which are hazardous and cannot be appropriately disposed of on site. The capacity of suppliers to deal with empty hazardous material containers and hazardous waste material itself, such as oil, fuel, lubricants, paints, reagents, detergents and thinners, should be investigated during supplier selection and negotiation. Medical waste (if generated on site during construction) should be collected separately, and legal disposal should be discussed with Ministry of Health and Social Services or the Town Council of Swakopmund.

2.2 Recycle

- Tins, glass, paper, plastic, tyres.

Tin, glass, paper and plastic originating in the kitchens, offices and canteens should be collected in appropriate containers and sent for recycling. The economic viability of recycling should be investigated once the decision has been taken to continue with the mine development.
Tyres shall be transported off site and if appropriate recycled.

2.3 Disposal in mine waste rock dump

- Sand, rocks.
- Air filters.
- Cement.

Sand and rock waste generated during construction could be used for construction (e.g. backfill) where appropriate. The remaining sand and rocks should be disposed of on the proposed waste rock dump. Inert and environmentally sound waste which cannot be recycled, such as building rubble and cement waste should be disposed of on the proposed waste rock dump. The rock dump should be laid out and managed in such a way as to ensure that this type of waste is properly covered so that it cannot be transported by wind.

2.4 Send to authorised waste disposal site

- Food waste.
- Cleaning agents used in the kitchen and canteens.
- Minor oil-contaminated rags and other parts.

All organic food scraps should be disposed of in an authorised landfill to avoid contamination of the surrounding habitat by alien material. Hazardous chemicals (non-biodegradable cleaning agents) used in the kitchen, canteens and office facilities should be collected separately and disposed of in a authorised landfill to avoid seepage into the soil. It is recommended that only biodegradable cleaning agents be used at the site where appropriate.

Minor oil or lubricant-contaminated material should be disposed of in an authorised landfill to avoid any possible contamination.

2.5 Scrap metal yard

- Metal scrap.
- Fan belts and other vehicle parts.
- Welding rods.
- Metal/steel piping.

At present it is proposed that a scrap yard be established on site. Material such as metal off-cuts, vehicle parts and other metal should be collected in the scrap yard. The possibility of recycling these waste types on a periodical basis to a scrap metal merchants should be investigated.

3 RECOMMENDATIONS

To keep the impact of the generated waste as low as possible, the following recommendations shall be considered by Bannerman prior to construction:

Overall recommendations:
- The overall goal should be waste prevention and minimisation during construction.
- Ensure that the workforce on site is informed of the waste management plan and obey the rules.

Specific recommendations:
- Establish sewage treatment plant for domestic water consumption.
- Adopt best recycle options in Namibia and South Africa.
- Erect waste containers to collect the different type of waste. The waste containers have to be covered to prevent litter being blown out of the container.
- Establish a storage area for recyclable waste before being transported off site.
- Establish appropriate facilities to store hazardous waste which has to be treated at special plants (e.g. fuel, oil, lubricants).

4 WASTE TYPES GENERATED DURING CONSTRUCTION AND DISPOSAL METHODS

Table 1 Waste generated during the construction phase of the proposed mine

Enviro. sound: environmentally friendly, will not cause any harm (except minor disturbance)
May cause harm: may cause environmental harm if not appropriately disposed of
Hazardous: not environmentally friendly, may cause major damage to the environment

Construction Site area		Waste category			Disposal Methods
	Waste type	**Enviro. sound**	**May cause harm**	**Hazardous**	
Access road/ mine network					
	Sand	x			Proposed waste rock dump
	Gravel	x			Proposed waste rock dump
Site offices					
	Paper	x			Recycle
	Used office materials (e.g. cartridges, pens)		x		Recycle or authorised landfill
Construction camp					
	Potable water effluents	x			Sewage treatment plant
	Ablution effluents		x		Sewage treatment plant
	Sewage effluent		x		Sewage treatment plant
	Generator fumes			x	Appropriate air filters
	Generator fuel/oil			x	Return waste to supplier, recycle
	Medical waste			x	Return expired products and waste to supplier, authorised landfill
Kitchen facilities					
	Food scraps		x		Authorised landfill
	Tins		x		Recycle
	Glass		x		Recycle

Construction Site area		Waste category			Disposal Methods
	Waste type	**Enviro. sound**	**May cause harm**	**Hazardous**	
	Paper		x		Recycle
	Cleaning agents			x	Authorised landfill, try to use biodegradable agents
Canteens					
	Tins		x		Recycle
	Bottles		x		Recycle
	Glass		x		Recycle
	Paper	x			Recycle
	Plastic		x		Recycle
Construction equipment					
	Containers		x		Return to supplier
	Pallets (wood, plastic)	x			Return to supplier, if damaged to the rock dump
	Styrofoam			x	Recycle
	Wood	x			Recycle or to the waste rock dump
	Boxes	x			Recycle
	Paper	x			Recycle
	Plastic scrap		x		Recycle
	Metal scrap		x		Scrap yard
Heavy construction machinery & vehicle parts					
	Oil filters			x	Return waste to supplier, recycle
	Air filters		x		Proposed waste rock dump
	Fuel filters			x	Return waste to supplier, recycle
	Vehicle batteries			x	Return waste to supplier
	Used tyres			x	Recycle, return waste to supplier
	Fan belts & other car parts			x	Scrap yard
	Fumes & gases			x	Appropriate filters
	Scrap metal		x		Scrap yard
	Oil/lubricants/ grease			x	Return waste to supplier, recycle
	Oil-contaminated rags		x		Authorised landfill
Fuel depot waste					
	Oil/grease/ lubricants			x	Return waste to supplier, recycle
	Contaminated soil			x	Treatment, e.g. bio-remediation or authorised landfill
	Used oil cans & drums			x	Return waste to supplier, recycle

Construction Site area		Waste category			Disposal Methods
	Waste type	**Enviro. sound**	**May cause harm**	**Hazardous**	
Building material					
	Welding rods		x		Scrap yard
	Scrap metal		x		Scrap yard
	Cement		x		Proposed waste rock dump
	Piping (plastic/metal)		x	x	Proposed waste rock dump or scrap yard, recycle
	Paint tins			x	Return waste to supplier, recycle
	Reagent containers			x	Return waste to supplier, recycle
	Detergent containers			x	Return waste to supplier, recycle

Appendix 5

Etango Project Mine Closure Plan Framework

APPENDIX 5

ETANGO PROJECT MINE CLOSURE PLAN FRAMEWORK

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1. ETANGO PROJECT MINE CLOSURE PLAN FRAMEWORK

1.1 Overview

This appendix sets out the Mine Closure Plan Framework for Bannerman's proposed Etango Project. During the construction phase and prior to commencement of operations, a detailed Mine Closure Plan will be compiled. Implementation of the plan will commence at the start of the mining operations. Mine closure is an integrated process that needs to commence during the early stages of operations. With better upfront planning and by undertaking closure activities in the operations phase, Bannerman aims to ensure successful and timeous closure of the mine. The Mine Closure Plan will be reviewed regularly during the operating phase and adjusted where appropriate.

Bannerman is a member of the Chamber of Mines (CoM) and plays an active role in the Uranium Stewardship Committee (USC) of the CoM. All members of the CoM are signatories to the Code of Conduct and Ethics (COC). *Section 2.1* of the COC states that members shall at all times comply with policies, guidelines, standards and directives that the CoM may issue for its members from time to time. Accordingly, the Mine Closure Framework being developed by the CoM stipulates minimum compliance standards for members. The Mine Closure Framework was endorsed by the CoM Council on 15 May 2009, thus Bannerman will be guided by the Mine Closure Framework while developing a Mine Closure Plan for the Etango Project. However, the CoM has referred some matters to legal counsel for clarification and the final Mine Closure Framework document has not been issued to members.

Bannerman is also a member of the World Nuclear Association (WNA) and thus must adhere to Policies and Principles of the WNA (see ESIA, section 5.1.5). *Inter alia* members of the WNA are committed to 'Contribute to the social and economic development of regions where they operate', thus Bannerman will develop and put in place a Mine Closure Plan prior to commencement of the proposed mining operations. Furthermore, Principle 1 of the WNA stipulates 'Adherence to Sustainable Development'. Although mining *per se* is a non-sustainable activity, during all stages of the Life of Mine, Bannerman intends to use its best efforts to meet sustainability criteria as much as possible.

The overall objective of Bannerman's Mine Closure Plan Framework is to produce a mine closure plan, including a rehabilitation plan, and to ensure adequate financial resources for closure/rehabilitation. Mine closure planning will address the removal of infrastructure, restoration of the environment as far as possible and provision for social closure. Bannerman undertakes to work closely with its stakeholders to develop a suitable mine closure plan.

1.2 Regulatory setting

Although Namibian legislation makes provision for funding and rehabilitation requirements, a mechanism for relinquishing the Mining Licence on mine closure has yet to be established. Bannerman has been an active participant in the development of the CoM's Mine Closure Framework and as such is committed to the process of responsible mine closure.

A list of Namibian legislation making reference to mine closure or rehabilitation of polluted environments is provided below.

1.2.1 Legal requirements

The following legislation makes reference to mine closure:

- Namibia's Environmental Assessment Policy for Sustainable Development and Environmental Conservation, 1994
- The Minerals (Prospecting & Mining) Act, No 33 of 1992

- General Environmental Assessment Guidelines for Mining (Onshore and Off-shore) Sector of Namibia, 2000
- Environmental Investment Fund of Namibia Act, No. 13 of 2001
- Minerals Policy of Namibia, 2002
- The Environmental Management Act, No. 7 of 2007
- Policy for the Conservation of Biotic Diversity and Habitat Protection, 1994
- Water Act, No. 54 of 1956
- The Atmospheric Pollution Prevention Ordinance, No. 11 of 1976
- Labour Act, No. 11 of 2007; Labour Act, No. [ ] of 1992: Regulations relating to the Health and Safety of employees at work.

1.3 Stakeholder involvement

Bannerman acknowledges the importance of both the positive and negative effects of the mine's activities on key stakeholders, including employees, local suppliers, communities, government and interested non-government organisations. The development of a successful Mine Closure Plan will require the involvement of all affected parties.

Understanding the concerns and obtaining the input from stakeholders will be an important part of the process while Bannerman develops the Mine Closure Plan and during its periodic review throughout the LOM. Bannerman believes the benefits of a successful stakeholder engagement process include:

- improved planning decisions
- improved cooperation with government
- better closure decisions
- good corporate governance
- improved community receptiveness.

Bannerman expects to take the following steps to ensure quality stakeholder engagement:

Step 1: Stakeholder identification

Stakeholders include employees, management and shareholders of the company, as well as external parties such as communities (for instance, local business, landholders, NGOs) and government (ministries, departments, local government and parastatals).

During the identification of the stakeholders for mine closure, Bannerman will recognise the difference between those directly affected by mine closure such as employees and those that have an interest in the process of mine closure, and will address the issues of each different group in the mine closure plan.

Step 2: Effective consultation and working with communities

Bannerman intends to engage with stakeholders early in the mine's life, preferably during the planning phase, and continue throughout operation and into the closure and relinquishment phases. Bannerman will consult and provide feedback to stakeholders and interested parties and intends to follow a two-way communication approach. Additionally, Bannerman's intention will be to manage and guide expectations of affected stakeholders and to mitigate, as best as possible,

negative (economic, social and bio-physical) impacts and to enhance positive impacts for the establishment of the mine project.

Step 3: Targeted communication strategy

Bannerman aims to develop a communication strategy ensuring that the needs of stakeholder groups and interested parties are adequately addressed and reflected in Bannerman's Mine Closure Plan.

Bannerman understands that the different stakeholder groups, having different concerns and needs, are addressed in the appropriate manner, e.g. employees and suppliers will need to find other business opportunities, and the custodian of the NNNP will like to see the area adequately restored and fit for tourism activities.

Step 4: Adequate human and financial resources

Bannerman's intention is that all stakeholders have the necessary information to cooperate effectively in the closure process. To achieve this goal Bannerman intends to ensure that adequate human and financial resources are allocated from the start of the life of mine to plan the mine closure.

1.4 Planning the Mine Closure Plan

The current lifespan of the proposed Etango mine is approximately 15 years, and it is highly likely, with continued exploration success, that this will be extended to 20 years and beyond. However, the life of the mine will also depend on changing world prices, which need to be addressed in the Mine Closure Plan. Figure 1.4.1 presents the steps to be followed to develop Bannerman's Mine Closure Plan.

The Mine Closure Plan is a dynamic process which will be regularly updated, reviewed and revised during the life of mine. Included in the plan will be considerations regarding stakeholder involvement, as well as post-mining economic and social options.

In the case of the Etango Project, no future alternative land uses are likely to be considered as the mine is within the Namib Naukluft National Park. The mine will be made safe and potentially hazardous areas will be permanently closed off to the public. Discussions and negotiations relating to the many provisions will be required to ensure that the components of the mine closure plan results in the best possible outcomes for all stakeholders.

When a mine, or part of a mine, ceases production or plans to cease mining activities, decommissioning activities start. In most cases today, mining operations are planned for a fixed period and, since decommissioning can already be foreseen at the commissioning phase, certain steps to ensure that specific decommissioning activities will be met, can be included in the regular mine operation activities from the start, e.g. restoration programmes and landscaping of the waste rock dump. It is Bannerman's intention to incorporate this philosophy in its mine closure planning.
If the environmental, social and radiation management plans of a mine have been implemented during all phases of the life of mine, only outstanding environmental impacts pertinent to mine closure will be left to manage. The possible nature of these impacts should be assessed, and the potentially significant impacts described.

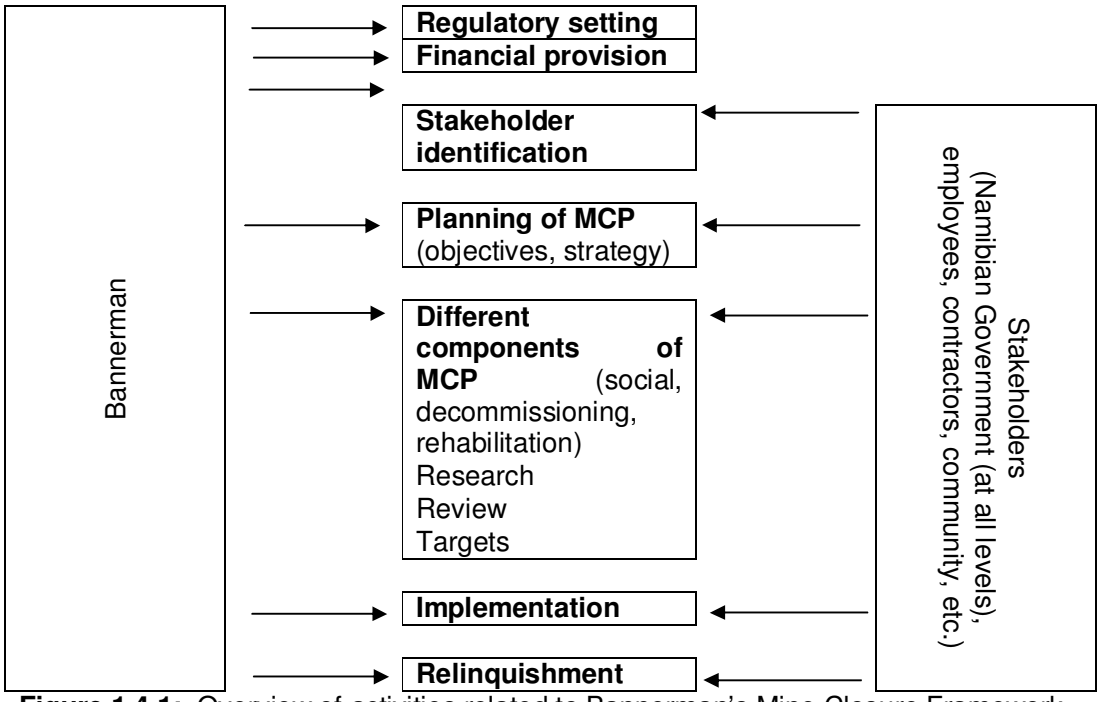

Figure 1.4.1: Overview of activities related to Bannerman's Mine Closure Framework

1.4.1 Objectives

The overarching targets of Bannerman's Mine Closure Plan will be:

- future public health and safety are safe-guarded;
- the environment and natural resources are not subject to physical and chemical deterioration;
- the site is returned to the NNNP, in a restored condition, as far as possible;
- adverse socio-economic impacts are minimised; and
- socio-economic benefits are maximised as far as it is practicable[1].

To achieve that, the objectives of Bannerman's mine closure plan are as follows:

- To minimise adverse impacts on the environment.
- To prevent potential ground-water contamination.
- To stabilise rehabilitated ground (and residue deposits).
- To minimise erosion by wind.
- To make certain areas safe (e.g. pits, dams)
- To minimise adverse socio-economic impacts on the affected labour force and the population in the mine's environs.

[1] Mining for Closure: policies, practices and guidelines for sustainable mining practices and closure of mines. United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), Organisation for Security and Co-operation in Europe (OSCE) and the North Atlantic Treaty Organisation (NATO), 2005.

- To provide opportunities for alternative forms of land use and sustainable business development after mine closure.
- To ensure that relevant authorities are kept informed according to the regulatory requirements.
- To provide all the necessary financial, knowledge and skills resources at implementation of the closure plan
- To have a formal relinquishment process in place releasing the mining company from future obligations when closure outcomes have been accepted and achieved.

1.4.2 Mine closure strategy

Bannerman's closure strategy will address:

- key objectives (for instance, community integration, future use of disturbed areas)
- main closure aspects and associated components
- closure risks analysis
- stakeholder expectations
- evaluation of alternatives
- identification of preferred land use alternatives after closure.

1.4.3 Components of the Mine Closure Plan

Bannerman's Mine Closure Plan will include:

- social plan (employees and communities)
- decommissioning plan
- rehabilitation plan
- monitoring plan
- closure costing.

For each component of the Mine Closure Plan, Bannerman will develop a list of aspects which need to be considered. It will conduct closure feasibility and research, regular and critical review, and completion criteria and targets to ensure that components of the Mine Closure Plan are realistic and that they reflect and address stakeholders' concerns and inputs.

1.4.4 Site-specific risk-based approach

Bannerman, with the assistance of an external consultant, intends to conduct a risk assessment. This will be based on the findings of the Environmental and Social Impact Assessment, and should include – *inter alia*:

- Dust mitigation and control during decommissioning and post closure, especially waste rock dumps and heap leach disposal pad.
- Pit safety including post closure stability and unauthorised access.
- Groundwater – prevention of seepage from pit, heap leach residue facility and old leach pads after mine closure.
- Decommissioning and dismantling of mine infrastructure.

- Radioactive residues and waste remaining after closure.
- Socio-economic issues.
- Post mining land use issues.
- Biodiversity issues.
- Visual and sense of place issues.
- Restoration of ecosystems.
- Long term monitoring.

1.5 Financial Provision

Sufficient funds will be available for the development and continuous management of Bannerman's Mine Closure Plan. Accordingly, financial arrangements and agreements (e.g. bonds or trusts) will be in place prior to any mine construction activities.

These provisions should cover the following aspects:

- Cost Estimate
- Regular review of cost estimates
- Financial provision
- Accepted accounting standards
- Financial mechanisms
- Closure aspects to be considered in the cost estimate
- Employee costs, e.g. retrenchment packages
- Other social aspects
- Rehabilitation costs
- Post closure monitoring and maintenance
- Project management.

1.6 Implementation

Bannerman's mine closure plan will consist of two sequential phases: planning and implementation. The successful coordination of these stages should result in a well designed, systematic, safe and cost-effective mine closure.

The following considerations will be addressed in the management and implementation of closure plans:

- Accountability for closure
- Adequate resources
- Ongoing management
- Objectives, targets and time frames.

1.7 Relinquishment

Relinquishment is the formal approval by an Organ of State, confirming that agreed targets of the mine closure plan have been achieved and the completion criteria for the closing mine have been

met to the satisfaction of the ministries concerned. Once sign off has occurred, liabilities may then be transferred to the subsequent owner.

Including the following will ensure successful relinquishment:

- Preparing for relinquishment
- Target setting process
- Completion criteria
- Indicators
- Performance targets
- Formal approval for relinquishment
- The process
- Records retention strategy.