

**ZIRCO ROODE HEUWEL (PTY) LTD
NORTHERN CAPE**

**KAMIESBERG PROJECT, NAMAQUALAND
SOUTH AFRICA**

FINAL

**ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN AND
MONITORING PROGRAMME**

PREPARED BY	PREPARED FOR
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Coastal and Environmental Services

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I **ERIC IGBINIGIE** declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed project, in application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



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LIST OF ABBREVIATIONS

E&S	Environmental & Social
CES	Coastal & Environmental Services
CESMP	Construction Phase ESMP
CLO	Community Liaison Officer
CSR	Corporate Social Responsibility
D/PESMP	Design and Planning Phase ESMP
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DESMP	Decommissioning Phase ESMP
DMR	Department of Mineral Resources
DWA&S	Department of Water & Sanitation
DWAF	Department of Water Affairs and Forestry
EAP	Environmental Assessment Practitioner
EAR	Environmental Affairs and Rehabilitation
ECO	Environmental Control Officer
EHS	Environmental, Health and Safety
EHS	Environmental, Health and Safety
EMP	Environmental Management Plan
EP III	Equator Principles III
EPCM	Engineering, Procurement, Contractor Management
EPFI	Equator Principles Financial Institutions
EPR	Emergency Preparedness and Response
ESAP	Environmental and Social Action Plans
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plans
ESMP	Operational Phase ESMP
ESMP_r	Environmental and Social Management Programme
ESMS	Environmental and Social Management System
FAO	Food and Agricultural Organisation's
FPIC	Free, Prior, and Informed Consent
GHG	Greenhouse Gas
GIIP	Good International Industry Practice
GM	General Manager
HAZOP	Hazard and Operability Study
HMC	Heavy Mineral Concentrate
HMP	Heritage Management Plan
HRDP	Human Resource Development Programme
HRM	Human Resource Manager
I&AP	Interested and Affected Parties
ICP	Informed Consultation and Participation
ICRC	International Committee of the Red Cross
IDP	Integrated Development Plans
IFC	International Finance Corporations

KLM	Support the Kamiesberg Local Municipality
KPI	Key Performance Indicators
LED	Local Economic Development
MORM	Naturally Occurring Radioactive Materials
MSDS	Material Safety Data Sheets
MSP	Mineral Separation Plant
NCR	Non-Conformance Report
NEMA	National Environmental Management Act
NGO	Non-Governmental Organisations
OECD	Organization for Economic Co-operation and Development
OFS	Orange Feldspathic Sands
OH&S	Occupational Health and Safety
PAC	Project-Affected Communities
PCP	Primary Concentrator Plant
PPE	Personal Protective Equipment
QA/QC	Quality Assurance / Quality Control
RAS	Red Aeolian Sands
SAHRA	South African Heritage Resources Agency
SANS	South African National Standards
SAWQG	South African Water Quality Guidelines
SASS5	South African Scoring System Version 5
SCC	Species of conservation concern
SDF	Spatial Development Frameworks
SEP	Stakeholder Engagement Plan
SLP	Social Labour Plan
SOP	Standard Operating Procedures
STD	Sexually transmitted diseases
TDS	Total dissolved solids
THM	total heavy mineral
tpa	tons per annum
tph	tons per hour
TSS	Total suspended solids
UK DWI	United Kingdom Drinking Water Inspectorate
UN	United Nation's
VCT	Voluntary Counselling and Testing
VLAC	Voluntary Land Acquisition and Community
WHO	World Health Organisation

1. INTRODUCTION

1.1 Project background

Zirco Roode Heuvel (Pty) Ltd (hereafter referred to as Zirco) currently holds the prospecting rights to the Roode Heuvel (6 314 ha) and Leeuvlei (6 005 ha) deposits located approximately 500 km north of Cape Town in the Northern Cape Province of South Africa. Zirco is in the process of acquiring prospecting rights for a further deposit immediately east of and adjacent to Roode Heuvel, referred to as “Sabies” (8 600 ha). The three deposits are here referred to as the Zirco Kamiesberg Project (Figure 1.1).

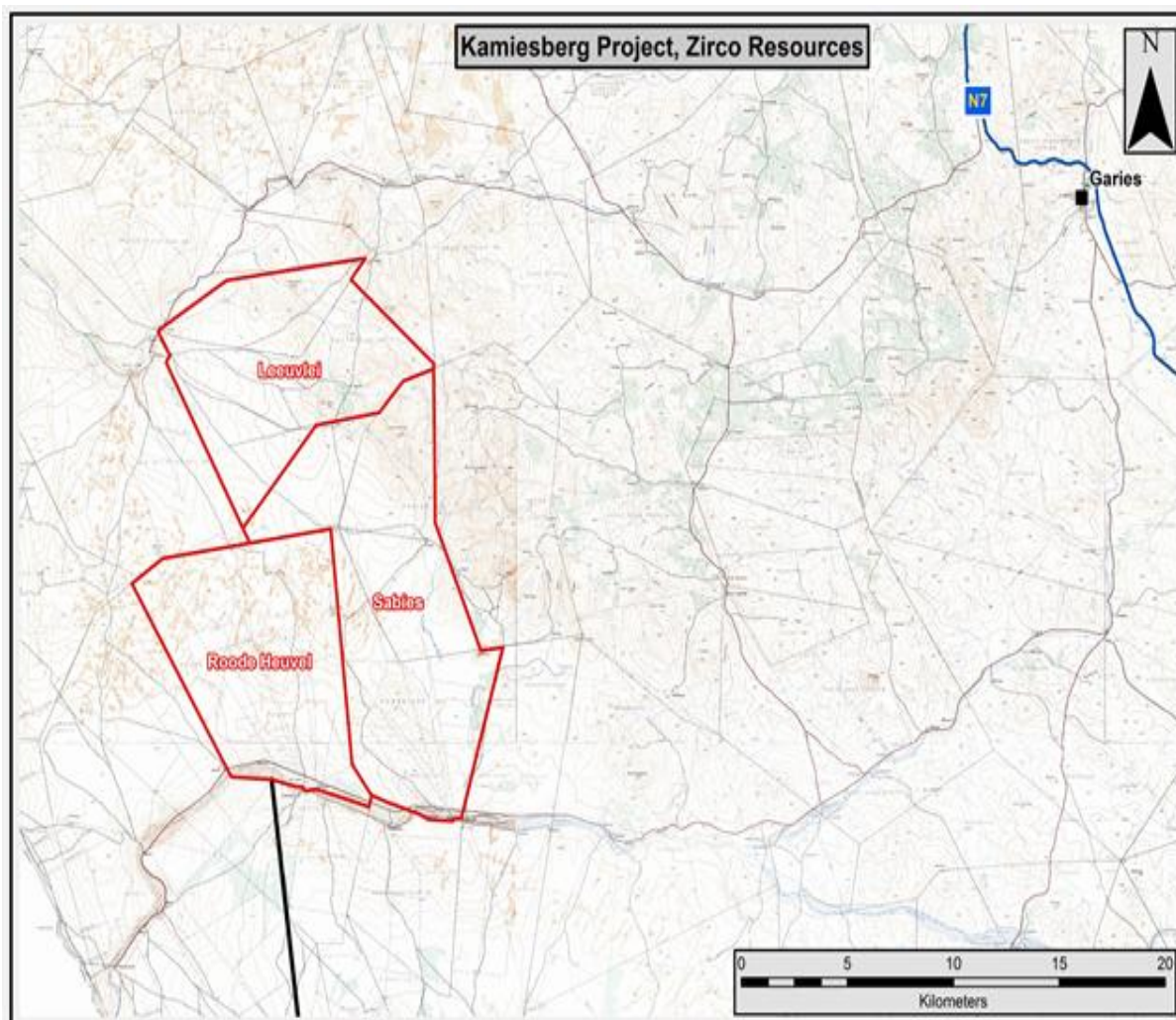


Figure 1.1: Locality of the Zirco Kamiesberg Project showing the location of the three prospecting rights

Zirco aim to be the leader in socially and environmentally responsible mining in the region and, as such, will seek compliance with the national and international requirement. The primary tool for implementing a sound Environmental & Social (E&S) management is a series of Environmental and Social Management Plans (ESMP) that include Design and Planning Phase ESMP (D/PESMP), Construction Phase ESMP (CESMP), Operational Phase ESMP (OESMP) and Decommissioning Phase ESMP (DESMP) (Equator Principles III, 2013). For the purpose of this report, these documents are jointly referred to as the Environmental and Social Management Programme (ESMP_r). The ESMP_r (this document) has been standardised and adapted to the requirements stipulated in the Equator Principles (EP III 2013), the International Finance Corporations (IFC) Performance Standards on

Environmental and Social Sustainability (2012) and associated Environmental, Health and Safety (EHS) Guidelines.

Consequently, this report is structured as follows:

- **Chapter 1** provides an overview of the Zirco Kamiesberg Project and details of the team members that drafted this report.
- **Chapter 2** provides a summary of the project description.
- **Chapter 3** provides a background to the ESMP and details of relevant management plans required in each phase of the operation to ensure compliance with relevant standards.
- **Chapter 4** provides the applicable legislation and relevant local and international policies and standards.
- **Chapter 5** identifies the training needs that include staff training and community training and partnerships that will be required to implement the ESMPr.
- **Chapter 6** contains community engagement and on-going consultation and communication requirements.
- **Chapter 7** contains the organisational capacity and human resources requirement to implement the ESMPr.
- **Chapter 8** presents the mitigation measures and identifies specific measures that would be required to manage the range of identified environmental and social impacts.
- **Chapter 9** describes the monitoring and review procedure implemented by the management team.
- **Chapter 10** provides details of the monitoring programmed required to address the described mitigation measures.
- **Chapter 11** provides details of the decommissioning, rehabilitation and closure of the mining infrastructures.

1.2 Objectives of the Environmental and Social Management System

This document is intended for the implementation of a sound E&S management at the Zirco Kamiesberg Project. It represents the company's commitment to addressing and managing the potential negative and positive impacts associated with the planning and construction, operation and decommissioning phases of the Kamiesberg project in a systematic, efficient and effective manner.

The objectives of the ESMS are to:

1. Ensure that the project is compliant with applicable national and international E&S legal and other requirements.
2. Identify the required mitigation measures that are needed in order to reduce negative E&S impacts and enhance positive ones.
3. Ensure that all mitigation measures and recommendations identified during the Environmental and Social Impact Assessment (ESIA) are captured and incorporated into relevant documentations that are referenced and expanded if necessary during the various phases of the project.
4. Outlines management structures to ensure that the implementation of the ESMPr is possible for all phases of the project.
5. Identify relevant documents and procedures to be developed that will facilitate the implementation of the ESMPr.

1.3 Environmental and Social Impact Assessment Process to Date

In 2013, Zirco requested Coastal & Environmental Services (CES) to conduct an ESIA completed in accordance with the South Africa standards as well as those of the IFC and the

Equator Principles. Table 1.1 presents the volumes that were produced during the ESIA process which informs the overall ESMS for the Kamiesberg project. All documents prepared as part of the ESIA process were in accordance with required national and international standards.

Table 1.1: Reports Produced for the Updated ESIA Process

Report produce	Date	Authors
Scoping		
Environmental Pre-feasibility Scoping Study and Terms of Reference	January 2014	Coastal & Environmental Services, South Africa
Specialist Studies		
Air Quality Assessment	August 2014	T. Bird & L. Burger
Preliminary Radiation Assessment	September 2014	JJ van Blerk, N Potgieter & ID Kruger
Biodiversity and Faunal Assessment	September 2013	Bill Branch, Nic Davenport & Werner Conradie
Health Impact Assessment	August 2014	Vumile Dlamini, Natasha Taylor-Meyer & Jan Perold
Heritage, Archaeological and Paleontological Impact Assessment	August 2014	Jonathan Kaplan
Marine and Rocky Shore Assessment	March 2014	Aiden Biccard & Barry Clark
Noise Impact Assessment	September 2014	Brett Williams
Rehabilitation Assessment	September 2014	Roy Allen Lubke & Ted Avis
Socio-economic Impact Assessment	June 2014	Anton Hough & Marc Hardy
Soil and Agricultural Impact Assessment	June 2014	R. de Kock & Bill Rowlston
Surface and Ground Water Assessment	September 2015	Bill Rowlston
Traffic and Transport Impact Assessment	September 2014	Michael Bailey & Bill Rowlston
Vegetation and floristic specialist study	September 2014	Nic Davenport, Werner Conradie & Nick Helme
Visual Impact Assessment	May 2014	Thomas King & Mike Bailey
Waste and Wastewater Impact Assessment	May 2014	Eric Igbinigie & Kevin Whittington-Jones
Economic Specialist Studies	June 2015	Hugo van Zyl
Groen Estuary Ecological Assessment	June 2015	J.B. Adams, M. Cowie & T.H. Wooldridge
Environmental and Social Impact Assessment		
Environmental and Social Impact Report		Coastal & Environmental Services
Environmental and Social Management Plan and Monitoring Programme		
Environmental and Social Management System (<i>this report</i>)	October 2015	Eric Igbinigie & Kevin Whittington-Jones

1.4 Study team

The following team members were involved in developing this document:

Dr Eric E Igbinigie

Eric holds a PhD in Environmental Biotechnology, a registered Professional Natural Scientist (Pr.Sci.Nat.) and a certified EMS ISO 14001:2004 Auditor (IRCA). He is a seasoned environmental consultant with project experience in different industry sectors across Africa including mining, oil and gas, agro-industry and water/effluent treatment facilities in developing countries financed by Equator Principles Financial Institutions such as the IFC, AFC, FMO, SWEDFUND, DEG and AfDB. Eric's areas of expertise include Scoping and EIA, Integrated Waste Management Plans, IFC Performance Standards on E&S Sustainability (2012) compliance assessment, EMS ISO 14001:2004, Waste and Wastewater

Impact/Quality Assessment, Bioremediation and Environmental Site Assessment (Phases I, II & III). Apart from his wealth of experience as an environmental consultant, he has an outstanding record in research and academic scholarship with Rhodes University, yielding sound scholarly publications and a patented technology for the rehabilitation and re-vegetation of coal mined land, which is currently in use in South Africa.

Bill Rowlston

Bill holds a First Class Honours degree in civil engineering from the University of Salford, England (1971), after which he worked for 11 years for engineering consultants in England.

He worked for 25 years for the South African Department of Water Affairs and Forestry, where he contributed to the development of the National Water Policy and the National Water Act, and compiled and edited the National Water Resource Strategy, First Edition (2004), much of which he wrote.

Bill joined CES as a Director in 2007. He has worked as project manager on a number of large ESIA's and ESHIA's in South Africa and in other African countries, and has undertaken environmental and social due diligence studies, compliance reviews and audits to international standards for a range of proposed and operational projects.

He has also prepared specialist reports on water resources, and has compiled traffic impact assessments for industrial, agri-industrial and mining projects, including a manganese smelter and an agri-industrial development in South Africa's Eastern Cape Province, an iron ore mine in Mozambique, forestry and agri-industrial projects in Mozambique, and a bulk water main in Kwa-Zulu Natal, South Africa.

2. PROJECT DESCRIPTION

2.1 Introduction

Information regarding the three deposits has been based on a drilling programme on the Roode Heuvel and Leeuvlei portions, as Zirco has not drilled the Sabie deposit yet. To date Zirco has completed 12 843 m of air core drilling and fully delineated the deposits on Roode Heuvel and Leeuvlei. Drilling was extended to the basement rock to fully define the depth of the deposit. Global total heavy mineral (THM) grades are in the order of 3%, with both deposits together projected to contain some 1 400 million tons of mineralised sand. These sands consist of surface aeolian sand (referred to as Red Aeolian Sands - RAS), and higher slimes, mineralised sand (referred to as Orange Feldspathic Sands – OFS). These make up the bulk of the deposit. Basal grits and conglomerates are locally developed immediately above the basement.

2.2 Project description

Based on the drilling programme completed, mineral resource estimates and mining studies undertaken at the Roode Heuvel deposit alone has an estimated mineral reserve of 270 million tons at 4.8% THM which could support 20 years of mining at a rate of 1 500 to 2 300 tons per hour (tph). Mining operations are planned to cover approximately 3 500 hectares. Initial mining will target the higher grade areas at an initial rate of 1 000 to 1 500 tph. After year 6 the operation will move to the lower grade areas and the mining rate will increase to 1 800 to 2 300 tph to maintain an average output of about 520 000 tons per annum (tpa) of heavy mineral concentrate. Over a 20 year mine life a total of some 270 million tons would be mined.

The mining will be initiated by the clearing of vegetation and stockpiling of topsoil ahead of the mine path. This will be followed by the excavation of the mineralised sand by dry mining process using front end loaders. The excavated sand will be screened to remove any oversized materials that will be returned to the mine pit. Screened sand is then transferred to a hopper from where it will be slurried and pumped to the Primary Concentrator Plant (PCP) to produce a Heavy Mineral Concentrate (HMC). Once the HMC has been upgraded to 95% THM it will be transported by trucking from the PCP to the Mineral Separation Plant (MSP), which is located at the mine site, where the HMC is processed to the final products - ilmenite, monazite, zircon and rutile. The products are then stored and transported to the market.

Tailings will be placed in an off mine path tailings facility as well as backfill within the mined areas (mine pit), covered with top soil and rehabilitated. A tailings facility is necessary as an initial void must be created prior to being able to deposit tailings back into the mined out areas and as a storage area when the areas being mined are not deep enough, or too steep, for effective tailings backfill.

While the project has been designed to minimise overall infrastructure requirements, mineral sands mining and processing plants require substantial quantities of water and energy (both in the form of fuel and electricity) to operate.

According to TZ Minerals International (2012):

- Up to 12 million m³ of make-up water will be required per annum, translating to 33 000 m³ per day. It is anticipated that seawater will be used for processing in the PCP as there is insufficient groundwater available for this purpose.
- Power requirement of 15 MW will be sourced from the national power grid.
- Approximately 10 million litres of fuel will be required for the MSP and related project use per annum. Both diesel and paraffin will be required, necessitating the need for

constructing a fuel depot. This will be done by a fuel supply company who will sell fuel on site to the mine.

Ancillary infrastructures to be constructed during the 12 to 18 months construction phase include:

- Administrative buildings, canteen and housing accommodation;
- Desalination plant;
- Ablution facilities;
- Landfill site;
- Fuel storage depot;
- Workshops, laboratories and clinic; and
- Airstrip.

Further details of the project description are contained in the *Kamiesberg Project, Namaqualand, South Africa, Final Environmental Impact Assessment Report (2014)*.

3. BACKGROUND TO ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

3.1 Introduction

Environmental and Social Management Plan, otherwise referred to as “Management Program” summarises the client’s commitments to address and mitigate risks and impacts identified as part of the E&S assessment, through avoidance, minimisation, and compensation/offset (Equator Principles III, 2013). It establishes mitigation measures which defines desired outcomes and actions to address the issues raised during the E&S assessment, as measurable events to the extent possible, with elements such as performance indicators, targets, or acceptance criteria that can be tracked over defined time periods, and with estimates of the resources and responsibilities for implementation. More specifically, the ESMP should include the following components:

- *Mitigation*: This identifies feasible and cost-effective measures that may reduce potentially significant adverse environmental impacts to acceptable levels. The plan includes compensatory measures if mitigation measures are not feasible, cost-effective, or sufficient.
- *Monitoring*: Environmental monitoring during project implementation provides information about key environmental aspects of the project, particularly the environmental impacts of the project and the effectiveness of mitigation measures.
- *Capacity Development and Training*: To support timely and effective implementation of mitigation measures, the ESMP must draw attention to the existence, role, and capability of environmental departments at various Government levels. The ESMP must provide a specific description of institutional arrangements, specifying who is responsible for carrying out the mitigation and monitoring measures.
- *Implementation Schedule and Cost Estimates*: For all three aspects (mitigation, monitoring, and capacity development), the ESMP provides an implementation schedule for measures that must be carried out as part of the project, and the capital and recurrent cost estimates and sources of funds for implementing the ESMP may also be provided.

The ESMP ensures that:

1. **During project planning and design** all mitigation measures identified during the ESIA that could be incorporated into the layout or design of the project are considered (as documented in this report). Although some of the identified responsibilities can be passed on to various third parties, such as contractors for construction-related impacts or sub-contractors for various operational activities (e.g. Vegetation clearing/ spillage from truck carrying raw organic material), the ultimate responsibility for ensuring compliance with the objectives of E&S management rests with Zirco and its project managers. A good approach to facilitate legal enforceability of the ESMP is to integrate the ESMP into the tender and contractual documents as a set of environmental specifications.
2. **During construction** all constraints, restrictions and actions required to minimize construction related impacts are implemented.
3. **During commissioning and operation**, detailed operating procedures are developed so that all constraints, restrictions and actions required to minimize impacts caused by commissioning and operation are developed, implemented and monitored for all aspects of the project.
4. **During the life of the project** continue to enhance positive impacts and ensure mitigation for negative impacts. An important component of this is monitoring, evaluation and communication of findings, and adherence to the principle of continued improvement.
5. **During decommissioning**, detailed procedures are developed to ensure that the project area is rehabilitated to an acceptable and previously agreed-to level.

3.2 Framework Environmental and Social Management Plans

The E&S assessment is normally conducted prior to preparation of the final design and operational details of the development. While it is possible to identify and assess potential E&S impacts at this early stage, in many cases, the outcome of the assessment process results in modification of the original conceptual plans. Thus, while it is possible to identify a number of specific mitigations measures applicable to the construction and operational phases at the time of completing the E&S assessment, it is necessary to allow for modification of these mitigation measures as the plans for the development mature. Framework ESMP allows for this flexibility and this approach has been adopted for the current development (see chapter 8). All ESMPs would be continually implemented and periodically audited, reviewed, and, if required, redeveloped to ensure that the procedures are efficient and serve their purpose.

A Framework ESMP does not present technical details and specifications for managing construction or operational phase impacts since many of these have not been finalised yet. Rather, it maps out broad management initiatives and principles, and establishes a framework within which environmental issues are managed at various stages in the project. The framework and principles do not deal with the specific project specifications of construction or operational impacts, and usually reflect the company's commitment and responsibility to manage project impacts. Although much of this responsibility is passed on to various third parties, such as contractors for construction related impacts or sub-contractors for various operational activities, the ultimate responsibility for ensuring compliance with the objectives of the Framework ESMP rest with the proponent and their project managers.

In large and complex projects it is usually necessary to expand and add to the environmental framework, management initiatives and principles developed in the Framework ESMP for the construction, operation and decommissioning phases of a project as the project evolves. This is required in order to update the Framework ESMPs using specific project details regarding the various actions that will take place once the project is implemented. These specific details are used to develop phase and action specific ESMP, but these will be guided overall by the framework and principles detailed in the Framework ESMP.

Further detail on the ESMPs for each phase of the project is provided below.

3.2.1 Design and Planning Phase ESMP

The Design and Planning Phase ESMP (D/PESMP) is an integral component of the project life cycle and requires interaction between the design engineers and environmental consultants to ensure that the engineers are aware of the environmental constraints that they must consider and incorporate into the final design. For the Zirco Kamiesberg Project, the selected contractor will finalise the detailed design for many of the components and undertake the construction of the plant and equipment. To ensure that the E&S constraints are accommodated in the final detailed design, the selected contractors will be briefed through the production of a D/PESMP.

The format of the D/PESMP is that of a checklist, to ensure that all specifications are included in the design phase. The design phase requires ongoing and in-depth discussions between the contractors final design team and the environmental officer. The engineer will have to cost for and be available for ongoing discussions with the environmental officer at all stages of final design. The key aim of the D/PESMP is to ensure that the final design stages of the Zirco Kamiesberg Project and its entire associated infrastructure, during its construction, operation, closure, and post-closure phases:

- Adheres to South African law.

- Adheres to applicable International best Practice including the IFC Performance Standards on Environmental and Social Sustainability (2012), IFC General EHS Guidelines (2007) and the IFC EHS Guidelines for Mining (2007);
- Takes due cognisance of the biophysical, social and economic environment in which the project will operate.

While the contractor is required to adhere to all the standards and policies outlined in this document (see chapter 4 of this report), the following checklist of criteria will be included as a minimum in the final design of project:

1. Any changes to the proposed location of primary infrastructure will take due cognisance of the environment and local communities and in particular impacts on the adjacent terrestrial environment.
2. Runoff and stormwater controls to be developed to prevent increased turbidity and pollution of fresh and marine water due to increased runoff.
3. Erosion control measures to be developed for the various project components where bare ground is exposed or where soil is stockpiled.
4. Any elements of the project that will result in air emissions or fugitive dust (such as product conveyors) will be designed in such a way so as to ensure that the required emissions limited and ambient air quality standards are consistently achieved.
5. Noise reduction measures to ensure that the relevant noise limits are not exceeded at the boundary of the site.
6. To prevent/contain oil spillages and chemical pollution of terrestrial and marine areas, the following must be incorporated into the design of the relevant components:
 - a. Oil traps, cut-off drains, sumps and settling ponds to be installed at all vehicle servicing areas, areas with hydraulic and transformer oils and other areas where needed.
 - b. Specific approved areas to be dedicated as routine service areas.
 - c. Fuel and chemical storage tanks to be designed in suitably bunded areas and in accordance with the accepted international standards.
 - d. An emergency response/preparedness plan for chemical spills and related incidents to be developed.
 - e. A training and awareness programme for handling chemical products to be developed and implemented.
7. Environmental performance objectives and measurable indicators against which the performance of the project can be measured and monitored have been developed and these will be applicable to all phases of the project to ensure the impact on the marine and terrestrial biophysical environment is minimal.

3.2.2 Construction Phase ESMPs

A comprehensive Construction Phase ESMP (CESMP) will be employed during the construction phase. This will list activities during the construction phase that are likely to have environmentally and socially significant impacts, and provide mitigation measures. Zirco will implement the CESMP for all activities that will occur during the construction phase (e.g. Waste Management Plan) based on international standards, especially IFC Performance Standards on Environmental and Social Sustainability (2012). This will be done to protect human health and the environment from the potential impacts of its activities, and to assist in maintaining and improving the quality of the environment.

3.2.3 Operational Phase ESMPs

The Operational Phase ESMP (OESMP) lists activities during the operational phase that are likely to have environmentally and socially significant impacts, and provide mitigation measures. Zirco will implement the OESMP for all operational activities (e.g. Waste Management Plan) based on international standards, especially IFC Performance Standards

on Environmental and Social Sustainability (2012). This will be done to protect human health and the environment from the potential impacts of its activities, and to assist in maintaining and improving the quality of the environment.

In some cases Standard Operating Procedures (SOPs) or Method Statements will be adequate to manage certain aspects of the operation. These should focus on the measures and actions necessary to comply with specific regulations and other applicable standards. For example, a SOP can be developed to deal with the handling and use of chemicals and pesticides. In addition, E&S Action Plans (ESAP) may be developed to fill in the gaps of existing management programmes or SOPs to ensure consistency or to provide immediate remedy and timely closure of specific items.

Environmental management during the operational phase will deal with impacts associated with, and caused by, the operational phase of the project. The OESMP eventually becomes the environmental, social, safety and occupational health operational procedures, much like specifications, that govern the actual day-to-day operational activities of the operation, and must therefore be practical, implementable and precise. They will form part of the Technical Operational Procedures that detail exactly how each operation needs to be undertaken and by whom, as well as when, to ensure efficient, safe and environmentally and socially acceptable operations. They deal with the "on-the-ground" management of actions that may have a direct impact on the environment and people.

3.2.4 Decommissioning Phase ESMPs

As the final phase in the project cycle, decommissioning may present positive environmental opportunities associated with the return of the land for alternative use and the cessation of impacts associated with operational activities. However, depending on the nature of the operational activity, the need to manage risks and potential residual impacts may remain well after operations have ceased. Examples of potential residual impacts and risks include contamination of soil and groundwater and old (unserviceable) structures. Decommissioning phase ESMP (DEMP) is typically encountered within extractive industries such as oil and gas exploration and extraction, and mineral mining extraction such as the Zirco Kamiesberg Project. It should be noted that due to the expected lifespan of the proposed project, a detailed DESMP has not been included in this volume but will need to be developed closer to the time of decommissioning.

A DESMP to be developed will include specifications relevant to the decommissioning of all the facilities, outlining the procedures required to close and rehabilitate the site once all operational activities have ceased. Closure and Rehabilitation Plans form an intricate part of the DESMP.

4. APPLICABLE POLICIES, LEGISLATION AND STANDARDS

A number of local and international standards and guidelines are applicable to the Zirco Kamiesberg Project and are briefly discussed below.

4.1 Applicable Local and National Legal Requirements

A summary of the applicable local and national legal requirements is provided in Tables 4.1 (legislation), 4.2 (environmental permits and licences) and 4.3 (national standards). It should be noted that the list provided below is not exhaustive, and has been restricted to documents that have direct relevance to either the environment and/or communities.

Table 4.1: Applicable Legislation and their relevance

Legislation	Relevance
<i>The Constitution of South Africa (Act No.108 of 1996)</i>	
	<ul style="list-style-type: none"> • Obligation to ensure that the proposed development will not result in pollution and ecological degradation; and • Obligation to ensure that the proposed development is ecologically sustainable, while demonstrating economic and social development.
<i>The National Environmental Management Act (NEMA) (107 of 1998) as amended</i>	
	<ul style="list-style-type: none"> • Obligation to ensure that the proposed development should, where possible, be in accordance with the NEMA guiding principles. Where this is not possible, deviation from the principles would have to be very strongly motivated; • Obligation to ensure that the proposed development will not result in pollution and ecological degradation; and • Obligation to ensure that the proposed development is ecologically sustainable, while demonstrating economic and social development.
<i>The National Forests Act (84 of 1998)</i>	
	<ul style="list-style-type: none"> • If any protected trees in terms of this Act occur on site, the developer will require a licence from the Department of Agriculture, Forestry and Fisheries (DAFF) to perform any of the above-listed activities.
<i>National Heritage Resources Act (25 of 1999)</i>	
	<ul style="list-style-type: none"> • An archaeological impact assessment must be undertaken during the detailed ESIR phase of the proposed project. • No person may alter or demolish any structure or part of a structure, which is older than 60 years or disturb any archaeological or paleontological site or grave older than 60 years without a permit issued by the relevant provincial heritage resources authority. • No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter or deface archaeological or historically significant sites.
<i>National Environmental Management: Air Quality Act (39 of 2004)</i>	
	<ul style="list-style-type: none"> • The “best practicable means” for the abatement of dust during construction and operation if approved have to be taken. • All appliances used for preventing or reducing to a minimum the escape into the atmosphere of noxious or offensive gases have to be properly operated and maintained and the best practice means for achieving this implemented. • The construction of facilities for the storage of ore may require an Air Emissions Licence should it be required to stockpiles ore in excess of 100 000 tons in an area other than the mine site.
<i>Occupational Health and Safety Act (85 of 1993)</i>	

- The developer must be mindful of the principles and broad liability and implications contained in the Occupational Health and Safety (OH&S) Act and mitigate any potential impacts.

National Water Act (36 of 1998)

- 19 (1) An owner of land, a person in control of land or a person who occupies or uses the land on which—
 - (a) any activity or process is or was performed or undertaken; or
 - (b) any other situation exists, which causes, has caused or is likely to cause pollution of a water resource, must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring.

Hazardous Substances Act (15 of 1973)

- Manage the hazardous waste in such a manner that it does not endanger human health or the environment.
- Prevent the waste from being used for an unauthorised purpose.

National Environmental Management: Protected Areas Act (31 of 2004)

- The proposed mine site is in close proximity to the Namaqua National Park

Conservation of Agricultural Resources Act (43 of 1983)

- If any declared weed and/or invader species listed in terms of this Act is present on site, it will have to be removed.

Mineral and Petroleum Resources Development Act (28 of 2002)

- The proposed project requires a mining license from Department of Mineral Resources (DMR).

National Environmental Management: Waste Act (59 of 2008)

- All reasonable measures must be taken to avoid the generation of waste and where such generation cannot be avoided, minimise the toxicity and amounts of waste that are generated; reduce, re-use, recycle and recover waste; where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
- Manage the waste in such a manner that it does not endanger human health or the environment or cause a nuisance through noise, odour or visual impacts.
- Prevent any employee or any person from contravening this Act; and prevent the waste from being used for an unauthorised purpose.
- Waste management activities should be licensed.

National Environmental Management: Integrated Coastal Management Act (24 of 2008)

- A coastal lease may be required from the Minister for the construction of infrastructure within areas defined as Coastal Public Property.

National Nuclear Regulator Act (47 of 1999)

- There may be permitting requirements for the production of ilmenite, zircon, rutile and monazite

Municipal by-laws and planning

- There will be certain requirements related to H&S during construction and approval of method statements. Certain activities related to the proposed development may, in addition to National legislation, be subject to control by municipal by-laws including the Namaqua District Municipality and Kamiesberg Local Municipality Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs).

Namaqua District Municipality

- According to the Namaqua District Municipality IDP (Draft IDP 2014/2015), one of the

focus areas will be to optimize natural resource use within the area in a sectorial manner. One of the goals set to achieve this is a mineral beneficiation plant (i.e. process whereby extracted ore from mining is separated into mineral and waste rock or tails). Since the mineral separation plant separates the HMC into product this qualifies as beneficiation and is thus in line with the IDP.

- In addition to the above, the IDP also stresses the need for social development within the area. Various goals such as the establishment of sport, arts, culture and heritage centres, and providing support to vulnerable groups, providing infrastructure, etc have been set by the District Municipality.

Table 4.2: Environmental Permits and Licences

Act, Regulation or Bylaw	Permit or licence	Requirements	Implementing agency
National Water Act, No. 36 of 1998, as amended	Water Use Licence	A licence is required for the abstraction, storage, use, diversion, flow reduction of water as well as for the treatment and disposal of effluent and sewage.	Department of Water & Sanitation (DWA&S)
NEM:Air Quality Act, No. 39 of 2004	Atmospheric Emission Licence	No listed activity in terms of the Act can take place without a licence.	Municipality
NEM:Waste Act, No. 59 of 2008	Waste Management Licence	A licence is required to establish and operate a waste disposal site. The Waste Management Series Guidelines issued by the former Department of Water Affairs and Forestry (DWAF) must be followed in order to obtain a licence.	Department of Environmental Affairs (DEA): Directorate: Integrated Pollution Prevention and Waste Management
National Forests Act, No. 84 of 1998	Forest Licence	A licence is required to cut, damage or destroy any listed indigenous trees.	DAFF
Mineral and Petroleum Resources Development Act, No. 28 of 2004	Prospecting Right Mining Right Mining Permit	Authorisation is required to explore, prospect for and mine any mineral.	DMR
Mineral and Petroleum Resources Development Act, No. 28 of 2004	Reconnaissance Permit Exploration Right Production Right	Authorisation is required to carry out reconnaissance and exploration activities for oil and gas and to produce such oil and gas.	DMR
Mineral and Petroleum Resources Development Act, No. 28 of 2004, and the Mine Health and Safety Act, No. 29 of 1996	Blasting Permit	A permit is required for any blasting activity.	DMR
National Heritage Resources Act, No. 25 of 1999	Permit	Permits are required for any development that may affect heritage resources, such as graves, wrecks and old buildings.	South African Heritage Resources Agency

Table 4.3: Effluent and Emission Standards and Guidelines

Sector	Relevant Documents
Solid waste	National Waste Management Strategy (DEA, 2011)
	Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, 3rd ed. (DWAF, 2005a)
	Minimum Requirements for Waste Disposal by Landfill, 3rd ed. (DWAF, 2005b)
	Minimum Requirements for Water Monitoring at Waste Management Facilities, 3rd ed. (DWAF, 2005c)
	White Paper on Integrated Pollution and Waste Management for South Africa (2000)
	National Norms and Standards for the Storage of Waste, Government Notice 926 of 2013
	National policy for the Provision of Basic Refuse Removal Services to Indigent Households (DEA, 2010)
	National Domestic Waste Collection Standards, Government Notice 21 of 2011
	Waste Classification and Management Regulations, Government Notice R634 of 2013
	National Norms and Standards for the Assessment of Waste for Landfill Disposal, Government Notice R635 of 2013
	National Norms and Standards for Disposal of Waste to Landfill, Government Notice R636 of 2013
	Guidelines for the Utilization and Disposal of Wastewater Sludge. Vol.1 to 5 (DWAF, 2006)
	Framework for the Management of Contaminated Land (DEA, 2010)
	Draft Standards for Assessment of Waste for Landfill Disposal. Notice 613 of 2012
	Waste Classification and Management Regulations 2013
	National Norms and Standards for the Remediation of Contaminated Land and Soil Quality 2014
	Guidelines for the Utilisation and Disposal of Wastewater Sludge, Vol. 1-5 (DWAF, 2005)
Water quality	SANS 241-1:2011: Drinking Water Specifications. Part 1: Microbiological, Physical, Aesthetic and Chemical Determinants
	SANS 241-2:2011: Application of SANS 241-1:2011
	National Guidelines for the Discharge of Effluent from Land-based sources into the coastal environment (2014)
	South African Water Quality Guidelines series, Vol. 1–8, (DWAF, 1996)
	General Authorisations, Government Gazette NO. 20526 of 1999
	Water Quality Management - Catchment Management Series 8.1 to 8.3 (DWAF, 2001)
Noise Quality	SANS 10103:2008: The Measurement and Rating of Environmental Noise with Respect to Annoyance and to Speech Communication
	SANS 10328:2008: Methods for Environmental Noise Impact Assessments
Air Quality	SANS 69:2004: Framework for setting and implementing national Ambient Air Quality Standards

Sector	Relevant Documents
	SANS 1929:2005: Ambient Air Quality – Limits for Common Pollutants
	National Ambient Air Quality Standards. Notice 1210 of 2009
	SANS 1929:2011: Air Quality Standard limits
	Model Air Quality Management By-Law for Easy Adoption by Municipalities. Notice 579 of 2010
	National Ambient Air Quality Standards. Notice 1210 of 2009
	National Dust Control Regulations. Notice 827 of 2013

4.2 International Instruments

4.2.1 The Equator Principles

The Equator Principles (Box 1 below) are a financial industry benchmark for determining, assessing and managing social and environmental risks to projects. They are intended to ensure that projects financed by the Equator Principles Financial Institutions (EPFI) are developed in a manner that is socially responsible and reflects sound environmental management practices. In January 2013 a total of 79 financial institutions from 32 countries across the globe had adopted the Equator Principles.

Box 1: The Equator Principles (EP III - June 2013)

Statement of Principles

The EPFI will only provide Project Finance and Project-Related Corporate Loans to Projects that meet the requirements of Principles 1-10.

Principle 1: Review and Categorisation

When a Project is proposed for financing the EPFI will, as part of its internal environmental and social review and due diligence, categorise it based on the magnitude of its potential environmental and social risks and impacts. Such screening is based on the environmental and social categorisation process of the International Finance Corporation (IFC).

Using categorisation the EPFI's environmental and social due diligence is commensurate with the nature, scale and stage of the Project, and with the level of environmental and social risks and impacts.

The categories are:

Category A – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented;

Category B – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and

Category C – Projects with minimal or no adverse environmental and social risks and/or impacts.

Principle 2: Environmental and Social Assessment

For all Category A and Category B Projects the EPFI will require the client to conduct an Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and impacts of the proposed Project (which may include the illustrative list of issues found in Exhibit II ^[1]). The Assessment Documentation should propose measures to minimise, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed Project.

The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A, and as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA). One or more specialised studies may also need to be undertaken. Furthermore, in limited high risk circumstances it may be appropriate for the client to complement its Assessment Documentation with specific human rights due diligence. For other Projects, a limited or focused environmental or social assessment (e.g. audit), or straightforward application of environmental siting, pollution standards, design criteria, or construction standards may be carried out.

For all Projects, in all locations, when combined Scope 1 and Scope 2 Emissions are expected to be more than 100 000 tonnes of CO₂ equivalent annually, an Alternatives Analysis will be conducted to evaluate less Greenhouse Gas (GHG) intensive alternatives. Refer to Annex A for alternatives analysis requirements

Principle 3: Applicable Environmental and Social Standards

The Assessment process should, in the first instance, address compliance with relevant host country laws,

regulations and permits that pertain to environmental and social issues.

EPFIs operate in diverse markets: some with robust environmental and social governance, legislation systems and institutional capacity designed to protect the people and the natural environment; and some with evolving technical and institutional capacity to manage environmental and social issues.

The EPFI will require that the Assessment process evaluates compliance with the applicable standards as follows:

1. For Projects located in Non-Designated Countries, the Assessment process evaluates compliance with the then applicable IFC Performance Standards on Environmental and Social Sustainability (Performance Standards) and the IFC / World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) (Exhibit III ^[2]).
2. For Projects located in Designated Countries, the Assessment process evaluates compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. Host country laws meet the requirements of environmental and/or social assessments (Principle 2), management systems and plans (Principle 4), Stakeholder Engagement (Principle 5) and, grievance mechanisms (Principle 6).

The Assessment process will establish to the EPFI's satisfaction the Project's overall compliance with, or justified deviation from, the applicable standards. The applicable standards (as described above) represent the minimum standards adopted by the EPFI. The EPFI may, at their sole discretion, apply additional requirements.

Principle 4: Environmental and Social Management System and Equator Principles Action Plan

For all Category A and Category B Projects the EPFI will require the client to develop or maintain an Environmental and Social Management System (ESMS).

Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where the applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree an Equator Principles Action Plan (AP). The Equator Principles AP is intended to outline gaps and commitments to meet EPFI requirements in line with the applicable standards.

Principle 5: Stakeholder Engagement

For all Category A and Category B Projects the EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities and, where relevant, other stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to: the risks and impacts of the Project; the Project's phase of development; the language preferences of the Affected Communities; the decision-making processes; and the needs of disadvantaged and vulnerable groups. This process should be free from external manipulation, interference, coercion and intimidation.

To facilitate Stakeholder Engagement the client will, commensurate to the Project's risks and impacts, make the appropriate Assessment Documentation readily available to the Affected Communities, and where relevant other stakeholders, in the local language and in a culturally appropriate manner.

The client will take account of and document the results of the Stakeholder Engagement process, including any actions agreed resulting from such process. For Projects with environmental or social risks and adverse impacts disclosure should occur early in the Assessment process, in any event before the Project construction commences, and on an ongoing basis.

EPFIs recognise that indigenous peoples may represent vulnerable segments of project-affected communities. Projects affecting indigenous peoples will be subject to a process of Informed Consultation and Participation, and will need to comply with the rights and protections for indigenous peoples contained in relevant national law, including those laws implementing host country obligations under international law. Consistent with the special circumstances described in with adverse impacts on indigenous people will require their Free, Prior and Informed Consent (FPIC).

Principle 6: Grievance Mechanism

For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the ESMS, to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance.

The grievance mechanism is required to be scaled to the risks and impacts of the Project and have Affected Communities as its primary user. It will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, readily accessible, at no cost, and without retribution to the party that originated the issue or concern. The mechanism should not impede access to judicial or administrative remedies. The client will inform the Affected Communities about the mechanism in the course of the Stakeholder Engagement process.

Principle 7: Independent Review

Project Finance

For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence and assess Equator Principles compliance.

The Independent Environmental and Social Consultant will also propose or opine on a suitable Equator Principles

AP capable of bringing the Project into compliance with the Equator Principles, or indicate when compliance is not possible.

Project-Related Corporate Loans

An Independent Review by an Independent Environmental and Social Consultant is required for Projects with potential high risk impacts including, but not limited to, any of the following:

- adverse impacts on indigenous peoples
- Critical Habitat impacts
- significant cultural heritage impacts
- large-scale resettlement

In other Category A, and as appropriate Category B, Project-Related Corporate Loans, the EPFI may determine whether an Independent Review is appropriate or if internal review by the EPFI is sufficient. This may take into account the due diligence performed by a multilateral or bilateral financial institution or an OECD Export Credit Agency, if relevant.

Principle 8: Covenants

An important strength of the Equator Principles is the incorporation of covenants linked to compliance.

For all Projects, the client will covenant in the financing documentation to comply with all relevant host country environmental and social laws, regulations and permits in all material respects.

Furthermore for all Category A and Category B Projects the client will covenant the financial documentation:

- a) to comply with the ESMPs and Equator Principles AP (where applicable) during the construction and operation of the Project in all material respects; and
- b) to provide periodic reports in a format agreed with the EPFI (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third party experts, that i) document compliance with the ESMPs and Equator Principles AP (where applicable), and ii) provide representation of compliance with relevant local, state and host country environmental and social laws, regulations and permits; and
- c) to decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.

Where a client is not in compliance with its environmental and social covenants, the EPFI will work with the client on remedial actions to bring the Project back into compliance to the extent feasible. If the client fails to re-establish compliance within an agreed grace period, the EPFI reserves the right to exercise remedies, as considered appropriate.

Principle 9: Independent Monitoring and Reporting

Project Finance

To assess Project compliance with the Equator Principles and ensure ongoing monitoring and reporting after Financial Close and over the life of the loan the EPFI will, for all Category A and, as appropriate, Category B Projects, require the appointment of an Independent Environmental and Social Consultant, or require that the client retain qualified and experienced external experts to verify its monitoring information, which would be shared with the EPFI.

Project-Related Corporate Loans

For Projects where an Independent Review is required under Principle 7 the EPFI will require the appointment of an Independent Environmental and Social Consultant after Financial Close, or require that the client retain qualified and experienced external experts to verify its monitoring information which would be shared with the EPFI.

Principle 10: Reporting and Transparency

Client Reporting Requirements

The following client reporting requirements are in addition to the disclosure requirements in Principle 5.

For all Category A and, as appropriate, Category B Projects:

- the client will ensure that, at a minimum, a summary of the ESIA is accessible and available online.
- the client will publicly report GHG emission levels (combined Scope 1 and Scope 2 Emissions) during the operational phase for Projects emitting over 100,000 tonnes of CO₂ equivalent annually. Refer to Annex A for detailed requirements on GHG emissions reporting.

EPFI Reporting Requirements

The EPFI will report publicly, at least annually, on transactions that have reached Financial Close and on its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations. The EPFI will report according to the minimum reporting requirements detailed in Annex B.

Notes:

- [1] **Exhibit II:** Illustrative List of Potential Environmental and Social Issues to be addressed in the Environmental and Social Assessment Documentation.
- [2] **Exhibit III:** IFC Performance Standards on Environmental and Social Sustainability and the IFC / World Bank Group Environmental, H&S Guidelines

The IFC Performance Standards, to which the Equator Principles refer, specifically in Exhibit III, are those that were published and took effect on 1st January 2012.

4.2.2 International Finance Corporation Performance Standards (2012)

In 2005 the IFC embarked on an extensive review of its environmental assessment procedures and performance standards. These performance standards (see Box 2) have become the international benchmark for ESIA's and are used to measure the environmental performance and management of large international projects. They have been adopted by most lender groups and Equator Principle-compliant commercial banks. Since early 2010 these eight Performance Standards have been revised, and the revisions were approved by the Board of the World Bank.

These slightly more rigorous and more clearly defined Performance Standards came into effect in January, 2012. Box 2 below outlines these standards, the main objectives of which are briefly discussed.

Box 2: IFC Performance Standards on Environmental and Social Sustainability

Performance Standard 1:	Assessment and Management of Environmental and Social Risks and Impacts
Performance Standard 2:	Labour and Working Conditions
Performance Standard 3:	Resource Efficiency and Pollution Prevention
Performance Standard 4:	Community Health, Safety and Security
Performance Standard 5:	Land Acquisition and Involuntary Resettlement
Performance Standard 6:	Biodiversity Conservation and Sustainable Management of Living Natural Resources
Performance Standard 7:	Indigenous Peoples
Performance Standard 8:	Cultural Heritage

Note: IFC PS 7 is not applicable to the project, since there is no indication that any group of potentially affected persons in the project's area of influence falls into the IFC definition of indigenous people (social groups with identities that are distinct from dominant groups in national societies)

Of particular relevance to this report is the IFC PS 1. A summary of the key objectives of the PS is set out in the Table 4.4 below.

Table 4.4: Key Objectives of the IFC Performance Standards

Performance Standard	Key objectives
PS 1: Assessment and management of environmental and social risks and impacts	<ul style="list-style-type: none"> ➤ To identify and evaluate environmental and social risks and impacts of the project. ➤ To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. ➤ To promote improved environmental and social performance of clients through the effective use of management systems. ➤ To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately. ➤ To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.
PS 2: Labour and Working Conditions	<ul style="list-style-type: none"> ➤ To promote the fair treatment, non-discrimination, and equal opportunity of workers. ➤ To establish, maintain, and improve the worker-management relationship. ➤ To promote compliance with national employment and labour laws. ➤ To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. ➤ To promote safe and healthy working conditions, and the health of workers. ➤ To avoid the use of forced labour.

Performance Standard	Key objectives
PS 3: Resource efficiency and pollution prevention	<ul style="list-style-type: none"> ➤ To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. ➤ To promote more sustainable use of resources, including energy and water. ➤ To reduce project-related GHG emissions.
PS 4: Community Health, Safety and Security	<ul style="list-style-type: none"> ➤ To anticipate and avoid adverse impacts on the H&S of the Affected Community during the project life from both routine and non-routine circumstances. ➤ To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.
PS 5: Land Acquisition and Involuntary Resettlement	<ul style="list-style-type: none"> ➤ To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs. ➤ To avoid forced eviction. ➤ To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by: <ul style="list-style-type: none"> - providing compensation for loss of assets at replacement cost and - ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. ➤ To improve, or restore, the livelihoods and standards of living of displaced persons. ➤ To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	<ul style="list-style-type: none"> ➤ To protect and conserve biodiversity. ➤ To maintain the benefits from ecosystem services. ➤ To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.
PS 7: Indigenous Peoples	<ul style="list-style-type: none"> ➤ To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. ➤ To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. ➤ To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. ➤ To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle. ➤ To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. ➤ To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.
PS 8: Cultural Heritage	<ul style="list-style-type: none"> ➤ To protect cultural heritage from the adverse impacts of project activities and support its preservation. ➤ To promote the equitable sharing of benefits from the use of cultural heritage.

The effective implementation of the ESMS is weighed heavily on the existing management structure and practice at Zirco. In the absence of an existing Environmental, Health and Safety (EHS) management system, any production and quality-based management systems operating within the organisation can be used as a foundation on which to build the elements of a system consistent with Performance Standards 1. The Zirco Kamiesberg Project will therefore adopt industry best practice management systems that will be implemented in a manner that ensures all requirements presented here are met.

As part of its on-going engagement with affected communities, Zirco is required to disclose its various EHS management plans in advance of project implementation to affected communities and stakeholders, and provide updates throughout the life of the project as

mitigation measures are adjusted and upgraded to reflect the feedback from the affected communities.

4.2.3 IFC General Environmental, Health and Safety Guidelines (2007)

The IFC General EHS Guidelines (2007) provide an organized, hierarchical, best-practice approach to managing EHS issues at facility or project level, which in broad terms comprises the following steps:

- Identifying EHS project hazards and associated risks as early as possible in the facility development or project cycle.
- Understanding the likelihood and magnitude of EHS risks, based on the nature of the project activities and the potential consequences to workers, communities, or the environment if hazards are not adequately managed.
- Prioritising risk management strategies with the objective of achieving an overall reduction of risk to human health and the environment, focusing on the prevention of irreversible and / or significant impacts.
- Favouring strategies that eliminate the cause of the hazard at its source to avoid the need for EHS controls.
- When impact avoidance is not feasible, incorporating engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequences.
- Preparing workers and nearby communities to respond to accidents, including providing technical and financial resources to effectively and safely control such events, and subsequently restoring workplace and community environments to a safe and healthy condition.
- Improving EHS performance through a combination of ongoing monitoring of facility performance and effective accountability.

The guideline document covers environmental, occupational H&S, community health and safety, performance indicators, and monitoring. It provide details of general impacts and ways to manage them and is to be used in conjunction with relevant Industry Sector Guidelines, in this case, the IFC EHS Guidelines for Mining (2007). The IFC General EHS Guidelines (2007) document is organised in four main sections:

1. Environmental
2. Occupational H&S
3. Community H&S
4. Construction and Decommissioning.

4.2.4 IFC EHS Guidelines for Mining

The IFC EHS Guidelines for Mining (2007) provide detail of mining impacts and ways to manage them. It also covers environmental, occupational H&S, community H&S, performance indicators, and monitoring.

5. TRAINING AND AWARENESS PROGRAMMES

5.1 Introduction

Zirco's personnel and its contractors, including third parties, will be conversant with all environmental and social legislation and international best practice applicable to their contract. They will need to be appropriately trained in environmental management in order to possess the skills necessary to impart on their subordinates.

All personnel involved in the construction and operation of the project will undergo a training and awareness programme on E&S management prior to commencing activities. Zirco will develop a procedure for environmental training which will lay out in detail the methodology for developing and presenting environmental awareness and induction training.

Information will be transferred in an appropriate manner and training courses will take language and cultural and educational levels into consideration. In particular, the training of illiterate staff will require the development of appropriate training programmes and extensive use of signage (such as pictures, logos, drawings etc). A site Environmental Handbook will be developed and distributed to all literate personnel. This handbook will cover some of the information presented in the Environmental Awareness and Induction Training. Records will be maintained of all E&S training.

5.2 General and Staff E&S Training

Zirco will ensure that its staff and other employed parties or their contractors, who carry out any aspects of the work, in any phase of the project, are adequately trained with regard to the implementation of the ESMP described here. Contractors and third parties will be aware of their health, safety, environmental and social requirements and obligations, and these will be legally and contractually binding on them. A training-needs-analysis that would cover EHS and Community issues would need to be developed and should identify the appropriate training programmes and target groups.

The training staff will be appropriately trained in their respective disciplines and will possess the skills necessary to train, inform and sensitise all personnel involved in the project.

All personnel involved in the construction and operation of the Zirco Kamiesberg Project will be required to participate in an EHS and Community induction programme. Training programmes will be targeted at three distinct levels of employment, i.e. executive, middle management and labour, and awareness training programmes will contain the following information:

- The names, positions and responsibilities of personnel to be trained.
- The framework for appropriate training plans.
- The summarised content of each training course.
- A schedule for the presentation of the training courses.

The range of topics that need to be covered in the awareness training will, inter alia, include:

- Zirco Kamiesberg Project's Environmental Policy;
- Zirco Kamiesberg Project's Health and Safety Policy;
- Zirco Kamiesberg Project's Community Policy;
- Zirco Kamiesberg Project's Environmental Objectives and Targets;
- Organizational structure and responsibilities;

- Aspects of routine day-to-day operational activities, which can have environmental, social, safety or health impacts;
- Environmental and safety hazards which could arise from non-routine situations and corrective actions;
- The importance of environmental and safety Incident reporting and completion of appropriate reports;
- Emergency Preparedness and Response;
- Channels of communication for discussing and reporting E&S issues;
- Documentation systems for maintaining appropriate records of E&S matters;
- Responsibilities under the applicable E&S legislation and international best practice;
- Responsibilities related to Labour and Working Conditions, in particular, the requirements of IFC Performance Standard 2 that will apply to project and their contractors;
- Culturally appropriate behaviour; and
- Community engagement, awareness, security and grievances.

Additional training on cultural heritage and culturally appropriate behaviour, and on health, safety, environmental and social hazards which could arise from non-routine situations and corrective actions will be provided. Training will highlight the importance of incident reporting and completion of appropriate reports, channels of communication for reporting EHS and Community issues and incidents, documentation systems and responsibilities under South African legislation.

Information will be transferred in an appropriate manner and form part of the induction process for all employees and contractors. The induction and training courses will take language, culture and educational levels into consideration. It is proposed that an EHS and Community Handbook be developed and distributed to all literate personnel.

5.3 Emergency Preparedness and Response Training and Awareness

Where the project involves specifically identified physical elements, aspects and facilities that are likely to have significant E&S impacts, Zirco will establish and maintain an Emergency Preparedness and Response (EPR) Plan, in collaboration with appropriate and relevant third parties. The EPR plan will be developed to respond to accidental and emergency situations associated with the project in a manner that will assist in preventing and mitigating any harm to people and/or the environment. In particular, the EPR plan will address:

- areas where accidents and emergency situations may occur (high risk areas),
- communities and individuals that may be impacted (high risk receptors),
- response procedures,
- provision of equipment and resources,
- designation of responsibilities,
- communication, including that with potentially affected communities; and
- periodic training to ensure effective response.

All staff, including contractors, will adhere to Zirco's EPR plans, including incident and accident-reporting requirements, as well as all relevant South African legislation. Where necessary, Method Statements or SOPs that detail the exact process, resource requirements and responsibilities for ensuring that these emergency procedures are documented and enforceable will be developed.

EPR training and awareness will form part of the EPR plan to be developed. Incidents that will be considered during the development of the EPR will include but will not be limited to:

- Details on emergency organisation (manpower) and responsibilities, accountability and liability;

- A list of key personnel to be contacted;
- Details of emergency services applicable to the various areas along the route that components will need to be transported and for the site itself (e.g. the fire department, spill clean-up services, etc.);
- Internal and external communication plans, including prescribed reporting procedures where required by legislation;
- A risk assessment and Hazard and Operability Study (HAZOP) to identify all potential incidents and emergencies;
- Actions to be taken in the event of different types of emergencies;
- Incident recording, progress reporting and remediation measures required to be implemented;
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release; and
- Training plans, testing exercises (including fire drills) and schedules for effectiveness;

Training and awareness component to be considered for the EPR plan will include:

- Accidental discharges to water and land;
- Accidental exposure of employees to hazardous substances;
- Medical evacuation;
- Work stoppage incidents requiring medical intervention across all aspects of the operation
- Accidental fires and fire drill; and
- Vehicle accidents, including vehicle collisions with pedestrians.

6. COMMUNITY ENGAGEMENT

6.1 Introduction

Stakeholder Engagement is an integral part of the EISA process (NEMA of No 107 of 1998). Stakeholders are defined in this chapter as per the IFC Standards (2012), which describe a stakeholder as, “[...] *persons or groups who are directly or indirectly affected by a project, as well as those who may have an interest in a project and/or the ability to influence its outcomes, either positively or negatively*”¹. Stakeholders can be conceptualised as groups, individuals or organisations that have a direct interest in a particular project. Such an interest might also be the stakeholder’s ability to influence decisions. The term is therefore an overarching term that applies to all the affected community members, future labour, government and Interested and Affected Parties (I&APs).

The stakeholder and community engagement process is a crucial process for any project. It is vital that all I&APs are not only aware of the project and its possible negative implications, but also understand the project and its potential benefits to their communities and surrounding environment. Failure to do so could cause disputes and disagreements between communities, the developer and government authorities and the disruption of established structures such as community administration.

6.2 Stakeholder Engagement Planning

A Stakeholder Engagement Plan (SEP) is the basis for building strong, constructive and responsive relationships that are essential for the successful management of a project’s E&S impacts. This is an on-going process that may involve, in varying degrees, the following elements: Stakeholder engagement planning; Disclosure and dissemination of information; consultation and participation; a grievance mechanism; and on-going reporting to affected communities.

The main objectives of SEP are as follows:

- Disclosure of planned project activities;
- Identification of concerns and grievances from stakeholders;
- Harnessing of local expertise and knowledge from interested and affected people;
- Response to grievances and enquiries of stakeholders; and
- Promoting collaborative efforts.

Stakeholder engagement is initiated during the ESIA process and continues for the duration of the project’s life cycle. As a minimum, the SEP will be:

- Underpinned by the concept of free prior and informed consent; and
- Structured in accordance with IFC’s guideline document “Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets (IFC, 2007).

Disclosure of relevant project information helps affected communities and other stakeholders understand the risks, impacts and opportunities of the project. Zirco will provide affected communities with access to relevant information and consultations and will avail the affected communities the opportunity to express their views on project risks, impacts and mitigation

¹ IFC. 2007. *Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets*. [Online]. Available: http://www1.ifc.org/wps/wcm/connect/938f1a0048855805beacfe6a6515bb18/IFC_StakeholderEngagement.pdf?MOD=AJPERES [2013, June 12].

measures. This will allow Zirco the opportunity to consider and respond to them.

In instances where stakeholder engagement is the responsibility of the South African authorities, Zirco will collaborate with the responsible government agency, to the extent permitted by the agency, to achieve outcomes that are consistent with the required objectives. In addition, where government capacity is limited, Zirco will play an active role during the stakeholder engagement planning, implementation and monitoring. According to the IFC Performance Standard 1 requirement, if the process conducted by the government does not meet the relevant requirements, Zirco will conduct a complementary process and, where appropriate, identify supplemental actions.

The benefits of timely stakeholder engagement include the following:

- It assists the developer to address relevant issues, including those raised by the different stakeholder groups.
- It harnesses traditional knowledge which conventional approaches often overlook.
- It improves information flow between the developers and different stakeholder groups, improving the understanding and 'ownership' of a project.
- It enables project proponents to better respond to different stakeholders' needs.
- It helps to identify important environmental characteristics or mitigation opportunities that might have been overlooked during the ESIA process.
- It helps to ensure that the magnitude and significance of impacts has been properly assessed; and improves the acceptability and quality of mitigation and monitoring processes.
- It may avoid escalation of potential conflicts between the company and the stakeholders.

6.3 South African Legislation on Stakeholder Engagement

According to Section 54(2) of the National Environmental Management Act, 107 of 1998 as amended (NEMA) "the person conducting a public participation process must take into account any guidelines applicable to public participation as contemplated in section 24J of the Act and must give notice to all potential interested and affected parties of the application which is subjected to public participation by:

- (a) Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of
 - i. The site where the activity to which the application relates is or is to be undertaken; and
 - ii. Any alternative site mentioned in the application.
- (b) Giving written notice to:
 - i. The owner or person in control of that land if the applicant is not the owner or person in control of the land;
 - ii. The occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
 - iii. Owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
 - iv. The municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
 - v. The municipality which has jurisdiction in the area;
 - vi. Any organ of state having jurisdiction in respect of any aspect of the activity; and
 - vii. Any other party as required by the competent authority;

- (c) Placing an advertisement in:
 - i. One local newspaper; or
 - ii. Any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations.
- (d) Placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or local municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official Gazette referred to in sub-regulation (c)(ii) paragraph (c)(ii); and
- (e) Using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is desiring of but unable to participate in the process due to:
 - i. Illiteracy;
 - ii. Disability; or
 - iii. Any other disadvantage.”

In addition to the above and according to Section 55 (1) of the NEMA Regulations “an Environmental Assessment Practitioner (EAP) managing an application must open and maintain a register which contains the names, contact details and addresses of:

- (a) All persons who, as a consequence of the public participation process conducted in respect of that application in terms of regulation 54, have submitted written comments or attended meetings with the applicant or EAP;
- (b) All persons who, after completion of the public participation process referred to in paragraph (a), have requested the applicant or the EAP managing the application, in writing, for their names to be placed on the register; and
- (c) All organs of state which have jurisdiction in respect of the activity to which the application relates.”

According to Section 56(1) of the NEMA Regulations “a registered I&AP is entitled to comment, in writing, on all written submissions, including draft reports made to the competent authority by the applicant or the EAP managing an application, and to bring to the attention of the competent authority any issues which that party believes may be of significance to the consideration of the application, provided that:

- (a) Comments are submitted within:
 - i. The timeframes that have been approved or set by the competent authority; or
 - ii. Any extension of a timeframe agreed to by the applicant or EAP.
- (b) A copy of comments submitted directly to the competent authority is served on the EAP; and
- (c) The interested and affected party discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.”

Lastly, Section 57(1) states that: “the EAP managing an application for environmental authorisation must ensure that the comments of interested and affected parties are recorded in reports and that such written comment, including records of meetings, are attached to the report, submitted to the competent authority in terms of these Regulations.”

6.4 The International Finance Corporation's Handbook on Stakeholder Engagement (2007)

The IFC defines stakeholder engagement as a broad, yet inclusive on-going process intended for a company to interact with its key stakeholders, labour-sending areas and interested groups. The intention is for such engagements to be continuous throughout the lifecycle of the project, and to consider the interests and/or concerns of those who are most directly affected by the project. The IFC PS 1 (2012) encourages developers to develop SEP, which the proponent shall be responsible for.

In 2007, the IFC published stakeholder engagement guidance notes in the form of a handbook to support projects to deal and engage with its stakeholders. According to this source, eight central pillars of a stakeholder engagement plan include the following:

- Stakeholder identification and analysis;
- Information disclosure;
- Stakeholder consultation;
- Negotiation and partnership;
- Grievance management;
- Stakeholder involvement and project monitoring;
- Reporting to stakeholders; and
- Management functions.

According to the IFC (2007), for any stakeholder plan, identifying the direct and indirect stakeholders is an important step which needs to form the basis for future engagement. Different stakeholders also have different interests in a project, and hence identifying such stakeholders not only ensures that different interest groups are being considered by a project, but also that such interests are incorporated into the design of a project to ameliorate future negative project impacts. Identifying such stakeholders also needs to be strategic and prioritised; constantly referring to previous stakeholder engagements and consultations to direct future engagement. For example, a socio-economic fact sheet or data on the affected population can be used to identify stakeholders and, more importantly, particular subsets of stakeholders such as vulnerable groups.

As encouraged by the IFC, in any engagement with stakeholders or the surrounding communities, the following questions need to be asked:

- Why are we engaging with these stakeholders at this particular phase of the project?
- What local and international requirements have to be met with regard to this consultation?
- Who are the stakeholder groups?
- Are there any sub-stakeholder groups that require special attention (vulnerable population)?
- What techniques or methods will be most affected in dealing with these stakeholders and to ensure their participation in the process?
- Who in the company will bear the responsibility for managing this stakeholder engagement?
- How are we going to capture, record, track and disseminate the results of our engagement processes and sessions?

Building upon these questions, engagement needs to be a two-way exchange of views and opinions in a process through which the project developer listens, but also addresses views and concerns from its stakeholders in a culturally appropriate manner. Attention also needs to be provided to gender inclusivity, especially for the project at hand as women are often marginalised and excluded from decision-making.

A decent community engagement strategy is nothing without proper documentation. “*Documenting consultation activities and their outcomes is critical to effectively managing the stakeholder engagement process*” (IFC, 2007). The process needs to be highly organised and records need to be kept of each consultation. Each issue raised needs to be documented, as well as action provided for each issue raised by a stakeholder during a consultation session. Documenting such issues and/or concerns also needs to be followed by corrective actions by the developer, and reported back in a timely way to those consulted with clarification steps.

Realising that different stakeholders’ interests need to be accounted for, it is often difficult to establish who needs to be present during stakeholder engagement sessions. Identifying and working through community representatives is therefore encouraged by the IFC. Such representatives may include an area’s elected officials, authorities or tribal leaders. However, communities are not homogenous and representatives from different interest groups such as women, youth and the elderly will, where possible be considered.

6.5 Proposed Zirco Kamiesberg Stakeholder Engagement Plan

Zirco will develop an SEP in accordance with the requirements of the IFC PS 1 and the relevant South African legislation. The SEP will include a communication mechanism to engage with its stakeholders, encompassing a Grievance Mechanism and the establishment of a sub-committee through which project-affected farm owners and labour-sending community members can voice any issues and/or concerns.

The fundamental principles of such an SEP include the following.

- For affected communities to be provided with opportunities to express their views on project risks, impacts and mitigation measures and allow the project proponent to consider and respond to them;
- For stakeholders to be thoroughly identified and verified in terms of their interests in the project;
- For community engagement to be free of external manipulation, interference or coercion and intimidation;
- Community engagement shall be conducted on the basis of timely, relevant, understandable, inclusive, culturally appropriate and accessible information;
- Local community culture, human rights, values and traditions will be upheld and genuinely endorsed during every aspect of engagement;
- Any engagement activity will be conducted in the preference of the stakeholder group concerned;
- All values, opinions and issues will be dealt with in a sensitive, transparent and, when appropriate, confidential manner;
- As part of any stakeholder engagement, interactions will be accessible to the public and documented, with appropriate and timely management-level responses to issue and/or concerns raised; and
- The concerns/issues of vulnerable groups will be differentially treated to ensure that such groups have the appropriate means to participate without any discrimination.

6.5.1 Stakeholder Identification and Engagement Procedures

The SEP will define all the stakeholders, as well as categorise each stakeholder’s interest in the Kamiesberg project according to certain interest levels. An initial stakeholder list has been developed during the Scoping phase. It is important, however, for the list to be dynamic and subject to regular updating and amendments, as the relationship between stakeholders and the proponent/developer might change over time.

Table 6.1 below presents a draft identification of key stakeholder involved in the project at the international-, national-, provincial- and district-level.

Table 6.1: Draft Identification of Stakeholders

Stakeholder levels	Stakeholders	Interests
International	<ul style="list-style-type: none"> ➤ Shareholders ➤ Lenders ➤ Relevant International Non-Governmental Organisations (NGOs) 	<p>Indirect interest, with the potential to influence the project outcomes in the following ways:</p> <ul style="list-style-type: none"> ➤ Investing in the project; ➤ Enforcing environmental and social responsibility; and ➤ Minimising project risks.
National	<ul style="list-style-type: none"> ➤ Department of Environmental Affairs ➤ Department of Mineral Resources ➤ Department of Agriculture, Forestry and Fisheries ➤ South African National Roads Agency ➤ Department of Agriculture ➤ Eskom Transmission: Grid Connectivity and Capacity ➤ Transnet National Ports Authority ➤ Department of Water Affairs ➤ South African Heritage Resources Agency <ul style="list-style-type: none"> ➤ SANParks 	<p>Direct interest with the potential to influence the project outcomes in the following ways:</p> <ul style="list-style-type: none"> ➤ Contributing to community development benefits; ➤ Regulating and monitoring the project; ➤ Sharing in the benefits of energy conservation and sustainable generation thereof; ➤ Receiving infrastructural development in the country; and ➤ Contributing to the South African economy. <p>NGOs and the media have an indirect interest in the project.</p>
	Northern Cape	
Provincial	<ul style="list-style-type: none"> ➤ Department of Roads and Public Works ➤ Department of Agriculture, Land Reform and Rural Development ➤ Department of Water Affairs ➤ Department of Mineral Resources ➤ Department of Nature and Environmental Conservation ➤ ESKOM ➤ Wildlife and Environment Society of South Africa ➤ Provincial Heritage Resource Authority 	<p>Direct interest and potential to influence the project's outcomes</p>
	Western Cape	
	<ul style="list-style-type: none"> ➤ Department of Roads and Public Works ➤ Transnet National Ports Authority 	<p>Direct interest and potential to influence the project's outcomes</p>
Local	<ul style="list-style-type: none"> ➤ The Namakwa District Municipality ➤ The Kamiesberg Local Municipality ➤ Ward Councillors ➤ Bird Life – Northern Cape ➤ Bird Life South Africa ➤ Namaqua National Park ➤ All the identified stakeholders and Interested and/or Affected Parties; ➤ Potential labour force; ➤ Local associations and forums; and ➤ Potential project suppliers. 	<p>Direct interests and the potential to influence the project outcomes in the following ways:</p> <ul style="list-style-type: none"> ➤ Farmers entitled to any possible economic displacement compensation ; ➤ Farmers impacted by possible land-loss, loss of sense of place and cultural heritage; and ➤ Project benefits (including employment). <p>Potential suppliers also have a direct</p>

Stakeholder levels	Stakeholders	Interests
		interest in the project as they supply employment opportunities.

In addition, the SEP shall include the development of several stakeholder engagement procedures to be followed, such as:

- Procedures for internal and external communications;
- Planning procedures for stakeholder consultations;
- Produces for meeting minutes; and
- Frequency of stakeholder engagements.

6.5.2 Establishing Communication and Grievance Mechanism

Zirco will develop, implement and maintain a procedure for external communications that includes, at a minimum, methods to:

- Receive and register external communications from the public;
- Screen and assess the issues raised and determine how to address them;
- Provide, track and document responses, if any; and
- Adjust the management program, as appropriate. In addition, Zirco will make publicly available periodic reports on their E&S sustainability.

Zirco will establish a Grievance Mechanism to receive and facilitate resolution of affected communities' concerns and grievances about its E&S performance. Zirco's grievance mechanism will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate and readily accessible, and at no cost and without retribution to the party that originated the issue or concern. Judicial or administrative remedies will not be impeded by the implementation of the developed Grievance Mechanism and will inform the affected communities of the procedure and requirements of the mechanism during stakeholder engagement process.

Zirco will conduct periodic reporting to the affected communities on progress with implementation of the project, issues that involve on-going risk to or impacts on affected communities and issues that the consultation process or Grievance Mechanism have identified as a concern to those communities. The frequency of these reports will be proportionate to the concerns of affected communities but not less than once annually.

7. ORGANISATIONAL REQUIREMENTS FOR IMPLEMENTATION

This section outlines the proposed organisational structures and other activities that will be required to implement the ESMP. This organisational structure is subject to change and is meant to ensure that the various ESMPs are adequately implemented.

7.1 Senior Management

The key management positions required to manage and implement the various management instruments are shown in the organogram below and discussed below (Figure 7.1). The actual titles used for each position may change once the project is implemented, but the responsibilities will largely remain unchanged.

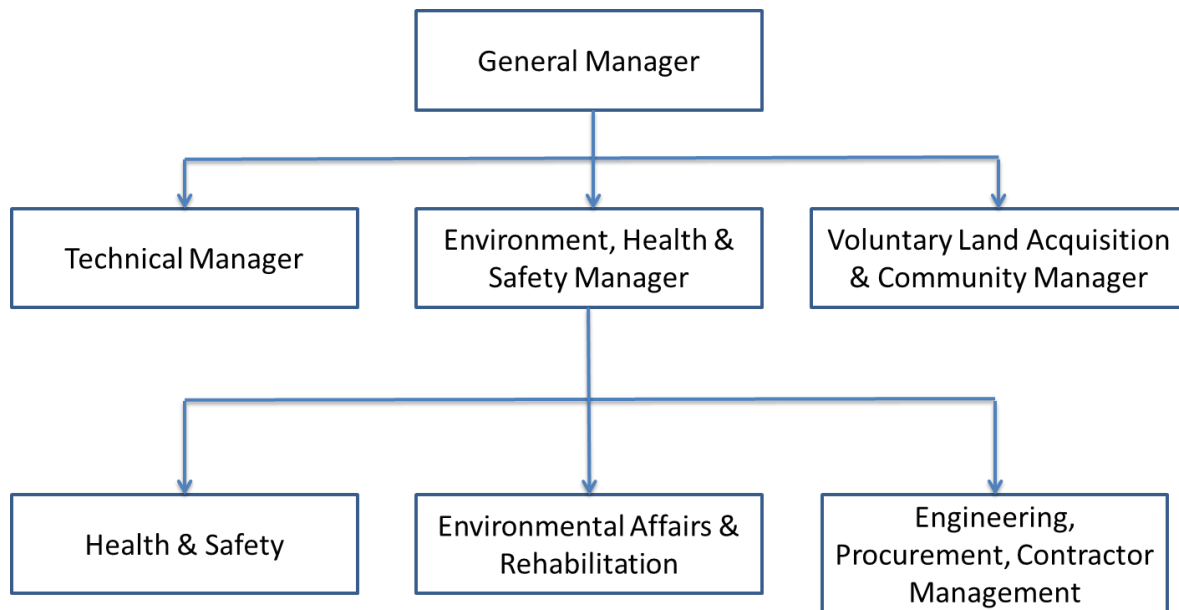


Figure 7.1: Organisational Structure for Senior Environmental, Health and Safety Management

7.1.1 General Manager

The EHS and Community responsibility of the General Manager (GM) will be to ensure that all personnel abide with the requirements of the ESMPs, and that all areas of the project are constructed and operated in such a manner that they meet all specified legal and contractual EHS and Community requirements. All senior mine managers will report directly to the GM, and all will ensure that all areas of the operations are designed, constructed, operated and decommissioned to meet the specified EHS and Community parameters and contractual and legal requirements.

7.1.2 Technical Managers

The role of the Technical Managers will be to ensure that all areas of the project are designed, constructed and operated to meet the specified contractual and legal requirements of the Zirco Kamiesberg Project. The Technical Manager will report directly to the GM.

7.1.3 Environment, Health & Safety Manager

Management of the EHS issues of the project will be the responsibility of the EHS Department headed by an EHS Manager. The EHS Department is responsible for ensuring implementation and compliance of all EHS actions specified in this ESMPr relating to all project operations. The EHS manager will report directly to the GM, and is responsible for ensuring that the project operates in an environmentally and socially responsible manner in all aspects of its operations. Specific roles and responsibilities of the EHS manager are expected to be as follows:

1. Development of the EHS documentation required for all aspects of the project;
2. Implementation of the project's ESMP;
3. Continuous review of the suitability and effectiveness of the activities described in all EHS documentation.
4. Oversee liaison activities with local stakeholders.
5. Ongoing liaison with appropriate project personnel.
6. Maintain and manage the monitoring programme.
7. Ongoing reporting to the senior management team and the board.
8. Oversight function to ensure integration of health, safety and environmental management and social development activities.

The EHS manager will be assisted by three section heads:

1. Section Head – Occupational Health & Safety (OH&S) Officer
2. Section Head – Environmental Affairs and Rehabilitation (EAR) Officer
3. Section Head – Engineering, Procurement, Contractor Management (EPCM) Officer

Section Head – Occupational Health & Safety (OH&S)

The OH&S Officer will report directly to the EHS manager and will be responsible for the management of all aspects related to OH&S issues, coordinates OH&S aspects related to all aspects of the mining operation and associated facilities. The Section Head will be responsible for ensuring the successful implementation and supervision of the following Operating procedures:

- Construction Health and Safety Management Plan
- Occupational Health and Safety Management Plan

The OH&S officer will work together with the Senior Management to ensure that OH&S standards are met at all times, that emergency equipment is available at all times and ensure that appropriate management interventions are implemented during all phases of the project.

Responsibilities include:

1. Ensure all project activities are assessed in a systematic risk assessment
2. Ensure a safe working culture is adopted and embraced by all project employees.
3. Ensuring that OH&S of employees is a project priority.
4. Ensuring implementation and compliance with all safety aspects of the EMP.
5. Ongoing liaison with Senior Managers and contractors through the GM regarding safety compliance.
6. Providing appropriate training on OH&S aspects for Zirco's employees and contractors.
7. Ongoing liaison with national and provincial Government agencies and regulatory authorities.
8. Ensuring that all incidents are reported to the GM within 24 hours. Significant incidents (loss of life, serious injury, etc) will be reported immediately to the GM.

The OH&S Officer will be assisted by a staff complement which may include Safety Officer(s) and Traffic Safety Officer(s).

Section Head – Environmental Affairs and Rehabilitation (EAR)

The EAR officer will report directly to the EHS manager, and will be responsible for the management of all aspects related to environmental compliance with the ESMP, internal Operating Procedures and policies. The Section Head will be responsible for ensuring the successful on-site implementation of the environmental aspects of the ESMP. Specifically, the EAR officer will be responsible for rehabilitation activities across the mine site, as well as managing the environmental aspects of the dams. The EAR officer will work together with Senior Management to ensure that environmental management and rehabilitation are implemented during all phases of the project.

Responsibilities include:

1. Ensuring that all the environmental authorisations and permits required in terms of the applicable legislation have been obtained prior to activities commencing on the ground.
2. Ensuring implementation and compliance with the ESMS and various Internal Operating Procedures.
3. Monitoring and regulating compliance by all personnel and contractors.
4. Execution of the environmental components of the monitoring programme.
5. Keeping accurate and detailed records of all activities on site.
6. Continued and ongoing liaison with Senior Managers and contractors through the EHS Department regarding environmental compliance.
7. Conducting environmental awareness training.
8. Ensuring that all sites disturbed during all phases of the operation are effectively rehabilitated as soon as possible.
9. Monitoring and verifying that environmental impacts are kept to a minimum.
10. Reviewing and approving method statements with input from senior management, in order to ensure that the environmental specifications in the ESMPs are adhered to.
11. Ordering the removal of, or issuing spot fines to contractors for person/s and/or equipment not complying with the specifications of the ESMPs.
12. Ongoing liaison with national and local Government agencies and regulatory authorities.
13. Monitoring all contractors' compliance with the ESMP.
14. Recommending actions to the EHS manager in the event of non-compliance.
15. Ensuring operational compliance of the river diversion structures and dams with recommendations provided in the ESIA.
16. Community Health and Safety management.
17. Environmental Emergency Preparedness Management Operating Procedure

The EAR officer will be assisted by a staff complement which may include Environmental Control and Monitoring Officer(s), Rehabilitation officer(s) and Driver(s).

Section Head - Engineering, Procurement, Construction Management (EPCM)

The EHS manager will appoint the EPCM officer who is a contractor based on site and will report directly to the EHS manager. The EPCM officer will specifically manage the EHS issues amongst the contractors during the all phases of the operation and ensure that the contractors regularly meet all the necessary requirements defined in the ESMP. The EPCM officer will liaise with the EHS manager on day to day issues and adhere to all instructions and requests relating to ESMP requirements issued by the latter.

7.1.4 Voluntary Land Acquisition and Community Manager

The Voluntary Land Acquisition and Community (VLAC) Manager will report directly to the GM and will be responsible for the management of the acquisition of the project affected farms, community skills development as well as stakeholder engagement. The VLAC manager will ensure successful on-site implementation and supervision of the OP - Stakeholder Engagement and coordinate the OP - Community and Skills Development. Specifically, the VLAC manager will have the following roles and responsibilities:

1. Draw up and discuss the final entitlement contracts for each affected farmer and households;
2. Be responsible for the finances and delivery of entitlement payments;
3. Liaise with local government on the implementation of the voluntary land acquisition;
4. Coordinate the elaboration of the land acquisition policy;
5. Address grievances through the established Grievance Mechanism;
6. Providing regular feedback to the all relevant local and national authorities on the progress of the land acquisition;
7. Attend regular meetings and continuously engaging with the established working group;
8. Internal monitoring (a key function of which is to regularly engage with the established working group and to have feedback and disclosure meetings with its members on a regular basis).

The VLAC manager will be assisted with a staff complement which may include Land Acquisition Officer(s), Community Liaison Officer(s), Driver(s), Database clerk(s) and Enumerator(s). One core responsibility of the Community Liaison Officer will be to continuously assess community engagements in terms of actions that need to be undertaken or processes and reports (including the SEP) which need to be amended. The Community Liaison Officer should also be responsible for local government liaison.

8. STRUCTURE AND IMPLEMENTATION OF ESMP

8.1 Introduction

The purpose of this section of the ESMP is to provide detailed recommendations aimed at mitigating negative impacts and enhancing benefits associated with the construction and operational phases of the project. As discussed in Chapter 3 of this ESMP, the requirements have been presented as a framework to allow for a certain degree of flexibility in the development of specific mitigation measures. However, a number of specific requirements aimed at these phases of the project have also been included in the chapter and will be taken into consideration by Zirco when developing the final Construction and Operational ESMPs.

8.2 Framework Requirements

The framework requirements for both the construction and operational phases for the development are detailed in Table 8.1. Included are a number of plans targeting specific phases of the project and also a number of “cross-cutting” plans, which are applicable to both the construction and operational phases. Once developed for the construction phases, these cross cutting plans can then be reviewed and, where required, updated to address environmental and social issues associated with the operational phase.

8.3 Specific Mitigation Measures

In addition to the framework requirements, a number of specific mitigation measures have emerged out of the E&S assessment. These requirements (Table 8.2) will, where possible, be incorporated into the relevant management plans referred to under the framework requirements. Alternatively, they may be incorporated into other forms of instructional documents such as SOPs or Method Statements for specific activities.

Further details on each of the plans referred to in Table 8.1 are provided in the IFC General EHS Guidelines (IFC 2007).

Table 8.1: Framework Environmental and Social Management Plans – Design and Construction Phase of the Zirco Kamiesberg Project

DOCUMENT TITLE	SCOPE	COMPLY WITH
DESIGN AND PLANNING PHASE		
Environmental and Social Management Plan and Monitoring Programme. (This document)	Provide an overview of the affected environment, the project and list impacts. Provide overview of legal requirements to be complied with, and define environmental standards. Present details on content of all management plans, as well as organisational structures - the Environmental Management Framework required for implementation.	➤ IFC Performance Standard 1.
CONSTRUCTION PHASE		
Site Specific Construction Environmental & Social Management plan (CESMP).	<p>This CESMP must deal with all E&S issues associated with establishing the project.</p> <p><i>Environmental impacts</i> related to soil erosion, dust, vegetation, fauna, erosion control and management, bulk earth works, materials handling and surface water run-off will need to be covered.</p> <p>This ESMP will also need to deal with the <i>social impacts</i> of the construction including labour requirements and how local labour will be managed, specify the E&S contractual obligations for contractors; define the EHS and Security role of Zirco’s and contractor staff; and apply aspects of all other ESMPs as applicable.</p> <p>In addition to the above, the ESMP will deal specifically with waste handling and disposal during construction (especially since there are no formalised hazardous waste sites in and around the project area), occupational H&S specific to these facilities during construction, and any other specific aspects not covered elsewhere. Certain aspects will be covered by the cross cutting plans (see Table 8.3).</p> <p>With respect to the proposed facility, the following aspects will require careful consideration:</p> <ol style="list-style-type: none"> i. Design specially adapted areas for storage of all potentially hazardous chemicals e.g. fuel and oil etc, according to international standards. ii. A specific bunded area will be designated for the offloading and storage of chemicals/hazardous materials. iii. All handling and disposal of hazardous waste will be undertaken in accordance with international good practice. iv. Personnel Protective Equipment (PPE) must be supplied and used where necessary v. Waste generated must be properly disposed of. 	<ul style="list-style-type: none"> ➤ IFC Performance Standards 1, 2, 3, 4, & 6. ➤ Site rules for Contractors ➤ The following IFC EHS Guidelines: <ul style="list-style-type: none"> • Air Emissions and Ambient Air Quality • Wastewater and Ambient Water Quality • Water Conservation • Hazardous Materials Management • Waste Management • Noise • Communication and Training • Physical Hazards • Chemical Hazards • Personal Protective Equipment (PPE) • Monitoring • Water quality & Availability • Life and Fire Safety • Traffic Safety • Disease Prevention • Emergency Preparedness and Response • Community Health & Safety • Occupational Health and Safety ➤ Relevant South African (Chapter 4)

Table 8.2: Framework Environmental and Social Management Plans – Operational Phase of the Zirco Kamiesberg Project

DOCUMENT TITLE	SCOPE	COMPLY WITH
OPERATIONAL PHASE		
<p>Site Specific Operational Environmental & Social Management plan (OESMP).</p>	<p>This OESMP must deal with all E&S issues associated with the operation of the facility. The scope of this Plan will be similar to that of the CESMP, although the priority issues requiring careful consideration will be slightly different. Based on the impact assessment, these issues are likely to be the following:</p> <p><i>Environmental impacts:</i></p> <ul style="list-style-type: none"> • Contamination of soil and surface water by hazardous materials • Ambient and workplace air quality • Ambient and workplace noise • Energy and water consumption • Waste management • Radiation <p><i>Social Impacts:</i></p> <ul style="list-style-type: none"> • Voluntary land acquisition • Labour requirements and how local labour will be managed • Occupational H&S, including explosion risks • Ongoing management of community expectations • Influx management <p>In addition to the above, the ESMP will need to include a specific requirement for the implementation of a formal Environmental and Social Management System (ESMS) and deal with any other specific aspects not covered elsewhere. Certain aspects will be covered by the cross cutting plans (see Table 8.3).</p>	<ul style="list-style-type: none"> ➤ IFC Performance Standards 1, 2, 3, 4, & 6. ➤ Site rules for Contractors ➤ The following IFC EHS Guidelines: <ul style="list-style-type: none"> • Air Emissions and Ambient Air Quality • Wastewater and Ambient Water Quality • Water Conservation • Hazardous Materials Management • Waste Management • Noise • Communication and Training • Physical Hazards • Chemical Hazards • PPE • Monitoring • Water quality & Availability • Life and Fire Safety • Traffic Safety • Disease Prevention • Emergency Preparedness and Response • Community Health & Safety • Occupational Health and Safety ➤ Relevant South African (Chapter 4)

Table 8.3: Cross-cutting Framework Environmental and Social Management Plans of the Zirco Kamiesberg Project

DOCUMENT TITLE	SCOPE	COMPLY WITH
CROSS-CUTTING PLANS		
<p>Labour Recruitment, Procurement and In-migration Management Plan</p>	<p>In order to avoid spontaneous settlement and speculative in-migration adjacent to or within the project area, and to ensure consistency of these practices on behalf of contractors, Zirco must implement a Recruitment, Procurement and In-migration Management Plan, which will include a Local Hiring and Purchasing Plan and a Temporary Employment Plan.</p> <p>Zirco will make commitments to deal with local expectations and risks, specifically maximizing local hiring for the unskilled job opportunities and local purchasing in the areas of project influence during the construction and operational phases. A Local Hiring and Local Purchasing Plan is required to govern Zirco and its contractors' hiring processes and purchasing programmes in the area of influence. The objectives are to:</p> <ul style="list-style-type: none"> • Develop procedures and practices that maximize opportunities for hiring local workers, and to minimize social risks in the areas of influence. • Develop transparent procedures that allow access to project jobs by the local population in an organized and fair manner. • Establish a hiring process that respects local cultural and social norms in order to facilitate local participation and avoid conflicts and other negative social impacts. • Promote fair practices in the hiring of local workers that protect against unauthorized third-party job brokers, child and forced labour, and discrimination. • Promote employment of women. <p>Contractors, in consultation with Zirco will design and implement a Temporary Employment Programme for the local population that will anticipate the demand for a skilled and unskilled work force, duration of the employment, and the requirements the applicant will have to meet to be accepted. The objectives of this program are to:</p> <ul style="list-style-type: none"> • Maximize the number of local personnel hired in the project's direct area of influence. • Minimize local expectations in terms of potential employment. • Prevent the migration of unwanted people towards the project area in 	<ul style="list-style-type: none"> ➤ South African Labour legislation including: <ul style="list-style-type: none"> • The Constitution of South Africa Act 108 of 1996 • Occupational Health and Safety Act 85 of 1993 • Basic Conditions of Employment Act 64 of 1997 • Land Reform (Labour Tenants) Act 3 of 1996 (as amended) • Employment Services Act 4 of 2014 • Compensation for Occupational Injuries and Disease Act 61 of 1997 • Employment Equity Act 55 of 1998 ➤ The Broad-Based Socio-Economic Empowerment Charter for the South African Mining and Minerals Industry (2010) ➤ IFC Performance Standards 1 & 2 ➤ All relevant International Labour Organisation Conventions ➤ IFC (2009). Projects and People. A handbook for addressing project induced in-migration. ➤ The following IFC EHS Guidelines: <ul style="list-style-type: none"> • Communication and Training • PPE • Water quality & Availability • Life and Fire Safety • Traffic Safety • Disease Prevention • Emergency Preparedness and Response

DOCUMENT TITLE	SCOPE	COMPLY WITH
	<p>search of work.</p> <p>This programme will be provided to the authorities, the local populations and stakeholders by offices that will be opened for that purpose. Zirco and its Contractors will provide information to the community and local stakeholders, through local and regional communication media, on the location of offices where they may learn about job opportunities and the priorities that will be given to local workers. These offices will in turn provide information on jobs; will identify the number of available positions and application requirements. It must be made clear that no workers will be hired at the construction sites.</p> <p>To decrease and control the flow of people seeking employment in the project area, it will be made clear that members of the population directly impacted by the project will be given preference when hiring, as long as they qualify technically and meet Zirco’s requirements.</p> <p>Recruiting strategies will identify the methods used for informing candidates that equal priority will be given to project affected people for unskilled positions.</p> <p>The above measures will serve to minimize in-migration to the project area. Furthermore, no goods and services can be procured from the project gate or stalls by the road. This prevents encouraging opportunistic traders into the area.</p>	
<p>Integrated Waste Management Plan</p>	<p>This Plan will include a commitment for Zirco to manage all waste streams in a manner that minimizes the likelihood of harm to the environment or human health. Furthermore, all waste streams will be managed according to the waste management hierarchy which requires that production of wastes is avoided and minimized. Wastes will then be re-used or recycled and where this is not possible, it will be disposed of in an environmentally responsible manner and in line with the relevant legal and other obligations.</p> <p>This plan will cover all solid and liquid wastes, both hazardous and non-hazardous, and will also cover the management of leachate from any storage areas.</p>	<ul style="list-style-type: none"> ➤ South African legislation (see Table 4.1 for relevant environmental legislation) ➤ IFC Performance Standard 3 ➤ The following IFC EHS Guidelines: <ul style="list-style-type: none"> • Wastewater & Ambient Water Quality • Water Conservation • Hazardous Materials Management • Waste Management • Contaminated land • Chemical Hazards • PPE • Monitoring • Transportation of Hazardous substances • Emergency Preparedness and Response

DOCUMENT TITLE	SCOPE	COMPLY WITH
<p>Occupational Health and Safety Management Plan</p>	<p>Construction and operation of the mine facilities will present a number of significant hazards to employees. As such, Zirco will implement a comprehensive Occupational Health, Safety and Environmental Plan or system. This Plan will include a detailed assessment of all occupational hazards associated with operation of the mine and mineral processing and a clear set of procedures aimed at minimizing harm to employees during the course of their activities on site. This plan must at least cover the following:</p> <ul style="list-style-type: none"> • Handling and storage of hazardous chemicals, • HIV/AIDS, • Risks associated with operation of crushers and cutters • Workplace air quality • Workplace noise 	<ul style="list-style-type: none"> ➤ Relevant South African legislation including: <ul style="list-style-type: none"> • The Constitution of South Africa Act 108 of 1996 • Occupational Health and Safety Act 85 of 1993 • Compensation for Occupational Injuries and Disease Act 61 of 1997 ➤ IFC Performance Standards 1 & 2 ➤ The following IFC EHS Guidelines: <ul style="list-style-type: none"> • General facility design • Communication and Training • Physical Hazards • Chemical Hazards • Drinking water quality • PPE • Monitoring • Life and Fire Safety • Traffic Safety • Transportation of Hazardous substances • Emergency Preparedness and Response
<p>Emergency Preparedness Management Plan</p>	<p>Emergency preparedness strategies are required to deal with general spillages, as well as the spillage of any hazardous materials. This is particularly important in areas adjacent to riparian environment where spillages may easily enter these waters. Identification of service providers and required facilities will need to be identified.</p> <p>The identification of upset conditions that can cause major environmental impacts (e.g. major storm events, catastrophic fires, explosions etc) is required, and measures to effectively handle these must be developed. A number of action plans or SOPs are therefore anticipated, such as:</p> <ul style="list-style-type: none"> • Emergencies Preparedness for Spillages action plan; • Facility Evacuation Plan <p>Preparation of this plan will include an assessment of the emergency response capabilities of local authorities and ensure that deficiencies are identified and addressed.</p>	<ul style="list-style-type: none"> ➤ Relevant South African legislation including: <ul style="list-style-type: none"> • The Constitution of South Africa Act 108 of 1996 • Occupational Health and Safety Act 85 of 1993 • Compensation for Occupational Injuries and Disease Act 61 of 1997 ➤ IFC Performance Standards 1, 2 & 4 ➤ The following IFC EHS Guidelines: <ul style="list-style-type: none"> • General facility design • Communication and Training • PPE • Monitoring • Life and Fire Safety • Transportation of Hazardous substances • Emergency Preparedness and Response
<p>Community Health and Safety Management Plan</p>	<p>Construction and operation of the mining facilities may present a number of hazards to local communities. As such, Zirco will develop a Community Occupational Health, Safety and Environmental Plan. This Plan will include a detailed assessment of all hazards associated with operation of the mine facilities that may impact negatively on local communities. It will also include a clear set of procedures aimed at minimizing harm to community members.</p>	<ul style="list-style-type: none"> ➤ Relevant South African legislation (refer to chapter 4) ➤ IFC Performance Standards 1 & 4 ➤ The following IFC EHS Guidelines: <ul style="list-style-type: none"> • General facility design • Communication and Training • Physical Hazards Chemical Hazards

DOCUMENT TITLE	SCOPE	COMPLY WITH
	<p>This plan must at least cover the following:</p> <ul style="list-style-type: none"> • Handling and storage of hazardous chemicals, • HIV/AIDS, • Transport of materials and product • Ambient air quality • Ambient noise 	<ul style="list-style-type: none"> • PPE • Monitoring • Ambient noise and air quality • Waste management • Transportation • Emergency Preparedness and Response
<p>Environmental & Social Monitoring Plan</p>	<p>The objectives of monitoring are to:</p> <ul style="list-style-type: none"> • Characterise environmental features (e.g. surface water) and identify changes or trends in their condition or state over time. • Identify specific existing or emerging problems in condition or state. • Gather information to design specific impact prevention or remediation programmes. • Determine whether project goals, such as compliance with regulations or implementation of effective control actions, are being met. • Provide early warning for emergencies such as floods. <p>It is anticipated that at least the following environmental and social components will need to be monitored:</p> <ul style="list-style-type: none"> • Water quality (Rivers, wetlands, wells and boreholes for water quality and quantity). • Meteorological conditions (important for management of tailings and interpretation of ambient air quality data and will include wind speed and direction; relative humidity; ambient temperature; rainfall and evaporation. • Use of natural resources, including power and water. • Waste disposal monitoring will need to be implemented during the construction and operational phase to confirm the effectiveness of the Integrated Waste Management Plan. • Ambient noise and air quality to ensure compliance with the required limits. • Occupational health and safety monitoring including entrance, exit and surveillance medicals for employees, workplace noise, lighting and air quality etc. • Storm water quality • Social monitoring to ensure that grievances are being attended to and that any necessary changes to the overall process are being timeously and sensibly made. 	<ul style="list-style-type: none"> ➤ IFC Performance Standards 1, 2, 3, 4, 6 & 8 ➤ IFC General EHS Guidelines (2007) ➤ IFC EHS Guidelines for mining (2007) ➤ Relevant national and international legislation / agreements (see Chapter 4) ➤ South African legislation (see Table 4.1 for relevant environmental legislation), permits (Table 4.2) standards (see Table 4.3).

DOCUMENT TITLE	SCOPE	COMPLY WITH
	<p>It is proposed that monitoring takes place at two levels, namely Internal Monitoring by a suitably qualified person within Zirco, and External Monitoring through a contracted independent body.</p>	
<p>Hazardous Chemical Management Plan</p>	<p>The construction and operation of the mine will involve the storage and use of hazardous chemicals. If not managed correctly, these could result in harm to the environment, in particular soil and water, as well as workers and community members.</p> <p>The objectives of this plan are to ensure that:</p> <ul style="list-style-type: none"> • The use and management of hazardous chemicals is carefully controlled; • Hazardous chemicals are only used authorised personnel; • The likelihood of harm to humans or the environment is minimised; <p>This management plan will need to cover at least the following:</p> <ul style="list-style-type: none"> • Approval and procurement of hazardous chemicals; • Storage of chemicals • Disposal of expired chemicals and containers • Emergency response • Availability of Material Safety Data Sheets (MSDS) 	<ul style="list-style-type: none"> ➤ South African legislation (see Table 4.1 for relevant environmental legislation), permits (Table 4.2) standards (see Table 4.3). ➤ IFC Performance Standards 1, 2, 3, & 4 ➤ IFC General EHS Guidelines (2007) <ul style="list-style-type: none"> • General facility design • Communication and Training • Chemical Hazards • PPE • Monitoring • Life and Fire Safety • Transportation of Hazardous substances ➤ Emergency Preparedness and Response ➤ IFC EHS Guidelines for mining (2007) ➤ Relevant national and international legislation / agreements including protocols related to banned and restricted chemicals (Stockholm Convention and Rotterdam Convention).
<p>Roads and Transport Management Plan</p>	<p>The construction and operational phases of the project will result in an increase in traffic volume which could pose a risk to the H&S of the community and the mine employees.</p> <p>The objective of this plan is therefore to reduce the risk of injury to community members and employees. The management plan will cover at least the following:</p> <ul style="list-style-type: none"> • Emphasizing safety aspects among drivers; • Improving driving skills and requiring licensing of drivers; • Adopting limits for trip duration and arranging driver rosters to avoid over tiredness; • Avoiding dangerous routes and times of day to reduce the risk of accidents; • Regular maintenance of vehicles and use of manufacturer approved parts to minimise potentially serious accidents caused by equipment failure; • Minimise pedestrian interaction with construction vehicles; and 	<ul style="list-style-type: none"> ➤ Relevant national and international legislation / agreements (see Chapter 4) ➤ IFC Performance Standards 1, 2, & 4 ➤ IFC General EHS Guidelines (2007) ➤ The following IFC EHS Guidelines: <ul style="list-style-type: none"> • Communication and Training • Physical Hazards • Chemical Hazards • PPE • Monitoring • Traffic Safety • Transportation of Hazardous substances ➤ Emergency Preparedness and Response ➤

DOCUMENT TITLE	SCOPE	COMPLY WITH
	<ul style="list-style-type: none"> Using signage and flag persons to warn of dangerous conditions. 	
Storm Water Management Plan	<p>If not managed, storm water run-off can result in the pollution and contamination of the soils and the freshwater systems in the adjacent riparian area. The objective of this plan is to:</p> <ul style="list-style-type: none"> Protect the health, welfare and safety of the public and to protect property from flood hazards by safely routing and discharging storm water from developments; and Preserve the natural environment. <p>This management plan will need to cover at least the following:</p> <ul style="list-style-type: none"> Incorporate measures to divert clean storm water away from sources of potential pollution, including waste storage and disposal areas and other operation areas; and Reduce the contact between storm water and hazardous chemicals. 	<ul style="list-style-type: none"> ➤ Relevant national and international legislation / agreements (see Chapter 4) ➤ IFC Performance Standards 1, 3 & 6 ➤ IFC General EHS Guidelines (2007) ➤ The following IFC EHS Guidelines: <ul style="list-style-type: none"> • General facility design • Communication and Training • Monitoring ➤ Emergency Preparedness and Response ➤ IFC EHS Guidelines for mine (2007)
Security Management Plan	<p>This plan provides guidelines and standards that Zirco and its security contractors need to adhere to during the operational phase of the project, in addition to all current laws, regulations and international conventions. Since components of project security may be out-sourced to third parties, it is important to ensure that these third party service providers also comply with the overall management plans and policies established for the project. This ESMP needs to detail how this will be achieved, and cover topics such as:</p> <ul style="list-style-type: none"> • Selection of security personnel • Securing the plant and operations • Monitoring of safety and security • Physical security enhancement • Inherently safer options • Restricted access to information • Public Disclosure • Security risk assessment 	<ul style="list-style-type: none"> ➤ IFC Performance Standard 4 ➤ The following IFC EHS Guidelines: <ul style="list-style-type: none"> • Communication and Training • Monitoring • Emergency preparedness and Response • Voluntary principles on security & human rights • Firearms and the use of force ➤ In addition, the following are applicable: <ul style="list-style-type: none"> • The United Nations Universal Declaration of Human Rights (adopted and proclaimed by General Assembly resolution 217 A (III) of 10 December 1948); • The United Nations Code of Conduct for Law Enforcement Officials (adopted by General Assembly resolution 34/169 of 17 December 1979); • The United Nations Basic Principles on the Use of Force and Firearms by Law Enforcement Officials (adopted by the Eighth United Nations Congress on the Prevention of Crime and the Treatment of Offenders, Havana, Cuba, 27 August to 7 September 1990); • The Draft Norms on the responsibilities of Transnational Corporations and Other Business Enterprises with Regard to Human Rights (approved August 13, 2003, by U.N. Sub-Commission on the Promotion and Protection of Human Rights resolution 2003/16, U.N. Doc. E/CN.4/Sub.2/2003/L.11 at 52 (2003) as amended from time to time);

DOCUMENT TITLE	SCOPE	COMPLY WITH
		<ul style="list-style-type: none"> • The Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises adopted by a meeting of its Ministerial Council in Paris on 27 June 2000; • The Voluntary Principles on Security and Human Rights published on 4 December 2000 by the governments of the United States of America and the United Kingdom and companies operating in the energy and mining sectors, to the extent that such principles do not contain any provisions that are in conflict with South African legislation in force; and • The appropriate laws of South African pertaining to security and human rights.

Table 8.4: Design/Planning and Construction Phases Environmental and Social Mitigation Measures for the Zirco Kamiesberg Project

Potential Impact Area	Sources of Impacts	Mitigation Measures
Impact category - Air Quality		
Study Area	Emissions (TSP, PM ₁₀ and PM _{2.5}) from vehicle tailpipe, and construction of plant complex and TFS facilities	<ul style="list-style-type: none"> • Incremental dustfall rates, as well as, PM₁₀ and PM_{2.5} concentrations due to the Construction Phase will be of relatively short-term and of local impact. The implementation of effective controls during this phase would, however, also serve to set the precedent for mitigation during the operational phase. • Dust control measures which may be implemented during the construction phase are below. Control techniques for fugitive dust sources generally involve watering, chemical stabilization, and the reduction of surface wind speed though the use of windbreaks and source enclosures. <p>Dust control measures</p> <ul style="list-style-type: none"> • Debris handling: <ul style="list-style-type: none"> ○ Wet suppression (hourly watering recommended) • Truck transport and road dust entrainment: <ul style="list-style-type: none"> ○ Wet suppression (hourly watering recommended) or chemical stabilization of unpaved roads ○ Transport trucks to be restricted to specified haul roads using the most direct route ○ Reduction of unnecessary traffic ○ Strict on-site speed control (i.e. 40 km/hr for haul trucks) • Materials storage, handling and transfer operations <ul style="list-style-type: none"> ○ Wet suppression where feasible, possibly using continuous sprays • Earthmoving operations <ul style="list-style-type: none"> ○ Wet suppression (hourly watering recommended) where feasible • Open areas (wind-blown emissions) <ul style="list-style-type: none"> ○ Reduction of extent of open areas in order to minimise the time between clearing and infrastructure construction; and/or use wind breaks and water suppression to reduce emissions from open areas ○ Restriction of disturbance to periods of low wind speeds (less than 5 m/s) ○ Stabilisation (chemical, rock cladding or vegetative) of disturbed soil ○ Re-vegetation of cleared areas as soon as practically feasible
Impact category – Preliminary Radiation Assessment		
<p><i>It should be noted that the most significant shortcoming to facilitate the preliminary radiation assessment are radiological data of the material that will be mined, processed, and disposed of as residue material for which no further use if foreseen, is not yet available. As such the following recommendation are made:</i></p> <ul style="list-style-type: none"> • The full spectrum radioanalysis be performed of a representative sample of the ore body, processed material, and any residue stream that will be generated during the mining and mineral processing process. 		

- A comprehensive baseline survey and site characterisation study be defined and executed for the Kamiesberg Project area at least one year before operations commence.
- The specialist studies required for the purpose of the radiological public safety assessment process should be sufficient for the purpose of the assessment and will include the source term release rate of contaminants for the groundwater pathway, the radon and thoron dispersion, as well as the human behavioural characteristics as observed in the vicinity of the Kamiesberg Project.

Until such time that sufficient information becomes available, the following mitigation measures are to be adhered to:

- Training/education programme to be presented to workers;
- A Radiation Management Plan will be developed and implemented for the Zirco Kamiesberg Project.
- Appropriate instrumentation to perform radiation and contamination surveys / monitoring will be sourced.

Impact category – Biodiversity and Faunal Assessment

Localised	Loss of biodiversity: Loss of amphibian diversity	<ul style="list-style-type: none"> • Avoid clearing or damaging riparian vegetation and limit the river and stream crossings at the Groen River pipeline crossing to a single point of disturbance. • Limit the removal or damage to riparian vegetation surrounding the construction of the pipeline across the Groen River. • Maintenance of water quality and flow dynamics is required to prevent indirect impacts on the Groen River
Localised	Loss of biodiversity: Loss of Reptile Diversity	<ul style="list-style-type: none"> • Avoid clearing or damaging areas of high faunal value. • Protect abiotic habitats, such as rock outcrops, which shelter many reptile species. • Basic Search and Rescue of species of conservation concern (SCC) need to be conducted before each plots get stripped from vegetation and erecting low drift fences around these plots (or at least on the border of the adjacent plot) will limit the movement of reptiles (especially tortoises) back onto site. • Curtail unnecessary night driving onsite roads as far as possible. • Prohibit exploitation of SCC, e.g. tortoises and chameleons, by employee's onsite. • Educate mine staff about the necessity of protecting snakes and other reptiles.
Localised	Loss of biodiversity: Loss of bird diversity	<ul style="list-style-type: none"> • Avoid clearing or damaging areas of high faunal value. • Maintain habitat connectivity, particularly to protected areas, via habitat corridors. • Undertake habitat clearance in systematic way to allow birds or other animals to move to undisturbed areas.
Localised	Loss of biodiversity: Loss of mammal diversity	<ul style="list-style-type: none"> • Avoid clearing or damaging areas of high faunal value. • Maintain habitat connectivity, particularly to intact habitats, via habitat corridors. • Protect abiotic habitats, such as rock outcrops, which shelter many small mammals, including bats.

Study Area	Loss of biodiversity: Loss of Species of Conservation Concern	<ul style="list-style-type: none"> • Avoid clearing or damaging areas of high faunal value. • Maintain habitat connectivity, particularly to intact habitats, via habitat corridors. • Protect abiotic habitats, such as rock outcrops, which shelter many small faunal species, including reptiles and bats. The eastern edge of Sabies is a particularly important habitat in this regard. • The design of project structures and transport linkages should avoid where possible sensitive habitat corridors, e.g. drainage lines and associated temporary wetlands. • Road designs should incorporate, where possible, underpasses and culverts that allow the movement of animals. • Where possible the road traffic should be limited after dark, as much of the surviving fauna is nocturnal, e.g. bats, most snakes, small rodents, amphibians, etc. • Vehicle speed should be limited to the lowest possible onsite, and should not exceed 40km/h (this limit is not applicable on the main provincial road which is set at 80km/h). • Drivers should be educated regarding their role in impacting on animals and the need to minimize collisions with animals at all times.
Study Area	Habitat loss and fragmentation: Impacts on fauna due to habitat fragmentation and habitat loss	<ul style="list-style-type: none"> • All specific project actions associated with construction, access roads, borrow pits and cut-and-fill construction must avoid sensitive habitats as far as is practicable. • Natural drainage should be maintained and the silt loads into rivers, streams and temporary wetlands must stay within normal limits. • Avoid clearing or damaging areas of high faunal value. • Maintain habitat connectivity, particularly to intact habitats, via habitat corridors. • Protect abiotic habitats, such as rock outcrops, which shelter many small faunal species, including reptiles and bats. • The design of project structures and transport linkages should avoid where possible sensitive habitat corridors, e.g. drainage lines. • Comply with procedures laid out in the Rehabilitation of Vegetation report. • Include post rehabilitation monitoring of faunal species.
Localised	Additional Construction Impacts on Fauna: Faunal impacts from dust	<ul style="list-style-type: none"> • Roads should be watered down, or binders used during high wind conditions. • Road speeds in sensitive regions e.g. near rivers, across drainage lines, and during extreme dry climatic conditions, should be limited to curtail dust production. • Vehicle speed should be limited to the lowest possible speed onsite, and should not exceed 40km/h. • Any material to be transported to and from project site should be done by covered trucks or containers to avoid contamination to the surrounding area.
Study Area	Additional Construction Impacts on Fauna: Disruption to fauna from increased noise levels:	<ul style="list-style-type: none"> • Mitigation of this impact is difficult, but noise reduction measures should be implemented in all sensitive areas (e.g. adjacent to the Groen river) at sensitive times (e.g. at night).
Localised	Additional Construction Impacts on Fauna: Pollution and Contamination	<p>Refer to the waste section and in addition;</p> <ul style="list-style-type: none"> • Storage facilities for chemicals, particularly diesel, should not be situated in regions subject to flooding. • They should be bunded so that in the event of spillage their contents run immediately into large catchments for decontamination. • The use of insecticides and herbicides should be closely monitored and dosages and application detailed in the EMP. • A waste management plan must be developed and all recommendations contained in the Plan must be adhered to.

Impact category – Health Impact Assessment

Regional	Acute respiratory infections and respiratory effects from housing	<ul style="list-style-type: none"> • Social management measures should include measures to discourage uncontrolled influx of job-seekers and proliferation of informal settlements. •
Regional	Sexually transmitted infections including HIV/AIDS	<ul style="list-style-type: none"> • Develop a HIV/AIDS policy that incorporates both the workplace and community considerations; • Support the local health authorities in extending care and treatment programs in the area. Support the local health authorities with the establishment of Voluntary Counselling and Testing (VCT) centres in the area; • Support community based condom distribution centres; • Providing women and young people with basic HIV/AIDS education; • Collaborate with local schools as schools are a well-established point of contact through which young people can receive AIDS education; • Use the media as it is a powerful way of reaching large numbers of people with HIV and AIDS information and prevention messages • Support information campaigns and community based peer educator programs in both the workforce and community. These need to use locally acceptable tools and based on the finding of the KAP study; • Support equal employment opportunities for women and support livelihood programs to reduce risk for opportunistic sexual encounters. This will enable them to be financially independent; • Support community based information campaigns related to TB symptoms and the need to seek care. The campaign should address the risk of co-infection between HIV and TB. This can be managed through community-based peer health educators; • Develop partnerships to support the community based TB control programs in conjunction with the authorities and any agencies/NGO;
		<ul style="list-style-type: none"> • Support the health management information system and collect longitudinal (spatial/ over time) data on key TB indicators. This will require health systems strengthening to get this essential data; and • Support NGO groups active in area on gender-based sexual violence.
Regional	Soil, water and waste related diseases	<ul style="list-style-type: none"> • The quality of groundwater and surface water must be monitored to ensure that the proposed Project does not have any detrimental effects on community water sources; • Influx management; • Restrict access to Project created water bodies; • Perform end user analysis of water quality. This serves as an indicator for monitoring water quality where it is consumed and determines the level of general sanitation and hygiene even if water is collected from clean sources; • Ensure proper disposal of human waste that is generated from the Project; and • Ensure proper waste management from Project generated waste according to waste management principles.

Study Area	Accidents and injuries	<ul style="list-style-type: none"> Improving road safety by collaborating with the district road-safety unit to establish and maintain pictorial road-safety signage near the site in local language (Afrikaans) and English language (if needed); Clearly demarcated pedestrian crossings in appropriate places etc. This could be achieved by establishing and implementing a Traffic Management Plan; Develop and implement an Emergency Preparedness and Response Plan for construction and operation, including provisions to deal with traffic accidents, particularly accidents involving personal injuries. All drivers must be made aware of the procedures to be followed; Develop community security and safety management structures (such as the Security Community Liaison Forum – a liaison body between the affected farmers and security personnel, through which security arrangements are discussed with affected farmers) for the Project related to the different activities. This should include emergency response plans for both community related accidents and also for the workplace. This must include a fire, rescue and chemical spill response capability, as well as medical emergency response strategies; Develop a clear policy for the management of emergencies or accidents in the community as a direct result of the projects activities; and Support with local safety and security as addressed in these specialist studies.
Study Area	Environmental health determinants: Radiation, Air, water, noise pollution and malodours	<ul style="list-style-type: none"> Implement mitigation measures as specified in the radiation and air quality assessment reports; The quality of ground water and surface water must be monitored to ensure that the proposed project does not have any detrimental effects on community water sources; Evaluate and managed air, water and noise issues as part of the environmental impact assessment and environmental plant requirements. Human health considerations should be considered based on results of the surveillance activity.
Study Area	Social determinants of health: Gender-based violence, alcohol and drugs	<ul style="list-style-type: none"> Social management plans and recommendations as part of the social impact assessment; and Gender empowerment should be considered.
Regional	Social determinants of health: Social cohesion and well-being	<ul style="list-style-type: none"> Gender empowerment and equity should include programmes designed to enhance employment opportunities. Corporate social investment should include: <ul style="list-style-type: none"> Supporting education programmes with a gender equity focus; Support cultural activities and sports especially in schools; Support vulnerable groups; and Support graduate training programmes for the youth in the community.
Impact category – Heritage, Archaeological and Paleontological Impact Assessment		
<p><i>The overall impacts to archaeological resources at the archaeological sites with heritage significance will be impacted during the Operational Phase of the project. However, it is recommended that mitigation of archaeological sites on Roode Heuvel application area, and sea water intake and pipeline should commence simultaneously (in the Pre-construction Phase). It is maintained that the most effective way of addressing cumulative impacts (during the Operational Phase) is through a Heritage Management Plan (HMP).</i></p>		
Impact category - Marine and Rocky Shore Assessment		
Localised	Direct losses of intertidal and infratidal biota in development footprint	<ul style="list-style-type: none"> The impact may be mitigated to some extent by the choice of pipeline material, as some sessile rocky shore and reef organisms are predicted to recolonize the concrete and pipeline surface in time. Further mitigation measures include minimising the surface area impacted by cementing. Alternatively bolting the pipeline directly to the rocky substratum or to concrete bases would minimize the area impacted.

Regional	Barotrauma of marine fauna as a result of blasting	<ul style="list-style-type: none"> All blasting should be conducted using a rock breaking technology known as NoneX (www.nonex.co.za). This is a non-explosive technology. It is propellant compound encased in a cartridge which reacts very quickly to produce high volumes of harmless gas (nitrogen, carbon dioxide and steam). Blasting activities must be limited to one detonation series per day to avoid or reduce the mortality of predators and seabirds attracted to fish kills from previous blasts.
Localised	Impaired water quality impacts to marine fauna	<ul style="list-style-type: none"> The use of NoneX blasting technology will result in the release of gases into the water column and none of the gases (nitrogen, carbon dioxide and steam) produced will be noxious given that the cartridge is oxygen balanced and sufficient oxygen is available to achieve optimal oxidation to produce gases consisting of carbon dioxide, nitrogen and steam.
Regional	Litter during construction	<ul style="list-style-type: none"> Inform & empower all staff about sensitive marine species & suitable disposal of construction waste. Filter effluent on start-up of plant to remove plastic particles.
Impact Category – Noise & Vibration Impact Assessment		
<p>The following general recommendations are to be adopted:</p> <ul style="list-style-type: none"> All vehicles will be fitted with silencers and the use of exhaust brakes along the DR2938 of the transport route be severely curtailed. The speed of the trucks should not exceed 60km/hr along DR2938 until it has been upgraded at which point they should not exceed 80km/hr. This will reduce the noise impact even further. The drivers should receive training in terms of sensitizing them to the noise issues. It is highly recommended that Global Positioning System trackers be fitted to the vehicles in order to monitor vehicle speeds along the routes. The hauling of final product along the DR2938 is curtailed to day light hours only. 		
Localised	Impact of the vehicle noise on the residents along the transport routes during construction	<ul style="list-style-type: none"> Trucks to adhere to speed limits of 60km/hr along DR2938 until it has been upgraded at which point they should not exceed 80km/hr.
Localised	Impact of the vehicle noise on the residents along the transport routes (N7)	<ul style="list-style-type: none"> None
Impact category - Rehabilitation		
<p><i>The following specific recommendations, taken from the vegetation assessment, will be incorporated into the rehabilitation programme, in order to mitigate impacts on the vegetation and fauna in the mining area:</i></p>		
Study Area	<ul style="list-style-type: none"> Ensure that construction phase footprints are rehabilitated to acceptable standards (minimum of 60% of original plant species present) as soon as possible after the area is no longer in use. Less than 300ha should be mined at any one time (the largest area on the mine path is 279ha) and hence the remainder of the mining area will either be undergoing rehabilitation or standing undisturbed, or be part of the TSF depending on the project phase, which will help reduce overall fragmentation of the site. 	

	<ul style="list-style-type: none"> • For the first 5 years of mining, rehabilitation must focus on the years 1-4 area to ensure that at least one 300m wide north – south ecological corridor can be re-instated. This will necessitate leaving a portion of the year 20 mining area in an undisturbed state along the western edge of the project area, to ensure there is a north-south linkage. This corridor is particularly important in the case of the primary target habitat – Namaqualand Sand Fynbos. This vegetation type has a north – south regional distribution, through the western half of the study area (mainly on Roode Heuvel), and it is part of a largely continuous strip of habitat that runs from northeast of Hondeklipbaai in the north to the Olifants River in the south. Complete severance of this currently largely intact habitat through open cast mining across its width is not desirable from an ecological perspective (Desmet & Helme 2009). • Maintain ecological corridors, as they will function as a vital repository of rehabilitation material (seeds) for the post mining phase. This will significantly enhance rehabilitation success, and will also help limit wind erosion • Do not use any alien grasses (eg. Lolium - ryegrass) for rehabilitation purposes. • Topsoil of at least 300mm depth (0.3m) must be set aside for rehabilitation purposes, as this will then retain its original pH, and will also include the bulk of the soil stored seed bank (including most of the bulbs, which are more deeply buried than most of the seeds). Furthermore, the top 2 metres of tailings returned to the surface after mining must be sand tailings only, as any clay will assist in the retention of salt. • No livestock should be allowed to graze in the approved mining area or within a 500m buffer area (if such an area is located within the permit area) from six months after any authorization up until the mine closure permit is granted. • It is strongly recommended that livestock not be introduced into the mined and rehabilitated areas for at least ten years after initial rehabilitation has been completed on the last block to be mined. Removal of livestock will dramatically improve rehabilitation by allowing flowering and seed set for the more palatable species. Livestock preferentially eat the most tender flowering parts (including seeds), and also target annuals, such as grasses and herbs. The latter are often pioneers, which would normally be the first to stabilize a disturbed area and provide habitat for the longer lived shrubs. Thus, by removing livestock one maximizes the available seed bank, and hence the rehabilitation potential. It is the cheapest and easiest way of enhancing rehabilitation success. It is recommended that the area be stocked with limited numbers of range appropriate game, and the possibility of tourist accommodation could be explored. • Rehabilitation targets must include a measurable element of botanical diversity. In other words the rehabilitation target for Strandveld areas should be to return the mined areas to at least 60% of the pre-mining botanical diversity for this habitat. • On-going, annual alien invasive vegetation management is required in the mined and rehabilitated areas until the mine closure permit is issued. • East – west oriented wind fences will be required in the rehabilitation areas in order to minimise wind erosion, probably at an interval of every 5m, as at Namakwa Sands
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Impact Category - Socio-economic Impact Assessment

Study Area	Influx of Job Seekers and Outside Workers: Community expansions and increased burdens on service delivery and cost of living	<ul style="list-style-type: none"> • The mine’s Social Labour Plan (SLP) should be implemented and annually updated. Sections of relevance in the SLP are the Human Resource Development Programme (HRDP) (and labour compliance targets), as well as its Preferential Procurement Policy. • The proponent should develop a Recruitment and Influx Management Plan. The following guidelines can be used in developing such a plan: <ul style="list-style-type: none"> ○ Information dissemination: Employment opportunities need to be advertised, however the procurement procedures for employment need to be made available to the public. Regular briefings with regard to recruitment and procurement to the wider public are necessary;
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		<ul style="list-style-type: none"> ○ Recruitment and supply chain transparency: Recruitment and procurement rules and opportunities have to be transparent and, most importantly, accessible to the public. This will be the responsibility of the Community Liaison Officer (CLO), as well as the Human Resource Manager (HRM); and ○ Influx management and security arrangements must be underpinned by a code of conduct signed with a private security company (explained shortly). • Although the mine is not in close proximity to surrounding communities, the project will still create an influx of job-seekers into the surrounding communities, especially the town of Garies. Therefore, the proponent should develop a Recruitment and Influx Management Plan and a SEP.
Study Area	Influx of Job Seekers and Outside Workers: Increased community conflicts due to differential benefits between local labour and outside workers	<ul style="list-style-type: none"> • The proponent should develop a Corporate Social Responsibility (CSR) Programme aimed at identifying and developing particular projects that could alleviate possible future conflicts and strengthen community values. It is suggested that a needs analysis be conducted amongst the Project-Affected Communities (PAC), which should aid in the development of such a programme. The following CSR projects could possibly be considered in the programme: <ul style="list-style-type: none"> ○ Assisting particular schools with education programmes aimed at teaching children the affects and consequences of crime and drug/alcohol abuse; ○ Sport programmes or the upgrading of particular sport fields; ○ The upgrading of sport facilities or safe playgrounds; ○ Supporting schools or the Kamiesberg Local Municipality with youth empowerment programmes; or ○ Support the Kamiesberg Local Municipality (KLM) with community out-reach programmes to deal with issues related to unsafe sexual practices, sex work, teenage pregnancies and sexual (gender) violence.
Study Area	The use of security personnel for mine access control	<ul style="list-style-type: none"> • The proponent should establish a Grievance Mechanism to allow the PAF-owners and PAC members to lodge any complaints. Management feedback should be provided to claimants within two weeks of claimants submitting formal complaints. Section 7.3 of this report provides a general procedural outline for establishing such a mechanism; • As far as possible, the proponent should comply with IFC PS 4 on the use of security personnel. Such compliance could be ensured by signing an agreement with the private security company. Such an agreement should include the following: <ul style="list-style-type: none"> ○ Security personnel need to be properly trained in the use of force and, most importantly, appropriate conduct towards farm-owners and farm labour; ○ Security personnel should not have been part of any past abuses or theft;
		<ul style="list-style-type: none"> ○ The above-mentioned code of conduct must be consistent with the United Nation’s (UN) Code of Conduct for Law Enforcement Officials, and the UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials; and ○ All the PAF-owners • As part of the CLO’s duties, a separate security liaison sub-committee should be established. Through this committee, the CLO could allow PAF-owners and PAC members to voice any issues and/or concerns to the proponent in relation to security issues and/or concerns. Affected farmers should volunteer and nominate farmers to act on this committee. This forum could also be used as a liaison body between the affected farmers and security personnel, through which security arrangements are discussed with affected farmers.

Localised	Provision of Basic Social Services: Assisting with housing requirements in Garies	<ul style="list-style-type: none"> The mine's SLP (Measures to Address Housing and Living Conditions), a Housing and Living Conditions Plan (for staff only) should be drafted by the proponent, which should be aligned with the Kamiesberg Local Municipality's IDP and their own housing plan; The proponent should implement its housing and living condition measures as per its SLP; and Fair and transparent measures should be adopted with assistance with housing development and related services, in accordance with Section 4.9 of the mine's SLP (Procurement Progression Plan).
Study Area	Provision of Basic Social Services: Assisting with Local Economic Development	<ul style="list-style-type: none"> The proponent should draft and implement an SEP; Community members should be regularly informed about any proposed Local Economic Development (LED) plans and should be able to provide input in the development of such projects; Monitoring and evaluation would be required for LED projects that could have a significant impact on employment provision or service delivery. Monitoring and evaluation could be used to identify shortfalls in programmes, using such data to adjust programmes as needed and in accordance with the needs of the communities; and As per legislation, the client's SLP (and hence LED programmes) should be reviewed annually and adapted or revised as necessary.
Study Area	Land acquisition for mine activity: Economic Viability of Remaining Unaffected Land	<ul style="list-style-type: none"> Mitigation and/or enhancement measures would not be applicable for this impact, as the proponent will compensate for land acquisition.
Study Area	Stimulation of Economic Growth: Employing local labour	<ul style="list-style-type: none"> The proponent should be held responsible and accountable for implementing its HRDP in its SLP (Section 3). Some of the mine's own commitments in this regard include: <ul style="list-style-type: none"> The provision of ABET programmes to community members and employees; Core business training to suitable employees; Learnership programmes for the mine's labour force and community members (for suitable members); Portable skills training opportunities for the mine's labour force and community members (for suitable members); and Community bursaries and internships (for suitable members). Employment should be managed by selecting suitable employees according to a selection system that ensures recruitment from local, impacted communities. This should ensure a fair recruitment process. The proponent should implement its SLP's Employment Equity Plan (Section 3.5 under the SLP), thus providing equal opportunities to members from all the possible labour-sending communities; The client's Procurement Progression Plan (Section 4.9 of the SLP) should be implemented to ensure that local suppliers are used. Moreover, local suppliers and SMMEs should be invited to list their businesses on a database managed by the proponent, possibly through the KLM; Appropriate HR policies and procedures, including a labour desk/employment committee should be established to design and implement the SLP's labour recruitment policies and Career Progression Plan. This should ensure that recruitment is done in a fair and transparent way, and that job creation opportunities are maximised; The recommendations contained in IFC PS 2 (Labour and Working Conditions) must be adhered to in developing the labour policy and operational guidelines (much of this has been included in the SLP already). These include: <ul style="list-style-type: none"> Developing appropriate HR policies and procedures (Nr 8); Establishing appropriate working conditions (Nr 10);

		<ul style="list-style-type: none"> ○ Ensuring non-discrimination and providing equal opportunities (Nr 15); ○ Establishing a Grievance Mechanism for labour issues (Nr 20); ○ Protecting the work force (Nr 21-22); and ○ Occupational Health and Safety (Nr 23). • The following ILO conventions must be adhered to: <ul style="list-style-type: none"> ○ ILO Convention 87 on freedom of association and protection of the right to organise; ○ ILO Convention 98 on the right to organise and collective bargaining; ○ ILO Convention 29 on forced labour; ○ ILO Convention 105 on the abolition of forced labour; ○ ILO Convention 138 on the minimum age of employment; ○ ILO Convention 182 on child labour; ○ ILO Convention 100 on equal remuneration; and ○ ILO Convention 111 on discrimination. • As far as possible, those labourers involved in the construction phase should be incorporated in the permanent staff for the operational phase; and • Attention should be paid to employment opportunities for women and disabled persons.
Regional	Stimulation of Economic Growth: Developing and supporting local businesses	<ul style="list-style-type: none"> • Through the client's Procurement Progression Plan in its SLP, commitment has been expressed to stimulate and develop local businesses. • Through the implementation of the SLP, the local economy of the municipality will be supported and stimulated through several community development programmes that are currently being considered by the Zirco. Each programme is being designed with a strong emphasis on stimulating and supporting local business development.
Regional	Stimulation of Economic Growth: Skills training and further training opportunities	<ul style="list-style-type: none"> • Sufficient skills and further training opportunities should be developed by the mine and this should be seen by the proponent as an investment for the mine. • Youth members who have not completed matric should be supported through adult basic educational training programmes to obtain appropriate certificates that would allow them to be employed and progress through the mine's internal employee ranks.
Localised	Altering the landscape: Effects on the area's tourism industry	<ul style="list-style-type: none"> • Through an SEP, PAF owners should be consulted regularly and be allowed to provide input into the development should they feel that particular measures could be adopted to mitigate some aspects that affect the land's cultural value; and • As part of the proponent's CSR Programme, local tourism initiatives could be supported and promoted.
Impact Category – Soil and Agricultural Impact Assessment		
Localised	Soil profile: Large scale excavation and other associated infrastructure that will disturb the soil profile.	<ul style="list-style-type: none"> • The upper 30cm of top soil must be stripped and stockpiled. It should be retained for re-spreading over disturbed surfaces during rehabilitation. • An Environmental Control Officer (ECO) should monitor all excavations to ensure backfilling with subsoil first and subsequently topsoil spreading takes place. • An ECO should monitor depth and cover of topsoil spreading during rehabilitation to ensure as close as possible to a depth of 30cm.
Study Area	Soil erosion: As a result of ablation:	<ul style="list-style-type: none"> • Rehabilitation of the affected landscape must commence as soon as possible after mining to minimise the period during which the soil surface is exposed. • Use of wind breaks is recommended. • Rehabilitation should, as far as possible, restore the pre-mining slopes and shape of the pre-mining landscape. • Only local sand should be used to landscape the impacted areas during rehabilitation

Impact category - Surface and Ground Water Assessment		
Localised	Impacts on groundwater of groundwater abstraction.	<p><i>Impacts on groundwater levels may occur when groundwater is abstracted for construction purposes.</i></p> <ul style="list-style-type: none"> • Restrict groundwater abstraction to the long-term sustainable yield of the well field to minimise lowering of groundwater table. • If necessary provide an alternative source of water for stock watering if abstractions for mining purposes prejudice the yield of existing wells and boreholes used by local population. • Continuously monitor groundwater levels via observation wells.
Study Area	Impacts on groundwater of pollution by contaminants	<ul style="list-style-type: none"> • All hydrocarbons of all types must be stored on impermeable surfaces with appropriately-sized containment bunds and grease traps. Traps must be regularly cleaned. • All chemicals of all types must be stored on impermeable surfaces in secure and bunded designated storage areas. • Cement must be stored on impermeable storage areas protected from the rain and mixed only in designated areas. Cement residue must be cleaned up immediately. • Vehicle repairs, servicing, refuelling and washing must be done only in designated areas with impermeable surfaces with appropriately-sized containment bunds and grease traps. • Where it is necessary to service, repair or refuel a vehicle or item of plant in the field drip trays must be used to catch drips, spills and leaks. • Spill kits must be available at all locations where chemicals of hydrocarbons are stored, handled or used, and spills must be cleaned up immediately in accordance with an established protocol appropriate to the material in question.
Localised	Impact on surface water of groundwater abstraction from the Groenrivier valley	<ul style="list-style-type: none"> • <i>Provided no water is abstracted from the groundwater system that feeds the spring no impacts on the river or estuary are anticipated during construction or operation, or in the long-term after mine closure.</i>
Localised	Impacts of river crossing infrastructure	<p><i>The construction of the road crossing and pipeline will necessitate working in and immediately adjacent to the river channel, and may require excavation in or alterations to the river bed and riparian zones.</i></p> <p><i>Road crossing</i></p> <ul style="list-style-type: none"> • If it is necessary to construct a new crossing, not on the alignment of the existing drift, it should be sited to avoid extensive excavation in the banks, and to avoid sensitive areas in the channel or riparian areas. • The conditions of the Water Use Licence (or General Authorisation) must be strictly adhered to <p><i>Pipe crossing</i></p> <ul style="list-style-type: none"> • Site the crossing to avoid extensive excavation in the banks, and to avoid sensitive areas in the channel or riparian areas. • As far as possible avoid the construction of structures below the level of the 100-year flood. • Remove the crossing after closure and decommissioning of the mine. • The conditions of the Water Use Licence must be strictly adhered to
Impact category - Traffic and Transport Impact Assessment		

Study Area	Increased volume of construction traffic on DR2938: Increased risk of vehicle collisions and personal injuries	<ul style="list-style-type: none"> The road must be upgraded to ensure that it is wide enough to allow two heavy vehicles to pass safely. The carriageway may need to be widened in places, and realigned at sharp bends (particularly where the road crosses the Groen River). Construction work on the road upgrade must be done in such a way as to minimise disruption to local traffic. A speed limit appropriate to the design and construction factors and characteristics of the road (such as width, horizontal and vertical alignment, grade, sightlines and surfacing material) must be specified for all construction vehicles, and strictly enforced. Signage must be erected at frequent intervals along the road. Warning signage must be erected at all intersections, including at the intersections with farm access roads.
		<ul style="list-style-type: none"> Heavy vehicles should not travel the road between 10pm and 6am unless it is absolutely unavoidable. Vehicle trips of any kind between 10pm and 6am should be minimised, concomitant with operational requirements Deliveries by heavy vehicles must, as far as possible, be scheduled to avoid the formation of convoys. Sufficient distance must be maintained between heavy vehicles to allow light vehicles to overtake safely. A Construction Traffic Management Plan must be developed and implemented. The Construction Emergency Preparedness and Response Plan must include provisions to deal with traffic accidents, particularly accidents involving personal injuries, and all drivers must be made aware of the procedures to be followed. Communication with the local community and individuals must provide regular information on the volumes of traffic particularly heavy vehicles, anticipated on the road during the construction period.
Study Area	Increased volume of construction traffic on DR2938: Increased dust generation	<ul style="list-style-type: none"> The upgrade of the road must include measures to reduce the generation of fugitive dust, preferably by means of a bituminous / aggregate sealing / wearing course, but otherwise by regular and frequent application of dust suppressant, including water if it is available in sufficient quantities.
Regional	Increased construction traffic on the N7 highway: Disruption of traffic flows on the N7	<ul style="list-style-type: none"> Upgrade the N7 at its intersection with DR2938 as required by SANRAL, which may include the construction of an auxiliary acceleration lane south from the intersection, and upgrading the DR2938 bellmouth entrance. Schedule heavy vehicle deliveries and vehicle returns to avoid, as far as possible, morning and evening periods in urban areas (where the N7 passes through Piketburg) and stretches of the N7 known to carry large volumes of morning and evening traffic. Extreme care must be exercised when travelling through urban areas, especially during morning and evening peak hour traffic, and speed limits must be strictly observed. Avoid the formation of convoys. Maintain sufficient distances between heavy vehicles to allow light vehicles to overtake safely. Develop and implement an Emergency Preparedness and Response Plan to deal with accidents and incidents en route
Regional	Increased construction traffic on provincial roads: Disruption of traffic flows on provincial roads	<ul style="list-style-type: none"> Heavy vehicle deliveries and vehicle returns should be scheduled to avoid, as far as possible, morning and evening periods in urban areas (Moorreesburg, Hopefield) and stretches of the provincial roads that carry significant volumes of morning and evening traffic. Extreme care must be exercised when travelling through urban areas, especially during morning and evening peak hour traffic, and speed limits must be strictly observed. The formation of convoys must be avoided. Sufficient distances must be maintained between heavy vehicles to allow light vehicles to overtake safely. An Emergency Preparedness and Response Plan must be in place to deal with incidents en route.

Regional	Abnormal loads: Disruption of traffic on the N7 and provincial roads	<ul style="list-style-type: none"> • Arrangements must be made with the provincial traffic authorities – Western Cape and Northern Cape - for abnormal loads, and their requirements strictly adhered to. • Speed limits must be strictly observed. • As far as possible deliveries of abnormal loads should be scheduled to avoid periods when significant volumes of construction traffic are making deliveries to site.
Vegetation and floristic specialist study		
Localised	<i>Loss of Vegetation Type: Loss of Strandveld (Namaqualand Strandveld)</i>	<ul style="list-style-type: none"> • Areas impacted by construction that are no longer required during the operational phase must be rehabilitated as soon as possible after cessation of disturbance; • Topsoil of at least 300mm (0.3m) depth must be harvested from within all development footprints and used for rehabilitation purposes. This is regarded as the minimum depth required in order to include at least 60% of the bulbs (geophytes). • Mine planning has been informed by the botanical sensitivity mapping to minimize what could otherwise be very significant negative botanical impacts, through the establishment of ecological corridors. • Where possible associated infrastructure (not tied to any particular area) has been located in areas of lowest sensitivity.
Localised	Loss of Vegetation Type: Loss of Sand Fynbos (Namaqualand Sand Fynbos)	<ul style="list-style-type: none"> • Areas impacted by construction that are no longer required during the operational phase must be rehabilitated as soon as possible after cessation of disturbance; • Topsoil of at least 300mm (0.3m) depth must be harvested from within all development footprints and used for rehabilitation purposes. This is regarded as the minimum depth required in order to include at least 60% of the bulbs (geophytes). • Mine planning has been informed by the botanical sensitivity mapping to minimize what could otherwise be very significant negative botanical impacts, through the establishment of ecological corridors. • Where possible associated infrastructure (not tied to any particular area) has been located in areas of lowest sensitivity.
Study Area	Loss of Vegetation Type: Loss of Heuweltjieveld (Namaqualand Heuweltjieveld)	<ul style="list-style-type: none"> • No special mitigation proposed as this unit is unlikely to be impacted by the construction phase
Study Area	Loss of Vegetation Type: Loss of Riparian Vegetation (Namaqualand Riviere)	<ul style="list-style-type: none"> • Locate the seawater pipeline in relatively disturbed parts of the Groen River crossing, and minimise impact to natural vegetation in this area.
Study Area	Loss of Vegetation Type: Loss of Seashore Dunes	<ul style="list-style-type: none"> • Locate the plant outside the identified areas of High dune sensitivity that cannot be easily rehabilitated. • Minimise disturbance around pump infrastructure, and allow for natural rehabilitation of disturbed areas.
Study Area	Loss of Vegetation Type: Loss of Coastal Duneveld	<ul style="list-style-type: none"> • Minimise impact to natural vegetation in this habitat, and allow for natural rehabilitation of disturbed areas. • Ongoing, annual alien invasive vegetation management along the pipeline route.

Study Area	Loss of Biodiversity and Species of Conservation Concern: Loss of Species of Conservation Concern	<ul style="list-style-type: none"> • All bulbs (geophytes) of Conservation Concern in the construction phase footprints (notably Lachenalia sp nov/arenicola) should be subject to Search and Rescue in the winter to spring season (June – September) preceding any mining. These plants should be located by suitably qualified staff or consultants who can identify the species. The plants should be immediately translocated to a similar, suitable receiving environment that will not be disturbed by mining activities at any stage in the future. • All succulents of Conservation Concern in the construction phase footprints (notably Lampranthus procumbens) should be subject to Search and Rescue in the autumn (April – May) preceding any mining. These plants should be located by suitably qualified staff or consultants who can identify the species. The plants should be immediately translocated to a similar, suitable receiving environment that will not be disturbed by mining activities at any stage in the future. • A nursery should be set up in the project area to propagate all possible SCC from within the mining and construction phase area, and the propagated plants should be returned to the post mining landscape about three years after initial rehabilitation has been completed. Planting out should take place after the first good winter rains, typically in May or June. Material for propagation should be sourced from the pre mining and construction phase areas. • The applicant should set aside for conservation undisturbed habitat that conserves at least 30% of the project area populations of all SCC recorded from the project area.
Study Area	Loss of Biodiversity and Species of Conservation Concern: Fragmentation of vegetation and edge effects	<ul style="list-style-type: none"> • Ongoing alien invasive vegetation management in the project area for the duration of life of mine. • Maintaining at least one 300m wide infrastructure free north – south ecological corridor along the entire western edge of the project area; • Keeping vegetation clearing during construction to a minimum. • Design and implement a Rehabilitation Management Plan which ensures that construction phase footprints are rehabilitated to acceptable standards (minimum of 60% of original plant species present) as soon as possible after the area is no longer in use.
Visual Impact Assessment		
Study Area	Visual intrusion on views of sensitive visual receptors due to mine construction	<ul style="list-style-type: none"> • The construction contractor should clearly demarcate areas for roads, clearing and stockpiling so as to minimise site disturbance. • To make space for stockpiles necessary during the construction phase, consider clearing areas for this purpose that will need to be cleared for mining activities during the operation phase. • Treat roads to reduce dust emissions.
Waste and Wastewater Impact Assessment		
Study Area	Management of non-process general waste: (i) Pollution of land and water and (ii) the generation of nuisance (including production of odours, visual impact and attraction of pest and vermin)	<p>General wastes mitigations</p> <ul style="list-style-type: none"> • An Integrated Waste Management Plan must be developed for the mine; • All wastes must be managed according to the requirements of South African legislation and, preferably, the requirements of the IFC General EHS Guidelines (2007); • As far as practicable, the philosophy of the waste management hierarchy should be applied to the management of all waste streams in accordance with the Waste Classification and Management Regulations, Government Notice R634 of 2013; • All general wastes that cannot be reused or recycled should be stored in a dedicated area and then transported regularly to the proposed landfill for disposal; • The proposed general landfill site must be sited, designed and operated to international standards in order to isolate the wastes and prevent environmental contamination, particularly groundwater contamination (EHS Guidelines for Waste Management Facilities 2007 and EPA 2000) and must be licenced by the developer early in the construction phase. Until such time as this facility is fully operational, all general waste produced during the construction phase must be stored on site in a secure access control area, in a legally-compliant manner that minimises environmental impacts;

		<ul style="list-style-type: none"> • It will be essential to implement a ground water monitoring system in the vicinity of the constructed landfill site in order to detect any changes to the quality of sub-surface water; • All bins for temporary storage of waste that are located outdoors should be covered to prevent ingress of water and access by animals; • A comprehensive Integrated Waste Management Plan should be developed for the site and it should include Key Performance Indicators (KPIs) against which the management of wastes can be audited; • All employees, contractors and visitors to the site must be informed of correct waste management procedures, including separation of general and hazardous waste at source; • Waste storage and disposal areas must be located at least 100m from surface water resources or important drainage lines.
Regional	Management of non-process hazardous waste: Pollution of land and water and the generation of nuisance (including production of odours, visual impact and attraction of pest and vermin)	<p>Hazardous wastes mitigations</p> <ul style="list-style-type: none"> • The Integrated Waste Management Plan for the facility must cover the management of all hazardous waste types; • Prior to safe disposal, all hazardous wastes must be temporarily stored at the hazardous waste storage facility. This facility should be designed to include secondary containment lined and covered to protect the contents from weather (sunlight and rain). If wastes are corrosive, the base of the storage facility should be lined with an acid-resistant coating; • Where possible, empty containers for hazardous chemicals will be returned to suppliers. Where empty containers for hazardous chemicals (hydrocarbons, pesticides, laboratory chemicals, degreasing agents etc.) cannot be returned to the suppliers, they must be triple-rinsed, punctured and stored in a secure area until such time as they can be disposed of safely. Rinse water may not be discharged directly to the environment; • Empty pesticide containers should be disposed of according to the Food and Agricultural Organisation's (FAO) Guidelines on Management Options for Empty Pesticide Containers (2008); • As per the FOA (2008) guidelines, burning of empty pesticide containers should be strongly discouraged. Specific guidance on the management of empty pesticide containers is provided by the FAO (2008); • A Hydrocarbon Management Operating Procedure should be designed and implemented. Copies of this document should be made available at designated facilities where hydrocarbons are used or stored. The purpose of this procedure is to provide for the proper storage and handling of hydrocarbons, including waste hydrocarbons, on site and hence prevent any form of contamination; • It is recommended that soil contaminated with hydrocarbon should be immediately removed and disposed of at a soil bioremediation facility on site or else disposed of as hazardous waste; • MSDS for all chemicals must be readily available on site and the precautions stipulated in these must be adhered to at all times. All staff must be trained on the correct management of bunded facilities, including the discharge of collected liquids; • Spill kits must be readily available at strategic points throughout the site and staff must be trained on the correct use of these kits; • No hazardous wastes should be disposed of into drains as this may impact negatively on the performance of the septic tanks; • There are two potential disposal options for medical waste which must be managed according to the management procedure described in Annex 3 of the ICRC Medical Waste Management (2011) and the requirements of the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, 3rd ed. (DWAF, 2005). The first would be to transport this material to the Joe Slovo clinic for safe disposal. The second would be to incinerate the material on site to render it harmless and then dispose of it at the on-site landfill.

Study Area	Disposal of domestic wastewater, brine and sewage sludge: Pollution of soil and water	<ul style="list-style-type: none"> • All domestic wash water and sewage from all sites must be diverted to the septic tanks or packaged sewage treatment plants for treatment and discharge from these facilities must meet the local and international discharge standards prior to its release into the process water pond; • Sewage effluent from sanitary facilities should be managed as described in the Guidelines for the Utilization and Disposal of Wastewater Sludge (Vol.1 to 5) (DWAF, 2006) as well as the EHS Guidelines for Water and Sanitation (2007); • Sewage sludge management requires stabilization and drying of the sludge before either disposal at the proposed landfill or alternatively, applied as a soil conditioner during rehabilitation of the mine, provided that levels of toxic constituents are sufficiently low. If soil application is adopted, soil contamination should be avoided and the soil standard prescribed by the AfDB and DWAF (2006) should be adhered to; • The pre-treatment of oil and grease containing effluents from canteens by the use of a grease trap prior to discharge into sewage treatment facilities; • Chemical toilets should not be used during the construction period unless the contents can be disposed of in a manner that does not pose a threat to the environment. Instead, alternatives such as VIPs, composting toilets or similar should be considered as preferred alternatives; • If VIPs are used, they must be lined, maintained and sited in a way that minimises the risk of contamination of surface and sub-surface water resources; • All sewage treatment facilities should be well maintained. To this end, at least one employee on site must be trained to maintain the system(s); • The performance of the sewage treatment systems must be monitored regularly. Where a system is found to be performing poorly, the cause of the poor performance must be investigated timeously and remediation measures put in place to restore performance; • The environmental monitoring programme for the facility must incorporate monitoring points that are able to detect a negative impact on the environment associated with the discharge of treated sewage; • The management of brine water from the desalination plant should be in accordance with IFC EHS Guidelines for Water and Sanitation (2007).
Regional	Disposal of domestic wastewater, brine and sewage sludge: Health impacts on employees and communities	<ul style="list-style-type: none"> • As detailed above and in addition, all employees tasked with management of sewage and sanitation systems should be vaccinated against key diseases associated with these waste streams such as hepatitis B.
Study Area	Disposal of run-off and stormwater: Pollution of land and water	<ul style="list-style-type: none"> • The management of all run-off must comply, as a minimum, with the requirements of South African legislation but preferably with the requirements of the IFC's General EHS Guidelines (2007); • A Storm Water Management Plan must be developed for the mine and it should incorporate measures to divert clean storm water away from stockpiles, waste storage and disposal areas and other operation areas; • Mitigation measures should be aimed at reducing contact between storm water and hazardous chemicals. This needs to be considered during the planning of the storm water drainage system for the mine facilities; • In terms of minimising discharge of pollutants and run-off quantity requiring treatment, all storm water run-off must be properly segregating and clean water run-off diverted to prevent it mixing with water containing a high solids content, to minimize the volume of water to be treated prior to release;

		<ul style="list-style-type: none"> • All run-off from machine wash areas must pass through an oil trap and should be treated as hazardous due to the presence of hydrocarbon. All other run-off water must pass through a sediment trap to remove the majority of suspended solids prior to discharge to the environment. All settled material must be disposed of at the landfill; and • The quality of all liquid waste streams discharged from the site, including storm water, must be monitored regularly to ensure compliance with the requirements of relevant legislation and standards.
Study Area	Management and disposal of obsolete equipment, scrap and tyres: Pollution of soil and water	<ul style="list-style-type: none"> • The Integrated Waste Management Plan or waste management procedure for the facility should address the management of scrap and obsolete equipment, including tyres; • All scrap or obsolete equipment that may potentially be contaminated with elevated levels of radionuclides (Naturally Occurring Radioactive Materials: NORM) should be managed and disposed of according to international best practice; • All scrap must be stored in designated areas, preferably a safe distance from any surface water features; • As far as possible, storm water must be diverted around the scrap storage areas; • Good house-keeping must be employed at the scrap storage area at all times; • Unauthorised individuals must be prevented from removing scrap from the site and the scrap area should be secured; • Where scrap is likely to contain hazardous liquids, including lubricants or hydraulic fluids, these items must be stored in such a way as to minimise pollution of soil and water; • The scrap storage area must be inspected regularly for signs of soil pollution and where this is detected, remediation measures must be implemented immediately; • Where scrap items are likely to release hydrocarbons or other hazardous chemicals, they must be stored on an impermeable surface to minimise the risk of contamination of soil and water; • Where ever possible, all scrap metals including waste tyres that have been cleared of contaminants including NORM should be returned to the suppliers or certified recycling companies for recycling; • All scrap, including waste tyres, must be stored in such a way so as to minimise the formation of stagnant water that will facilitate breeding of mosquitoes.
Regional	Regional waste profile and community awareness: Local knowledge of waste management practices	<ul style="list-style-type: none"> • Train all employees on the importance of proper management of waste streams and sanitation; • Consider options to facilitate improved management of solid waste in local communities. This may include allowing local communities to dispose of their solid wastes at the new landfill facility or training local communities on composting techniques. This may be incorporated into an urbanisation plan for the area. • Consider involving local communities in waste recycling initiatives if these are considered practical within the context of the project.
Regional	Regional waste profile and community awareness: Change in waste profile in the local communities	<ul style="list-style-type: none"> • The mine could assist in the facilitation the development of an urbanisation plan for the local communities; • Consider options to facilitate improved management of solid waste in local communities. This may include allowing local communities to dispose of their solid wastes at the new landfill facility, training local communities on composting techniques or investigating and, if considered feasible, supporting recycling initiatives.
Impact category – Economic impacts		

Study area	Impacts on tourism	<ul style="list-style-type: none"> The construction phase impacts on tourism should be low provided the construction phase is well managed and the mitigation measures suggested by the other specialist studies forming part of the EIA are implemented. These measures are not repeated here. Serious consideration should be given to funding tourism enhancement projects in collaboration with local tourism stakeholders as part of the mine's future Social and Labour Plan (SLP) contributions. With regard to rehabilitation much will depend not only on how the applicant's EMP is conceived but critically and how it is implemented in partnership with the relevant authorities and other stakeholders. As such, rehabilitation needs to be rigorously applied and adequately funded both concurrently and at closure especially to minimise visual scarring and other tourism risks. The biodiversity offset recommended by the botanical specialist would have particular potential to compensate for tourism risks. The initial location options for the offset recommended by the botanical specialist are adjacent to the NNP allowing for new areas to be added to the NNP. Ideally, further choices among these options should be made with NNP tourism development in mind so that the areas chosen can enhance tourism. Such an offset could reduce overall tourism risks to a low significance if appropriately chosen, successful integrated into the NNP and in conjunction with other mitigation and rehabilitation measures.
Study area	Impacts on nearby land owners	<ul style="list-style-type: none"> Some disturbance and nuisance would be experienced during construction. This would include the potential for increased dust and noise as well as increased risk of the emergence of 'social ills' associated with the presence of the construction workforce. Associated impacts would be low provided the construction phase is well managed and the mitigation measures suggested by the other specialist studies forming part of the EIA are implemented. These measures are not repeated here. Negative impacts on surrounding land owners are often exacerbated by a lack of clarity on what can and cannot be expected from applicants. This can be avoided through proper engagement and the establishment of clear systems and procedures. In this regard, a comprehensive monitoring system should be established before mining with the full participation of surrounding land owners. As in the case of tourism risks, rehabilitation needs to be adequately funded and rigorously applied both concurrently and at closure to minimise impacts on surrounding land owners.
Regional	Impacts linked to the construction phase expenditure	<ul style="list-style-type: none"> The applicant's procurement processes, hiring and training of staff and social and labour plan (SLP) projects should act as a departure points when considering benefit enhancement measures. Mitigation in the form of benefit enhancement should focus on three areas: <ul style="list-style-type: none"> Targets should preferably be set for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized. Local sub-contractors should be used where possible and contractors from outside the local area that tender for work should also be required to meet targets for how many locals are given employment. The applicant should explore ways to enhance local community benefits with a focus on well-conceived SLP projects that are clearly aligned with local needs as outlined in the Kamiesberg Municipality IDP
Impact category – Groen estuary ecology		
The present ecological status of the Groen estuary ecology is a 'B', however the estuary is in a protected area (Namaqua National Park) and should therefore be restored to an A status or maintained in a Best Attainable State.		
Regional	The proposed mining activities upstream of the estuary could potentially lead to an increase in groundwater salinity.	<p>SANPAK's responsibility should include the following:</p> <ul style="list-style-type: none"> Permanent probes be deployed to continuously measure salinity in the upper reaches of the estuary. Regular measurements of salinity and other physico-chemical characteristics be conducted along the length of the estuary (quarterly). Vegetation mapping and biological surveys are needed to check for health of brackish wetlands and salt marshes (variable – linked to

Regional	Areas of estuarine open water appear to have decreased over past decades (supported by anecdotal statements made by local residents).	<p>the rate of salinity change in the lower estuary).</p> <ul style="list-style-type: none"> • Bird counts of the estuary should continue (quarterly). <p>Zirco's responsibility should include the following:</p> <ul style="list-style-type: none"> • With respect to the proposed mining operation, permanent salinity probes need to be deployed between the mining site and the head of the estuary to monitor any potential future change in groundwater salinity.
Regional	Changes of the Groen Estuary are potentially linked to both natural and anthropogenic influences.	

Table 8.5: Operational Phase Environmental and Social Mitigation Measures for the Zirco Kamiesberg Project

Potential Impact Area	Sources of Impacts	Mitigation Measures
Impact category - Air Quality		
Study Area	Particulates: Dustfall	<p>Wind erosion from exposed areas and TSF (PM_{10} and $PM_{2.5}$ concentrations and dustfall rates)</p> <ul style="list-style-type: none"> Reshape all disturbed areas to their natural contours. Cover rehabilitated areas with previously collected topsoil and replant native species. <p>Material handling operations</p> <ul style="list-style-type: none"> Drop height from wheel loader into mining unit to be kept at a minimum for mineral sands. <p>Vehicle activity on unpaved roads</p> <ul style="list-style-type: none"> Regular water sprays preferably combined with chemicals on unpaved haul roads to ensure 75% control efficiency. Speed limit on unpaved roads not to exceed 40 km/h. <p>Vehicle tailpipe emissions</p> <ul style="list-style-type: none"> Minimisation of gaseous emissions by preventative controls including: minimisation of vehicle idling times, regular maintenance and servicing of vehicles according to manufacturer’s guidance. <p>Source Monitoring</p> <ul style="list-style-type: none"> Regular monitoring of the emissions from the dryer stacks is likely to be stipulated in the conditions of the Atmospheric Emissions License to ensure compliance with the emissions standards. Regular servicing and maintenance of dust abatement units, i.e. cyclones and baghouse. <p>Ambient Monitoring</p> <ul style="list-style-type: none"> Establish and maintain a dustfall monitoring network - dust fallout rates to be below 1 200 mg/m².day at the property boundary and below 600 mg/m².day at residences surrounding the mining operations, averaged over 30 days. Establish and maintain a continuous PM10 monitor, possibly at the current meteorological station.
Impact category – Radiation Assessment		
<p><i>Refer to Table 8.4 above and in addition:</i></p> <ul style="list-style-type: none"> Training/education programme to be presented to workers; A Radiation Management Plan will be developed and implemented for the Zirco Kamiesberg Project. Appropriate instrumentation to perform radiation and contamination surveys / monitoring will be sourced. Maintain records of accumulated radiation exposure of workers handling the material. Segregate material suspected to be of enhanced levels of radioactivity from the rest of the material. Post signage at areas where such material is handled and stored. Ensure the physical security of the core samples and contaminated scrap steel (pipes, vessels, pumps, valves, flanges, etc.) during all stages of the process. This could include a dedicated shed or storage area, with security fencing for material with enhanced levels of radioactivity, access control to the area, protection of the material against the elements and prevention of contamination of the surrounding soils and groundwater, appropriate recordkeeping of quantities of such material, etc. 		

<ul style="list-style-type: none"> Implement International Atomic Energy Agency (IAEA) transport regulations during the transport of the core samples, specifically those containing enhanced levels of radioactivity, to various laboratories abroad; Availability of emergency control measures should any incident or accident happen to material containing enhanced levels of radioactivity, i.e. during handling, during transport, etc. 		
Impact category – Biodiversity and Faunal Assessment		
Localised	Loss of biodiversity: Loss of faunal biodiversity	<ul style="list-style-type: none"> Mitigation of the impact entails protection and where necessary, rehabilitation of adjacent habitats as a possible environmental offset particularly temporary wetland and riparian habitats, and the rocky habitats in the east of Sabies. Avoid clearing or damaging temporary wetlands, and limit river and stream crossings as far as possible. Associated infrastructure, particularly transport linkages, should avoid these areas. Include a buffer distance of 30 m.
		<ul style="list-style-type: none"> Maintenance of water quality and flow dynamics. Protect abiotic habitats, such as rock outcrops, which shelter many reptile and mammal species. Curtail unnecessary night driving onsite roads as far as possible. Prohibit exploitation of SCC e.g. tortoise and chameleons, by mine employees. Educate mine staff about the necessity of faunal groups such as snakes.
Study Area	Loss of biodiversity: Loss of Species of Conservation Concern	<ul style="list-style-type: none"> Refer to the recommended mitigation Measures in Table 8.4
Localised	Loss of biodiversity: Introduction of Alien fauna	<ul style="list-style-type: none"> The deliberate introduction of alien species should be prohibited, unless a full environmental assessment is undertaken and control methods for escapees detailed. Eradication programs of problem animals should be undertaken in consultation with conservation authorities.
Localised	Habitat impacts: Impacts on fauna due to habitat fragmentation and habitat loss	<ul style="list-style-type: none"> Where possible the planning of the roads and the location of buildings should ensure minimal fragmentation of sensitive habitats. Road designs should incorporate, where possible, underpasses and culverts that allow the movement of animals. This is of particular importance along drainage lines, which form natural corridors for faunal movements. Ecological corridors of sufficient width should be establish to facilitate faunal (especially reptiles and small mammals) movement.
Localised	Additional Operational Impacts on Fauna: Increased Dust Levels	<ul style="list-style-type: none"> Roads should be watered down, or binders used during high wind conditions (refer to air quality assessment for further dust control mitigation). Road speeds in sensitive regions e.g. near temporary wetlands, across drainage lines, and during extreme dry climatic conditions, should be limited to below 40 km/h to curtail dust generation. All products that are to be transported should be done by covered trucks or containers to avoid contamination to the surrounding area.
Study Area	Additional Operational Impacts on Fauna: Noise pollution	<ul style="list-style-type: none"> Mitigation of this impact is difficult and unlikely to be effected, but could involve noise reduction measures in sensitive areas (e.g. adjacent to wetlands) at sensitive times (e.g. at night).
Localised	Additional Operational Impacts on Fauna: Pollution and contamination	<ul style="list-style-type: none"> Refer to the recommended mitigation Measures in Table 8.4

Study Area	Impacts from Product Transport and increased vehicle movements in the area: Threats to Animal Movements	<ul style="list-style-type: none"> • Mitigation depends firstly on ongoing assessment of the significance of animal road mortalities, levels of which should be monitored during the construction and operational phase. • The design of project infrastructure and transport linkages should avoid where possible sensitive habitat corridors, e.g. drainage lines and temporary wetlands. • Road designs should incorporate, where possible, underpasses and culverts that allow the movement of animals. This is of particular importance along drainage lines, which form natural corridors for faunal movements. • Where possible the road traffic on site should be limited after dark, as much of the terrestrial fauna is nocturnal, e.g. bats, most snakes, small rodents, amphibians, etc. Or lower speeds limits must be enforced at night-time on site. These recommendations will help reduce night driving impacts. Limit the transport of product from and to site at night-time as far as possible on the main provincial road, as this will dramatically reduce the impact on all faunal groups.
		<ul style="list-style-type: none"> • Vehicle speed on site should be limited to the lowest possible, and should not exceed 40km/h. • Drivers should be educated regarding their role in impacting on animals and the need to minimize collisions with animals at all times.
Impact category – Health Impact Assessment		
<p><i>The following Operational phase Health issues / impacts and their mitigation measures are similar to that of the Design/Planning and Construction phase and have not been repeated here. For details, refer to Table 8.4 above.</i></p> <ul style="list-style-type: none"> • Acute respiratory infections and respiratory effects from housing. • Sexually transmitted infections including HIV/AIDS. • Soil, water and waste related diseases. • Accidents and injuries. • Environmental health determinants: Radiation, Air, water, noise pollution and malodours • Social determinants of health: Gender-based violence, alcohol and drugs. • Social determinants of health: Social cohesion and well-being 		
Study Area	Food and nutrition related issues.	<ul style="list-style-type: none"> • Support sustainable livelihood programs through increased use of agriculture. The financial benefit of farming over other practices will be essential to support. An example of this could be community gardens; • Support maternal and child health programs; and • Favour local procurement of food items in combination with incentives to increase local production.
Regional	Non-communicable diseases	<ul style="list-style-type: none"> • Collect indicator data on NCD in area. Focus on hypertension and diabetes as most common conditions; • Support the local health care personnel with training on disease management programs and the recognition of NCD symptoms and associated management; and • Support health education programs as part of a community based peer health educator program. These should focus on lifestyle risk factors such as diet, exercise, smoking and alcohol consumption.
Impact category – Heritage, Archaeological and Paleontological Impact Assessment		
Localised	Assessment of archaeological impacts	The assessment of significance with mitigation assumes that archaeological mitigation will take place. Should the affected sites be avoided completely then the significance would drop to Low – almost negligible – which effectively reflects the status quo. However, it will be important to protect those sites where they occur in non-mining areas by developing and implementing a Heritage Management Plan.

		<p>Roode Heuvel (Sites 328, 096, 097, 098, 086, 088, 090, 091 & 092) and Leeuvlei (Sites 025 & 050-055, 101, 033, 037, 041 & 088)</p> <ul style="list-style-type: none"> • Archaeological remains in wind deflated sites must be mapped (on a grid system) prior to any mining or mining related activities commencing in that particular area. • Sands should also be sieved for the presence of sub-surface material. • The remains must be collected, curated and written up and a report presented to the South African Heritage Resources Agency (SAHRA). No archaeological material may be collected or damaged without a permit issued by SAHRA. • Should any unmarked human remains, or ostrich eggshell caches for example, be uncovered or exposed during mining or associated activities, these must immediately be reported to the archaeologist (Jonathan Kaplan 082 321 0172), or the South African Heritage Resource Agency (Ms Mariagrazia Galimberti 021 462 4502). • Burials must not be removed or disturbed until inspected by a professional archaeologist. • A Heritage Management Plan (HMP) must be implemented in order to protect important archaeological sites that fall within 'non-mining areas', during the Construction and Operational Phase of the project. The HMP must be included as part of the Environmental Management Plan (EMP) for the proposed project. The HMP must be submitted to SAHRA for approval. • A buffer of 5m must be established around outcroppings of quartz (Sites 101, 033, 037, 041 & 088). Alternatively, these sites must be fenced off. Fencing must be done in consultation with and under the supervision of the archaeologist. <p>Proposed seawater intake, pump station and pipeline</p> <p>Kmm5</p> <ul style="list-style-type: none"> • Shellfish deposits (Site 095) at the sea water intake must be sampled. This should take the form of a series of 1m x 1m excavations in order to test the significance and extent of the archaeological deposits. • Shellfish and bone must also be collected for dating. Should significant sub-surface deposits be encountered during test excavations, a larger sample will need to be rescued. • Scatters of shellfish (Sites 096-103 & Sites 105-115) in the pipeline route, and between the sea water intake and the pump station (Sites 277-279, Sites 283-286 & Site 296) must be sampled using a sampling strategy designed by Dr Jayson Orton for ephemeral sites of this nature. This will entail more detailed visual recording, sub-surface sampling (i. e. sieving), and collection of shellfish (for dating) and archaeological material. Such studies have shown an improved knowledge of pre-colonial landscapes. • Scatter of tools (Site 136) in the wind deflated site in the pipeline route south of the Groen River must be mapped on a grid system and sand sieved for the presence of sub-surface material. All the remains must be collected, curated and written up and a report presented to SAHRA. No archaeological material may be collected or damaged without a permit issued by SAHRA (alternatively, the pipeline must be moved to avoid this important site). • Outcropping of quartz (Sites 138 & 139) alongside the pipeline must be investigated. This will entail more detailed visual recording, mapping and collection. The material must be written up and a report presented to SAHRA. No archaeological material may be collected without a permit issued by SAHRA (alternatively, the pipeline must be moved to avoid this important site). • Should any unmarked human remains or ostrich eggshell caches be uncovered or exposed during excavations for the pump station for example, these must immediately be reported to the archaeologist (Jonathan Kaplan 082 321 0172), or the South African Heritage Resource Agency (Att: Ms Mariagrazia Galimberti 021 462 4502). Burials must not be removed or disturbed until inspected by a professional archaeologist.
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		<p>Kmm4</p> <ul style="list-style-type: none"> Scatters of shellfish (Site 273, Sites 233, 236 & 237, Sites 244 & 245, Sites 250-255 & Site 261) in the pipeline route, and scatters of shellfish between the sea water intake and the pump station (Site 229 & Site 272) must be sampled using a sampling strategy designed by Dr Jayson Orton for ephemeral sites of this nature. This will entail more detailed visual recording, sub-surface sampling (i. e. sieving), and collection of shellfish (for dating) and archaeological material. Such studies have shown an improved knowledge of pre-colonial landscapes. <p>Sabies</p> <ul style="list-style-type: none"> If prospecting rights are approved, the area known as Sabies must be assessed for archaeological heritage ahead of any mining or development activity.
Impact category - Marine and Rocky Shore Assessment		
Localised	Impingement of organisms	<ul style="list-style-type: none"> Having discussed the optimum intake velocity with the engineers it was agreed that the recommended intake flow may not exceed 0.2 m/s through the installation of an appropriate sized intake structure on the base of the foot valve. The intake structure should be directed such that water flows in a 'horizontal' rather than vertical direction; The intake pipes must be positioned at least 0.5 m off the seabed to reduce the intake of sediment and benthic organisms (Fredorenko 1991); and The intake pipes must be positioned at least 1.4 m below the Mean Low Water Spring Tide mark to reduce entrainment of larvae and most other planktonic marine organisms as these are generally concentrated at or near the surface.
Impact Category – Noise and Vibration Impact Assessment		
<p><i>Operational phase Noise and Vibration issues / impacts and their mitigation measures are similar to that of the Planning/Design and construction phase and have not been repeated here. For details, refer to Table 8.4 above.</i></p>		
Impact category - Rehabilitation		
Study Area	Rehabilitation during mining operations	<p>Step 1: Seed and plant harvesting</p> <ul style="list-style-type: none"> Prior to mining from the mine path: <ul style="list-style-type: none"> Plan topsoil stripping to take place after plant harvesting Seed collection and propagation must take place throughout winter until early summer. Geophytes, succulents, and suitable plants must be harvested and relocated to rehabilitation sites. If conditions are un-favourable, they will need to be established in a holding nursery for later use. <p>Step 2: Relocation of plant material</p> <ul style="list-style-type: none"> This must be a seasonal activity, taking place between April to June, but before the rains. Harvested plants must be transplanted directly into rehabilitation areas (parcels of land already mined) whenever possible, as this is much more cost effective, and success rate is significantly enhanced. Plants should be maintenance through a single watering up front might be sufficient, but two additional watering might be required. Experiments to determine if hydrogel is to be added to the planting holes to improve water retention is required, and if this reduces root establishment then it must not be used. It is too expensive to transplant mature plants and with poor chances of success (e.g. skilpadbossie).

		<p>Step 3: Bush clearing</p> <ul style="list-style-type: none"> • Use a bush rake to clear vegetation (modified front bucket of a bulldozer). • Scrape top 300 mm of soil, with organic material (keep as coarse as possible to slow down decomposition and to create micro habitat). Push this material into wind rows. • Use a loader/excavator to load onto dump trucks, which take material to the rehabilitation area. Dump in rows and then use a bulldozer to open and spread material. • Material becomes compacted due to mechanical handling and thus requires ripping by small Cat D6 with tines at the back. Rip to topsoil depth (0.3m). This will mix the top soil and underlying fill reducing the soil variance and incorporate organic matter and seed. • Conduct broadcast seeding of primarily indigenous pioneer vegetation that will rapidly germinate and stabilise areas. <p>Step 4:- Tailings stacking</p> <ul style="list-style-type: none"> • The top 2 metres of tailings in all the mine voids must be sand tailings only. • Slimes overflow will go to the TSF or elsewhere in the mining voids, in areas where co-disposal occurs. These areas do not correspond exactly to mining years, but co-disposal will take place in the areas to be mined in years 1 to 7, and 8 to 11. This will not have a major impact on the rehabilitation in these areas. • It is important that sand tailings cover all the co-disposal sites, as more than 10% clay content in the sand will bind the salt and retain it in the soil profile (Carrick and Kruger, 2007), and should be avoided. This means that the TSF will need to remain operational for life of mine, so that higher clay content tailings can be disposed into the TSF. In some areas (e.g. years 17 and 18) no tailings is placed onto the mining footprint, hence no salt enrichment occurs. In these areas rehab can proceed faster after mining without added saline stress. <p>Step 5: Erosion control</p> <ul style="list-style-type: none"> • The surface must not be sprayed with a thin layer (<1cm) of slimes using a water monitor (or similar) as the benefits for rehabilitation are not significant. In fact, the slimes layer may limit rehabilitation success as it retains salts in the soil surface. This should be used only for erosion control. • The planting of brush (as done during the pilot phase) will be too expensive. The cheapest option to control wind erosion is to establish rows of shade-cloth to act as wind breaks. These are to be spaced at 5m intervals and at 750mm height. Custom made wind nets with R10 steel droppers at 5m spacing must be used. These wind rows can be re-used, but they must stay in place for 3 years. Thus, 20 wind rows per hectare of 100m length are estimated, totalling 2 000m of wind rows per hectare. <p>Step 6: Seeding and planting</p> <ul style="list-style-type: none"> • Step 1 - Relocated plant material (geophytes & succulents) must be planted in areas where topsoil has been spread and wind rows installed. This activity will be initiated in year 3 of mining, on the year 1 and 2 parcels of land, totalling 230ha. These areas must be over-seeded at a rate of 5kg/ha with indigenous pioneer species collected from ahead of the mining area. Possible species include <i>Oncosiphon spp.</i>; <i>Ehrharta calycina</i> and <i>Stipagrostis spp.</i> The focus of seed harvesting must be on easily harvested seeds. • Step 2 - Assess the need for in-planting and the establishment of woody vegetation as functional plant groupings. These plants must be harvested from the veld, and directly planted into the rehabilitation areas. It is too expensive to bag and leave them in a nursery, and the success rates are generally lower than from direct planting. This should only be done for SCC or if no suitable habitats exist.
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		<p>Step 7: Establish nursery</p> <ul style="list-style-type: none"> The nursery is primarily required for the propagation of species of special concern and the management of seed harvesting etc. The nursery must be established at the start of construction, prior to any clearing in order for harvested seeds to be stored, and any SCC collected and translocated to the nursery, or planted directly into the ecological corridors (preferably, as the success rate will be higher). <p>Step 8: Ongoing maintenance</p> <ul style="list-style-type: none"> Primary activities include <ul style="list-style-type: none"> Repair and maintain netting. Watering of plants in 1st year during periods of drought. Erosion control. Maintain transplanted nursery plants Maintain seeding Additional planting of bare patches. Alien vegetation cleaning.
Study Area	Topsoil handling and maintenance	<p>Topsoil stockpile maintenance:</p> <ul style="list-style-type: none"> Ideally stockpiles should not be higher than 2m, but this means one requires 1ha storage space per 7 ha of cleared area. An area of 60ha is required to stockpile top soil from years 1 and 2 of mining for a two year period. A compromise between depth of topsoil stockpile and area affected by the stockpiles will need to be achieved, as topsoil below the stockpile will be negatively affected. If the topsoil is stored for more than 6 months loss of seed bank and micro-organisms occurs. The topsoil removed from the TSF area will need to be stored for the life of mine and only used at closure, to rehabilitate the TSF. Loss of seed bank and micro-organisms will occur in any event, and thus, it is recommended to maximise storage height and ameliorate topsoil later when used. The side slopes of the stockpiles must not have slopes greater than 1:3 For long term TSF top soil storage, store topsoil at a maximum height of 5m. This will require 1ha stockpiles for every 15ha cleared. Total size of the TSF is 340ha, and a total area of at least 25 ha will be required for the TSF topsoil stockpile Temporary topsoil stockpiles will also be required during mining, with topsoil for close to 400ha required on occasion. At a 2m recommended height for temporary stockpiles, each 7ha requires 1ha surface area, requiring approximately 60ha for temporary topsoil stockpiles. Thus, topsoil stockpile management is an important component of the rehabilitation programme. Over-seed the permanent stockpiles (and those portions of the temporary stockpiles not been re-worked), and rehabilitate using same procedure as done for other areas, by following steps 2; 5; 6 & 8 above (<i>Rehabilitation during mining operations</i>). <p>Topsoil handling</p> <ul style="list-style-type: none"> The correct handling of topsoil is one of the most critical determining factors for successful rehabilitation. If the storage of topsoil can be limited, then seed banks and soil fauna remain biologically active, speeding up the rehabilitation process. The following sequence of topsoil handling is suggested, to demonstrates the practically and principal of being able to integrate topsoil placement as part of the mining process. It is assumed that topsoil placement will be two years out of rotation, and it is acknowledged that significantly more detailed planning will be required to refine the sequence of top soil replacement required. This sequencing and planning will be constantly updated as part of ongoing mine planning throughout the life of the operation: Years 1 & 2 - Construction areas and year 1 and 2 mine area topsoil will go to the topsoil stockpile located in the south west corner, in the year 13 mining area (called the SW stockpile).

		<ul style="list-style-type: none"> • Year 3 – the year 1 area will not be rehabilitated , as a void needs to be created and mining must progress to a point where rehabilitation can start. The mined out year 1 area will be covered with topsoil from the SW stockpile. • Year 4 - The year 2 area will be covered with topsoil from the year 3 mining area. • Year 5 - the year 3 mining area will be covered with topsoil from the year 4 area. This has an area of 185ha, so the topsoil from the additional 86ha will need to be stored in the SW stockpile. • Year 6 – the year 4 area will be covered with topsoil from year 5 area, which is 135ha in extent. Topsoil for the additional 50ha will need to come from the SW stockpile. At this stage there will be a surplus of 93.5ha of topsoil for use later in the process. • Year 7 – the year 5 area will be covered with topsoil from the year 6 mining area of 91.5 ha. Additional topsoil for the 43.5ha area will need to come from the SW stockpile. • Year 8 – the year 6 area will be covered with topsoil from the year 7 mining area, which has an area of 157.5 ha. It is recommended that a second stockpile be established in the adjacent to the year 19 mining area. The additional 66ha should be stockpiled in this north-west stockpile. • Year 9 – the year 7 area will be covered with topsoil from the year 8 mining area of 125ha. Top soil for the additional 31 ha will be obtained from the NW stockpile. • Year 10 - the year 8 area of 125ha will be covered with topsoil from the year 9 mining area of 160ha. Top soil for the remaining 35ha will need to be stored in the SW stockpile, increasing this to a reserve sufficient for covering 228.5ha. • Year 11 - the year 9 area of will be covered with topsoil from the year 10 mining area of 180ha. The additional topsoil of 20ha will be stored in the SW stockpile. • Year 12 - the year 10 area of will be covered with topsoil from the year 11 mining area, which is identical in size. • Year 13 – the year 11 area of 180ha will be covered with topsoil from the year 12 mining area of 254ha. Additional topsoil of 74ha will be stored in the SW stockpile, leaving a net amount of 302.5ha available for rehabilitation. • Year 14 - the year 12 area of 254ha will be covered with topsoil from the year 13 mining area of 178ha. Additional topsoil for 76ha will come from the SW stockpile, leaving a net amount of 226.5ha available for rehabilitation. • Year 15 - the year 13 area of 178ha will be covered with topsoil from the year 14 mining area of 106ha. Additional topsoil for 72ha will come from the SW stockpile, leaving a net amount of 154.5ha available for rehabilitation. • Year 16 - the year 14 area of 52.5ha will be covered with topsoil from the SW stockpile, reducing its size to 48ha to serve as a reserve for any rehabilitation at closure. Topsoil from the year 15 mining area of 223ha should be used for the northern portion of the year 14 area (52.5ha), with the remaining 170.5ha going to the NW stockpile, increasing its size to 205.5ha for use later in the programme. • Year 17 - the year 15 mining area of 223ha will be covered with topsoil from the year 16 area of 261ha. The additional 38ha will need to be stored in the NW stockpile, increasing its size to 243.5ha available for rehabilitation. • Year 18 - the year 16 mining area of 261ha will be covered with topsoil from the year 17 area of 279.5ha. The additional 18.5ha will need to be stored in the NW stockpile, increasing its size to 262ha available for rehabilitation. • Year 19 - the year 17 mining area of 279.5ha will be covered with topsoil from the year 18 area of approximately 200ha, with topsoil for the additional 79.5ha coming from the NW stockpile, reducing its size to 182.5ha available for rehabilitation. • Year 20 - the year 18 mining area of 200ha will be covered with topsoil from the year 19 area of 106.5ha. The additional 83.5ha will need to come from the NW stockpile, reducing its size to 99ha available for rehabilitation. • Year 21 - the year 19 mining area of 106.5ha will be covered with topsoil from the year 20 area of 130ha. The additional 24ha will be stored in the NW stockpile, increasing its size to 123ha available for rehabilitation.
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Localised	Tailings storage facility	<ul style="list-style-type: none"> Year 22 – The year 20 mining area of 130ha will be rehabilitated with topsoil from the NW stockpile, which at this time will have 123ha available for rehabilitation. The depleted stockpile area will also be rehabilitated. There is requirement to remove the top 30cm of topsoil from the TSF void, for later use to cap the saline saturated clay material in the TSF. Topsoil from the permanent topsoil stockpile can also be used to cap the TSF. It is recommended that the TSF topsoil stockpile of 25ha be located east of the TSF. It is assumed that between 0.5 – 1m of capping material will be required.
Impact Category - Socio-economic Impact Assessment		
Operational phase Socio-economic issues and impacts and their mitigation measures are similar to that of the construction phase and have not been repeated here. For details, refer to Table 8.4 above.		
Impact Category – Soil and Agricultural Impact Assessment		
Study Area	Loss of agricultural land: As a result mining activities	<ul style="list-style-type: none"> Develop a Rehabilitation Plan that will ensure that the land can be utilised for agricultural purposes after closure and rehabilitation of the mining area.
Study Area	Surface water and run-off: Concrete foundations and roads leading to erosion	<ul style="list-style-type: none"> All run-off water must be collected, channelled and disposed of in an appropriate manner. The site must be visually monitored for occurrences of erosion, which must be recorded and immediately rectified. If erosion occurs the necessary changes to the surface drainage management system must be implemented.
Study Area	Sedimentation: Mining activities resulting in increased sedimentation of rivers and streams.	<ul style="list-style-type: none"> Ensure that all stockpiled material (subsoil and topsoil) are appropriately sited and shaped to reduce wind-blown sand. Other mitigation measures include wetting, canvassing or netting down stockpiles, and the construction of wind breaks.
Study Area	Loss of natural vegetation: Resulting from mining activities.	<ul style="list-style-type: none"> The upper 10cm of top soil must be stripped and stockpiled prior to commencement of the mining activity. It must be retained for re-spreading over disturbed surfaces during rehabilitation. Local seed mixes may be used to aid and speed up the rehabilitation process. Seed mixes must be approved by the ECO.
Regional	Loss of water: Ground and surface water loss resulting from mining activities.	<ul style="list-style-type: none"> Minimise groundwater usage for mining activities. Implement rainwater harvesting management plan to ensure the maximum usage of rainwater for mining consumption.
Impact category - Surface and Ground Water Assessment		
Study Area	Impacts on groundwater of the tailings storage facility and backfill	<p><i>Groundwater modelling indicates that increases in TDS during the 20-year operational lifetime of the mine will occur only in the immediate vicinity of the TSF, and is unlikely to prejudice any activity outside the mining area even after mining ceases.</i></p> <ul style="list-style-type: none"> Recover seawater from tailings via sumps in paddocks and recycle as process water. Optimise the use of slimes mixed with coarser material (co-disposal) to reduce the rate of infiltration and seepage. Continuously monitor the salinity of the groundwater in and around the mining area to confirm or otherwise the results of modelling, and continuously update the model to take account of the monitoring results and data from the weather station. If necessary, concomitant with the chosen form of post-mining land use, provide alternative sources of water for stock watering if salinity levels exceed levels appropriate for animal consumption. New boreholes may need to be established outside the mining area to the east and west, and also on the south side of the Groenrivier.

Localised	Impacts on groundwater of groundwater abstraction	<p><i>Impacts on groundwater levels will almost certainly occur if groundwater is abstracted for use in mineral processing, even if groundwater is used only to supplement seawater.</i></p> <ul style="list-style-type: none"> • Restrict groundwater abstraction to the long-term sustainable yield of the well field to minimise lowering of groundwater table. • If necessary provide an alternative source of water for stock watering if abstractions for mining purposes prejudice the yield of existing wells and boreholes used by local population. • Continuously monitor groundwater levels via observation wells.
Study Area	Impacts on groundwater of pollution by contaminants	<p><i>Refer to Table 8.4 for mitigation measures for this impact is similar to those provided for the construction phase and are not repeated here.</i></p>
	Impact on surface water of groundwater abstraction from the Groenrivier valley	<ul style="list-style-type: none"> • <i>Provided no water is abstracted from the groundwater system that feeds the spring no impacts on the river or estuary are anticipated during construction or operation, or in the long-term after mine closure.</i>
Localised	Impacts of river crossing infrastructure	<p><i>A road crossing already exists, and the upgraded / new crossing is not expected to cause additional impacts to the flow regime of river, or to the bed or banks, during mine operation. The seawater pipeline will be constructed across the river at a height sufficient to avoid damage by the occasional high flows in the river.</i></p> <ul style="list-style-type: none"> • <i>Refer to Table 8.4 for mitigation measures for this impact is similar to those provided for the construction phase and are not repeated here.</i>
Impact category - Traffic and Transport Impact Assessment		
Study Area	Increased operational traffic on DR2938: Increased risk of vehicle collisions and personal injuries	<ul style="list-style-type: none"> • The road must be upgraded to ensure that it is wide enough to allow two heavy vehicles to pass safely. The carriageway may need to be widened in places, and realigned at sharp bends. Construction work on the road upgrade must be done in such a way as to minimise disruption to local traffic. • A speed limit appropriate to the design and construction factors and characteristics of the road (such as width, horizontal and vertical alignment, grade, sightlines and surfacing material) must be specified for all construction vehicles, and strictly enforced. Signage must be erected at frequent intervals along the road. • Warning signage must be erected at all intersections, including at the intersections with farm access roads. • Operational trips must be minimised during the hours of darkness. Trips by heavy vehicles must, as far as possible, be avoided during the hours of darkness. • Deliveries by heavy vehicles must, as far as possible, be scheduled to avoid the formation of convoys. Sufficient distance must be maintained between heavy vehicles to allow light vehicles to overtake safely.
		<ul style="list-style-type: none"> • An Operational Construction Traffic Management Plan must be developed and implemented. • The Operational Emergency Preparedness and Response Plan must include provisions to deal with traffic accidents, and particularly accidents involving personal injuries, and all drivers must be made aware of the procedures to be followed. • Communication with the local community and individuals must provide regular information on the volumes of traffic particularly heavy vehicles, anticipated on the road during the operation of the mine.
Study Area	Increased operational traffic on DR2938: Increased dust generation	<ul style="list-style-type: none"> • The upgrade of the road must include measures to reduce the generation of fugitive dust, preferably by means of a bituminous / aggregate sealing / wearing course, but otherwise by regular and frequent application of dust suppressant, including water if it is available in sufficient quantities.

Regional	Increased operational traffic on the N7 highway: Disruption of traffic flows on the N7	<ul style="list-style-type: none"> • Upgrade the N7 at its intersection with DR2938 as required by SANRAL, which may include the construction of an auxiliary acceleration lane south from the intersection, and upgrading the DR2938 bellmouth entrance. • Extreme care must be exercised when travelling through the urban areas of Piketburg, especially during morning and evening peak hour traffic, and speed limits must be strictly observed. • Avoid the formation of convoys. • Maintain sufficient distances between heavy vehicles to allow light vehicles to overtake safely. • Develop and implement an Emergency Preparedness and Response Plan to deal with incidents en route.
Regional	Increased operational traffic on provincial roads: Disruption of traffic flows on provincial roads	<ul style="list-style-type: none"> • Extreme care must be exercised when travelling through the urban areas of Moorreesburg and Hopefield, especially during morning and evening peak hour traffic, and speed limits must be strictly observed. • The formation of convoys must be avoided. • Sufficient distances must be maintained between heavy vehicles to allow light vehicles to overtake safely. • An Emergency Preparedness and Response Plan must be in place to deal with incidents en route.
Vegetation and floristic specialist study		
<p><i>The following habitat will not be impacted by mining and as such no specific mitigation measures are required:</i></p> <ul style="list-style-type: none"> • Loss of Riparian Vegetation (Namaqualand Riviere) • Loss of Klipkop Shrubland (Namaqualand Klipkoppe Shrubland) • Loss of Seashore Dunes • Loss of Coastal Duneveld 		
Study Area	Loss of Vegetation Type: Loss of Strandveld (Namaqualand Strandveld)	<ul style="list-style-type: none"> • Areas impacted by mining must be rehabilitated as soon as possible after cessation of disturbance; • Topsoil of at least 300mm (0.3m) depth must be harvested from within all development footprints and used for rehabilitation purposes. This is regarded as the minimum depth required in order to include at least 60% of the bulbs (geophytes). • There must be a north-south corridor at least 300 m wide through the project area at all times. This corridor will be along the eastern side of Roode Heuwel during years 1-5 of mining and along the western edge of the project site once rehabilitation has been completed, for the remainder of the mine life. • Areas within the project area that are not required during mining should be demarcated as no-go areas and conserved. These areas provide important refugia for birds, reptiles, amphibians and mammals. • All Very High sensitivity areas outside the approved mining area should be treated as conservation areas and should not be subject to invasive prospecting or mining; • No livestock should be allowed to graze in the approved mining area nor within a 500m buffer area (if such an area is located within the permit area) from six months after any authorization up until the mine closure permit is granted. Removal of livestock from the area will significantly enhance seed set and hence rehabilitation. • Design and implement a Rehabilitation Management Plan. • Rehabilitation targets must include a measurable element of botanical diversity. In other words the rehabilitation target for Strandveld areas should be to return the mined areas to at least 60% of the pre-mining botanical diversity for this habitat. • Ongoing, annual alien invasive vegetation management is required in the mined and rehabilitated areas until the mine closure permit is issued. • East – west oriented wind fences will be required in the rehabilitation areas in order to minimise wind erosion, probably at an interval of every 5m, as at Namakwa Sands.

Study Area	Loss of Vegetation Type: Loss of Sand Fynbos (Namaqualand Sand Fynbos)	<ul style="list-style-type: none"> The portions of the northern Namaqualand Sand Fynbos within the ecological corridors in the project area must be set aside as a formal conservation area and managed as such for the duration of the project. It is recommended that discussions are undertaken with the Namaqua National Park with regards to incorporating this section into the Park. This may however, not be a viable option as there are limited linkages between the Park and the proposed project area. No livestock should be allowed to graze in the area demarcated as ecological corridors within the Roode Heuwel property, which will be owned by Zirco. To serve as biological offset if Roode Heuwel is not of interest to the National Park suitable high quality areas of Namaqualand Sand Fynbos in the region, adjacent to the Namaqua National Park, have been identified.
Study Area	Loss of Vegetation Type: Loss of Heuweltjieveld (Namaqualand Heuweltjieveld)	<ul style="list-style-type: none"> All Very High sensitivity areas (notably quartz patches) outside the proposed mining area should be treated as conservation areas and should not be subject to prospecting or mining.
Study Area	Loss of Species of Conservation Concern	<ul style="list-style-type: none"> All bulbs (geophytes) of Conservation Concern in the mining area (notably <i>Lachenalia</i> sp nov/<i>arenicola</i>) should be subject to Search and Rescue in the winter to spring season (June – September) preceding any mining. These plants should be located by suitably qualified staff or consultants who can identify the species. The plants should be immediately translocated to a similar, suitable receiving environment that will not be disturbed by mining activities at any stage in the future. All succulents of Conservation Concern in the mining area (notably <i>Lampranthus procumbens</i>) should be subject to Search and Rescue in the autumn (April – May) preceding any mining. These plants should be located by suitably qualified staff or consultants who can identify the species. The plants should be immediately translocated to a similar, suitable receiving environment that will not be disturbed by mining activities at any stage in the future.
		<ul style="list-style-type: none"> A nursery should be set up in the project area to propagate all possible SCC from within the mining area, and the propagated plants should be returned to the post mining landscape about three years after initial rehabilitation has been completed. Planting out should take place after the first good winter rains, typically in May or June. Material for propagation should be sourced from the pre mining areas.
Study Area	Loss of Species of Conservation Concern: Fragmentation of vegetation and edge effects	<ul style="list-style-type: none"> Ongoing alien invasive vegetation management in the mining and project area for the duration of life of mine. Setting aside key representative portions of each vegetation type as conservation areas (as depicted in the proposed corridor map) within the project area. There must be a north-south corridor at least 300 m wide through the project area at all times. This corridor will be along the eastern side of Roode Heuwel during years 1-5 of mining and along the western edge of the project site once rehabilitation has been completed, for the remainder of the mine life. Best practise rehabilitation of mined areas as soon as feasible after cessation of mining of each block. Mining of only one block at a time (all blocks <300ha in extent), with concurrent rehabilitation of any previously mined blocks, and no disturbance of blocks that will only be mined in the future.
Study Area	Loss of Species of Conservation Concern: Increased dust levels on vegetation	<ul style="list-style-type: none"> Haul roads and the heavy use areas around the main plant should be compacted and treated with dust inhibitors. Heavy vehicle speed limits on unpaved roads on site should be 40km/h. Wind fences should be erected at suitable intervals (probably every 5m) on all recently mined and rehabilitated areas. Only single blocks should be mined at any one time, with no block being bigger than 300ha.

Study Area	Loss of Species of Conservation Concern: Invasion of alien species	<ul style="list-style-type: none"> • Prepare an Alien Management Plan, with ongoing, annual alien vegetation management throughout the project area, and in the mining area and along roads in particular. • Eradicate alien invasive plants as they appear. Alien invasive plants should be stockpiled and burnt to destroy their seeds. • Do not use any alien grasses (eg. Lolium - ryegrass) for rehabilitation purposes. • Do not allow livestock on the mining site during the life of mine and for at least 10 years after mine closure, as livestock grazing will selectively remove the palatable species and leave the unpalatable species. The latter are typically the common, weedy species that dominate most disturbed areas, and once established are difficult to remove. • Put in place environmentally acceptable procedures for waste management. • Monitor the project area for any new invasive plant species, and remove them as they appear.
Visual Impact Assessment		
Study Area	Impact of introducing highly visible mine infrastructure into a rural, undeveloped landscape.	<ul style="list-style-type: none"> • Maintain as much natural vegetation as possible between the mine buildings and the edge of the mine area. • Non-reflective paint should be used on all buildings and roofs of buildings. Galvanised steel structures should be darkened to prevent glare. • Rehabilitate areas that have been cleared of vegetation during the construction phase. • Treat roads to reduce dust emissions. • Light fixtures installed should not spill light beyond the mine area, where they are needed for 24 hour mine operation. Direct the light beams downwards, and use blinds as necessary. • Use timer switches or motion detectors to provide light in areas where light is not needed continuously.
Study Area	Visual intrusion on views of sensitive visual receptors due to mine construction	<ul style="list-style-type: none"> • The construction contractor should clearly demarcate areas for roads, clearing and stockpiling so as to minimise site disturbance. • To make space for stockpiles necessary during the construction phase, consider clearing areas for this purpose that will need to be cleared for mining activities during the operation phase. • Treat roads to reduce dust emissions.
Study Area	Impact of mine construction and operation in light of the Department of Environmental Affairs' Strategy on Buffer Zones for National Parks	<ul style="list-style-type: none"> • There is little that can be done to mitigate this impact, however it will be necessary to interact closely with SANParks, and reach agreement on a way forward that will assist the Namaqua National Park in achieving its function as specified in its management plan.
Waste and Wastewater Impact Assessment		
Localised	Disposal of tailings: Health and safety of employees and local communities.	<ul style="list-style-type: none"> • The management of TSF will conform to the requirements of the IFC's EHS Guidelines for Mining (IFC, 2007); • As far as practical, the TSF must be sited in a location such that in the event of failure, pollution of soil and water as well as physical risk to farms, including communities is minimised;
		<ul style="list-style-type: none"> • The integrity of the TSF must be inspected regularly by suitably qualified personnel throughout the life of the mine; • Access to the TSF should be restricted as far as practical and all local communities including farms should be informed of the potential risks associated with these facilities through site notices and community meetings.

Localised	Storage of effluent in the process water pond: (i) Pollution of soil and water and (ii) Risk to Health and Safety of Employees	<ul style="list-style-type: none"> • The process water storage pond will be fenced off with appropriate signage to limit unauthorised access; • Flotation devices will be readily available around the facility; • The Health & Safety induction training should incorporate these risks; • The integrity of the TSF must be inspected regularly by an independent and suitably qualified and experienced engineer; • The operation of the facility must ensure sufficient freeboard to ensure that the pond does not overflow; • The quality of the stored process water should be monitored so that in the event of accidental discharge, the contaminants released into the environment are known. • Warning notices should be placed around such facilities.
<p><i>The following Operational phase Waste and wastewater issues and impacts and their mitigation measures are similar to that of the construction phase and have not been repeated here. For details, refer to Table 8.4 above.</i></p> <ul style="list-style-type: none"> • Management of non-process general and hazardous waste: (i) Pollution of land and water, and (ii) Nuisance including odour, visual and attraction of pest and vermin. • Disposal of domestic wastewater, brine and sewage sludge: (i) Pollution of soil and water, (ii) Health impact on employee and communities and (iii) Nuisance (odour and flies). • Disposal of run-off and storm water: Pollution of land and water. • Management and disposal of obsolete equipment, scrap and tyres: Pollution of soil and water. • Regional waste profile and community awareness: (i) Change in the local knowledge of waste management practices and (ii) Change in waste profile in the local communities. 		
Impact category – Economic impacts		
<p><i>Operational phase economic issues and impacts and their mitigation measures are similar to that of the construction phase and have not been repeated here. For details, refer to Table 8.4 above.</i></p>		
Impact category – Groen estuary ecology		
<p><i>Operational phase Groen estuary ecology issues and impacts and their mitigation measures are similar to that of the construction phase and have not been repeated here. For details, refer to Table 8.4 above.</i></p>		

Table 8.6: Decommissioning Phase Environmental and Social Mitigation Measures for the Zirco Kamiesberg Project

Potential Impact Area	Sources of Impacts	Mitigation Measures
General mine infrastructures		
Localised	Mine void	<p>During operational phase:</p> <ul style="list-style-type: none"> The composition of the tailings from the PCP, which amount to > 90% of the mined material, will be unchanged by the process and will be immediately returned to the mining void as backfill material or the TSF. The tailings that result from the primary separation processing of heavy minerals occur in two distinctly separate streams, namely fine tailings containing a high proportion of clay-sized material (D50±3 micron) (referred to as slimes) and coarse sand tailings (D50±150 micron) (TZMI, 2014). These tails will be co-disposed into the mine void in suitable areas or into the TSF. Once the mine void has been backfilled (with a combination of tailings and slimes) the surface will be contoured and the topsoil that was previously removed and stockpiled as part of the clearing and stripping process will be returned and spread by bulldozers and replanted. As far as practical, the natural seed bank within the topsoil will be encouraged to germinate. This will involve developing the operational processes in a manner that minimises the length of time that topsoil is stockpiled. Post-closure monitoring of stability of the area (i.e. formation of sink holes), radiation levels, vegetation cover, soil structure and nutrient profiles and water quality will be carried out to ensure that the area is stable and that the water is of quality that meets relevant legislative requirements and does not pose a risk to human or environmental health. Monitoring will begin within 6 months after an area has been rehabilitated. Rehabilitated areas should be monitored annually until 4 years after the mine has closed. Further biennial (once every two years) monitoring should occur after the mine has closed from years 4 to 10.
Localised	MSP, PCP, workshops, administration, fuel storage areas and other infrastructure	<ul style="list-style-type: none"> Certain infrastructure may remain post closure. No dedicated haul road will be constructed for the proposed development, as existing roads will be upgraded. These upgrades will remain post closure and will not be decommissioned. In addition, the buildings of the administration block, workshop and maintenance area will remain to support post closure use. Once closure is complete, a decision to either demolish remaining facilities or hand them over to the KLM for conversion into social infrastructure (e.g. schools, clinic) will need to be made using a consultative process. The future use of the reverse osmosis plant and pipeline should be discussed with the relevant authorities and municipalities with a view to handing the system over to the KLM. This could be to the benefit of the local communities as potable water is a scarce commodity within the region. <p>All other infrastructure will be decommissioned as follows:</p> <ul style="list-style-type: none"> Any surface buildings and infrastructure which are no longer required will be demolished, unless specific directives to the contrary are received from the authorities. Such directives may result from communities' requests. This will need to be confirmed through a stakeholder engagement process undertaken as part of the closure plan goal refinement exercise. Foundations will either be removed or will be covered with a layer of soil, or soil forming material, the depth of which will need to be determined following appropriate trials.

		<ul style="list-style-type: none"> • Non-re-useable materials including rubble and waste will be disposed of at suitable sites in accordance with the waste management and disposal plan that will be developed. • Following the removal of the infrastructure a soil contamination assessment will be undertaken by an independent specialist and remediation and re-vegetation activities implemented where necessary. • Support infrastructure buried underground such as tanks and their pipes, other pipes and service tunnels will, depending on the proposed future use of the site, either be kept as is or be unearthed and removed from the site. If they are to be left in-situ, the integrity of all underground pipes and tanks will be assessed by an independent expert. If the integrity of sub-surface infrastructure is compromised, it will be removed. • Remaining openings and access ways of support infrastructure will be blanked. • A detailed plan indicating the location of any remaining infrastructure will form part of the closure plan. • Electrical equipment and infrastructure i.e. generators will be removed from the site. The soils in the vicinity of the generators will be assessed for contamination and appropriate decontamination measures will be implemented, in accordance with South African regulatory requirements. • All disused mining plant and equipment such as the MSP, PCP, and heavy machinery will be removed from the site. It is not anticipated that any of this machinery or equipment will be contaminated. However, the mine will confirm this before any machinery or equipment is removed from the site. If any of the machinery or equipment is found to be contaminated it will be appropriately decontaminated before being removed. • During the mitigation and rehabilitation works, particular attention will be paid to the places where equipment will be parked. The mine will assess these sites and if the soils are contaminated appropriate remedial measures will be taken in compliance with South African regulatory requirements. • There will be a landfill on site for general waste. The design of this dump has not yet been finalized. However the following design principles will apply: <ul style="list-style-type: none"> ○The dump will be designed according to generally acceptable environmental standards and in compliance with South African legislation. ○The dump will be well managed at all times and wastes deposited will be covered in an ongoing manner. ○On completion of the land fill the covers will be completed and re-vegetation of the cover undertaken. ○The slopes of the dump will be designed to ensure that erosion is properly controlled at all times and stability of the slopes ensured. ○The closure plan for the mine will include details for the closure of the landfill and will ensure that the closure of this specific facility meets the requirements of South African legislation and international best practice. Post-closure monitoring of these facilities may be required.
Impact category - Air Quality		
<i>Decommissioning phase Air quality issues / impacts and their mitigation measures are similar to that of the Design/Planning and Construction phase and are not repeated here. For details, refer to Tables 8.4</i>		
Impact category – Radiation Assessment		
<i>Refer to Tables 8.4 and 8.5 above</i>		
Impact category – Biodiversity and Faunal Assessment		

Localised	General Decommissioning Impacts on Fauna: Increased dust levels	<ul style="list-style-type: none"> • Road speeds in sensitive regions e.g. near rivers, across drainage lines, and during extreme dry climatic conditions, should be limited to curtail dust generation. • Speed limits on unpaved roads should be reduced, and in areas of high dust production road surfaces should be dampened or binders should be used. • Any material that needs to be transported to and from project site should be done by covered trucks or containers to avoid contamination to the surrounding area.
Localised	General Decommissioning Impacts on Fauna: Pollution and contamination	<ul style="list-style-type: none"> • Storage facilities for chemicals, particularly diesel, should not be situated in regions subject to flooding. • They should be banded so that in the event of spillage their contents run immediately into large catchments for decontamination. • The use of insecticides and herbicides should be closely monitored and dosages and application detailed in the EMP. • A waste management plan must be developed and all recommendations contained in the Plan must be adhered to.
Study Area	General Decommissioning Impacts on Fauna: Noise pollution	<ul style="list-style-type: none"> • Mitigation of this impact is difficult and unlikely to be effected, but could involve noise reduction measures in sensitive areas (e.g. adjacent to wetlands) at sensitive times (e.g. at night).

Impact category – Health Impact Assessment

The following Decommissioning phase Health issues / impacts and their mitigation measures are similar to that of the Design/Planning and Construction phase and the Operational phase and have not been repeated here. For details, refer to Tables 8.4 and 8.5 above.

- Acute respiratory infections and respiratory effects from housing.
- Sexually transmitted infections including HIV/AIDS.
- Soil, water and waste related diseases.
- Accidents and injuries.
- Environmental health determinants: Radiation, Air, water, noise pollution and malodours
- Social determinants of health: Gender-based violence, alcohol and drugs.
- Social determinants of health: Social cohesion and well-being
- Food and nutrition related issues.
- Non-communicable diseases

Impact category – Heritage, Archaeological and Paleontological Impact Assessment

Decommissioning phase Heritage, archaeological and paleontological issue / impact will mainly occur during the Operational phase of the project. For mitigation measures refer to Table 8.5 above.

Impact category - Marine and Rocky Shore Assessment

The following Decommissioning phase Marine and Rocky Shore issues / impacts and their mitigation measures are similar to that of the construction phase and have not been repeated here. For details, refer to Table 8.4 above.

- Barotrauma of marine fauna as a result of blasting.
- Impaired water quality impacts to marine fauna.
- Littering during decommissioning

Impact Category – Noise & Vibration Impact Assessment

<p><i>Decommissioning phase Noise and Vibration issues / impacts and their mitigation measures are similar to that of the Planning/Design and construction phase and have not been repeated here. For details, refer to Table 8.4 above.</i></p>		
<p>Impact category - Rehabilitation Assessment</p>		
<p><i>The rehabilitation of the site is initiated during the Design/Planning and Construction phase and is followed through during the Operational phase. For details, refer to Tables 8.4 and 8.5.</i></p>		
<p>Impact Category - Socio-economic Impact Assessment</p>		
Study Area		<ul style="list-style-type: none"> • Incorporate closure planning into the early stages of project development and operations; • Collating the goals and views of various stakeholders (project owner, local community, government, and non-governmental organizations (NGOs)) at the early feasibility (EIA) stage of project development to inform closure and post closure goals; • Acting to meet the goals by working with the relevant stakeholders within and outside Zirco; • Using the concepts of risk and opportunity to both minimize liability and maximize benefits to all relevant parties; • Using multidisciplinary expertise and multi-stakeholder processes to ensure that mitigation of risk in one area does not increase risks in another; and • Ensuring that the social closure phase ties in with the infrastructural and environmental closure phases.
<p>Impact Category – Soil and Agricultural Impact Assessment</p>		
Study Area	Rehabilitation of soil: Incorrect or insufficient rehabilitation of soil will result in a decrease of agricultural ability	<ul style="list-style-type: none"> • Develop and implement a Rehabilitation and Monitoring Plan to monitor rehabilitated areas. • Implement measures such as wind-breaks, swales and watering to aid the initial grown of primary vegetation
<p>Impact category - Surface and Ground Water Assessment</p>		
Study Area	Impacts on groundwater of the tailings storage facility and backfill	<p><i>The results of groundwater modelling indicate that the potential plume of saline seepage from backfill and the TSF will continue to be mobile for many years after the cessation of mining, and that the TDS levels in some locations in the southern half of the Roode Heuvel block (an area of about 30km²) and for about 750m westward of its boundary, will rise to levels well above 13 000mg/l, which is considered unsuitable for animal consumption.</i></p> <ul style="list-style-type: none"> • Refer to Table 8.5 for mitigation measures for this impact is similar to those provided for the construction phase and are not repeated here.
Localised	Impacts on surface water of the tailings storage facility and backfill	<p><i>The results of groundwater modelling indicate that the probability of the plume of highly-saline seepage from backfill and the TSF affecting the integrity of the estuary is sufficiently low to be considered negligible.</i></p> <ul style="list-style-type: none"> • Mitigation measures proposed for Impact 1 may result in a reduction of salinity levels of around 5 000 mg/l. • Having established a pre-mining baseline of the salinity levels in the estuary (SWS 2015), the general biological state of the estuary should be established and monitored at regular intervals thereafter. •
<p>Impact category - Traffic and Transport Impact Assessment</p>		
<p><i>Decommissioning phase Traffic and Transport issues / impacts and their mitigation measures are similar to that of the Planning/Design and construction phase and have not been repeated here. For details, refer to Table 8.4 above.</i></p>		
<p>Impact category - Vegetation and floristic specialist study</p>		

It is strongly recommended that livestock not be introduced into the mined and rehabilitated areas for at least ten years after initial rehabilitation has been completed on the last block to be mined. Removal of livestock will dramatically improve rehabilitation by allowing flowering and seed set for the more palatable species. It is recommended that the area be stocked with limited numbers of range appropriate game, and the possibility of tourist accommodation could be explored.

Impact category - Visual Impact Assessment

Decommissioning phase Visual and floristic issues / impacts and their mitigation measures are similar to that of the Operational phase as most infrastructure may be retained for other use. For details, refer to Table 8.5.

Impact category - Waste and Wastewater Impact Assessment

The following Decommissioning phase Waste and wastewater issues and impacts and their mitigation measures are similar to that of the construction phase and have not been repeated here. For details, refer to Table 8.4 above.

- Management of non-process general and hazardous waste: Pollution of land and water.
- Disposal of domestic wastewater, brine and sewage sludge: Pollution of soil and water.
- Disposal of run-off and stormwater: Pollution of land and water.
- Management and disposal of obsolete equipment, scrap and tyres: Pollution of soil and water.

Impact category – Groen estuary ecology

Decommissioning phase Groen estuary ecology issues and impacts and their mitigation measures are similar to that of the construction phase and have not been repeated here. For details, refer to Table 8.4 above.

9. MONITORING, IMPLEMENTATION AND REVIEW

9.1 Introduction

The Zirco Kamiesberg Project will establish procedures to monitor and measure the effectiveness of the ESMPs, as well as its compliance with any related legal and/or contractual obligations and regulatory requirements and standards. Where the Authorities or other third party has responsibility for managing specific risks and impacts and associated mitigation measures, Zirco will collaborate in establishing and monitoring such mitigation measures. Where appropriate, Zirco will consider involving representatives from Affected Communities to participate in monitoring activities.

A number of monitoring, measurement and review measures will be adopted by the Zirco Kamiesberg Project in accordance with the IFC Performance Standard 1 and are described below.

9.2 Checking and Monitoring

Checking of the monitoring will be implemented and is required to ensure that the management activities are being implemented and desired outcomes are being achieved. If not, then corrective and or preventive actions must be identified and implemented. This component includes five key relevant activities:

- Defining objectives and targets;
- Monitoring selected E&S and H&S quality variables as defined in the objectives and targets;
- On-going inspections and continuous improvement of general state of the operations;
- Internal audits to assess the robustness of the ESMPs and SOPs or to focus on a particular performance issue; and,
- External audits to provide independent verification of the efficacy of the ESMPs and its associated reports and procedures.

9.2.1 Performance objectives and targets

Performance objectives and targets (measurable indicators) against which the performance of the project can be measured and monitored will be developed as part of management report development, and agreed upon for activities in all phases of the project's life cycle. These objectives and targets will be clearly defined and incorporated, where appropriate, as contractual obligations that have to be fulfilled by third parties. In so doing, Zirco will be better able to manage its health, safety, environmental and community risks and obligations. Objectives and targets will be reviewed on a regular basis. In cases where objectives and targets are not met, new and revised method statements indicating proposed corrective measures will be developed and approved.

9.2.2 Monitoring Programmes

Zirco and its contractors will establish procedures to monitor and measure the effectiveness of the management plans, as well as compliance with any related legal and/or contractual obligations and regulatory requirements. The variables that are to be monitored are defined in the Zirco Kamiesberg Project Monitoring and Implementation programme and incorporated in the respective ESMPs to be developed. Results obtained from the monitoring programme will be structured and presented for review on an on-going basis so that if objectives and targets are not met, corrective action can be taken.

It is required that all monitoring programmes are to be headed by appropriate personnel in the organisational structure. Where appropriate, Zirco will consider involving representatives from affected communities to participate in the monitoring activities. Where skills do not exist, or where significant impacts are involved, Zirco will retain external experts to verify its monitoring information. In instances where a third party has responsibility for managing specific risks and impacts and associated mitigation measures, Zirco will collaborate in the establishment and monitoring of such activities.

9.2.3 On-going inspections and continuous improvement

On-going inspection and continuous improvement will form a key component of the E&S and H&S management as documents associated with the ESMP will be regularly reviewed and updated. Research on certain aspects will be undertaken to refine environmental management and to ensure that the levels of environmental protection outlined in the respective ESMPs are achieved.

Owing to the transient nature of the construction phase, the greatest source of information will be obtained through on-going visual inspection. At the same time some potential impacts are difficult to monitor quantitatively, such as soil erosion and waste management. An on-going, but pragmatic inspection regime will be developed that allows for potential E&S and H&S non-conformances to be identified proactively so that mitigation can be quickly and effectively implemented.

9.2.4 Internal and external audits

Internal audit of the environmental performance of the project will be conducted regularly by trained in-house personnel while external audits will be undertaken on an annual basis by accredited institutions. The purpose of the audits will be to:

- assess compliance with the conditions of the Environmental Licence and Certification,
- determine if the objectives and targets outlined in the ESMPs and SOPs are being met.

The findings of internal and external audits and informal environmental reviews will be recorded and items requiring action will be identified. The implementation of these actions will be assessed in the following audit.

Where the monitoring data and the inspection reports highlight problems, an internal audit can be used to ascertain the source of the problem and to define action to prevent its recurrence. The three key areas for audit are operating efficiencies of facilities, project procedures and their implementation, and Contractor's EHS performance.

9.3 Incidents Reporting, Non-conformance and Corrective Action

9.3.1 Incident Documentation and Reporting

Zirco and its contractors will develop procedures for managing all EHS incidents, subject to approval by senior management. A report will be completed for all incidents, and appropriate action taken where necessary to minimise any potential impacts. The relevant local and national South African authorities will be informed of any environmental incident, in accordance with legislative requirements.

A procedure for reporting E&S and H&S complaints from the affected community and employees will be developed prior to the onset of construction activities and will be applicable to all phases. Notification of an incident or emergency will include the following:

- Description of the incident;

- The location of the emergency or incident;
- The name and telephone number of the designated contact person;
- The time of the emergency or incident;
- The suspected root cause of the emergency or incident;
- The environmental harm and/or environmental nuisance caused, or suspected to be caused, by the emergency or incident; and
- The action taken to prevent future occurrence of the incident and mitigate any harm and/or environmental nuisance caused by the emergency or incident.

The Incident reporting and documentation requirements will be based on best practice principles, and will take the following requirements into account:

- Documents associated with the ESMP will be regularly reviewed and updated by all environmental management parties;
- External audits will be conducted quarterly during the construction phase and annually during the operation phase by accredited institutions that are vetted by the local authorities. Internal audit will be conducted regularly for the duration of the project's life cycle. The purpose of the audits will be to assess compliance with the conditions of the Environmental Licence, and objectives and targets outlined in the related ESMP, and its various management tools;
- The findings of external, internal and informal environmental reviews will be recorded and items requiring action will be identified from the recommendations made and Action Plans developed; and
- Zirco is contractually obliged to fulfil any reasonable recommendations, and implementation of applicable ESMP.

9.3.2 Non-conformance

The ESMP or SOP is deemed not to have been complied with when:

- There is evidence of contravention of the recommendations in the document, its environmental specifications or the developed Method Statements or Procedures;
- If Company activities take place outside the legal boundaries of the concession area;
- Environmental damage ensues due to negligence;
- Personnel fail to comply with corrective/preventive or other instructions that have been issued as corrective/preventive measures; and
- Personnel fail to respond adequately to complaints from the public or local/national authorities.

9.3.3 Corrective Action

In order to ensure compliance with the ESMP, a staff warning and disciplinary system will be developed. The developed system will cater for non-conformity and corrective action and will be of international best practice. There are several mechanisms for implementing corrective action and they include verbal instructions, written instructions and contract notices.

Verbal instructions are likely to be the most frequently used form of corrective action and are given in response to minor transgressions that are evident during routine site inspections. Verbal instructions are also used to create further awareness amongst Contractors, as often the transgressions are a function of a lack of awareness.

Written instructions in the form of Non-Conformance Report (NCR) will be issued following the identification of non-conformances after an audit. The NCRs will indicate the source(s) of the problem(s), and proposed feasible solution(s). The implementation of these solutions can also be assessed in a follow-up audit and further NCRs issued if required. All NCRs will be

centrally logged to ensure that there is an auditable record of such instructions and how they were responded to.

A contract notice is a more extreme form of written notice because it reflects the transgression as a potential breach of contract. If there is not an adequate response to a contract notice, then the next step can be to have the contractor removed from the site and the contract cancelled. Contracts will be drafted with this in mind.

9.4 Management review

The process of management review is in keeping with the principle of continual improvement and will be conducted at least once annually. As such, Zirco will develop a management review procedure to ensure that the Company defines and maintains a documented process and agenda for Senior Managers to periodically review the continuing suitability, adequacy and effectiveness of the ESMP. The management review, which will be conducted regularly, will include a review of internal and external audit reports. The purpose of the review is to critically examine the effectiveness of the ESMPs and its implementation and to decide on potential modifications as and when necessary.

9.5 Financial Resources

The proponent will be responsible for ensuring that sufficient financial resources are made available for the effective implementation of the requirements of this ESMP. Where applicable, and particularly during the construction phase, Zirco will need to ensure that all contractors are aware of their obligations in terms of this ESMP and that they have made appropriate financial provisions to ensure full compliance.

10. MONITORING PROGRAMME

10.1 Introduction

This Monitoring Programme outlines the E&S monitoring requirements for the Construction, Operational and decommissioning Phases of the Zirco Kamiesberg project. This programme has been based on the findings of the ESIA and the contents of the ESMPr and will be periodically reviewed and updated. It should be noted that in order to comply with international best practice, it is required that where standards are available for the host country, these will be compared to international standards and where there is a difference, the most stringent requirement for each monitoring parameter will be adopted.

10.1.1 Objectives

The objectives of the Environmental Monitoring Programme are:

- To confirm compliance with commitments to legislative and non-legislative E&S Standards as detailed in chapter 4 of this ESMPr;
- To provide early warning of potential impacts, determine the extent of predicted impacts and identify any unforeseen impacts associated with the project activities;
- To provide a baseline E&S data set;
- To provide feedback on the adequacy of environmental management practices and allow improved practices to be developed to continuously improve operations;
- To detect and measure environmental trends or changes and enable analysis of their cause; and
- To provide site management with information and data that can be used as a basis for decision making.

Baseline data will be used to compare pre-project conditions with future phases of the project. Where baseline conditions are not known or deficient, this programme describes additional baseline data requirements.

10.1.2 Monitoring Programmes Structure

This programme consists of various monitoring plans, each of which covers a separate element. The structure of the programme and associated management plans is shown in Figure 10.1.

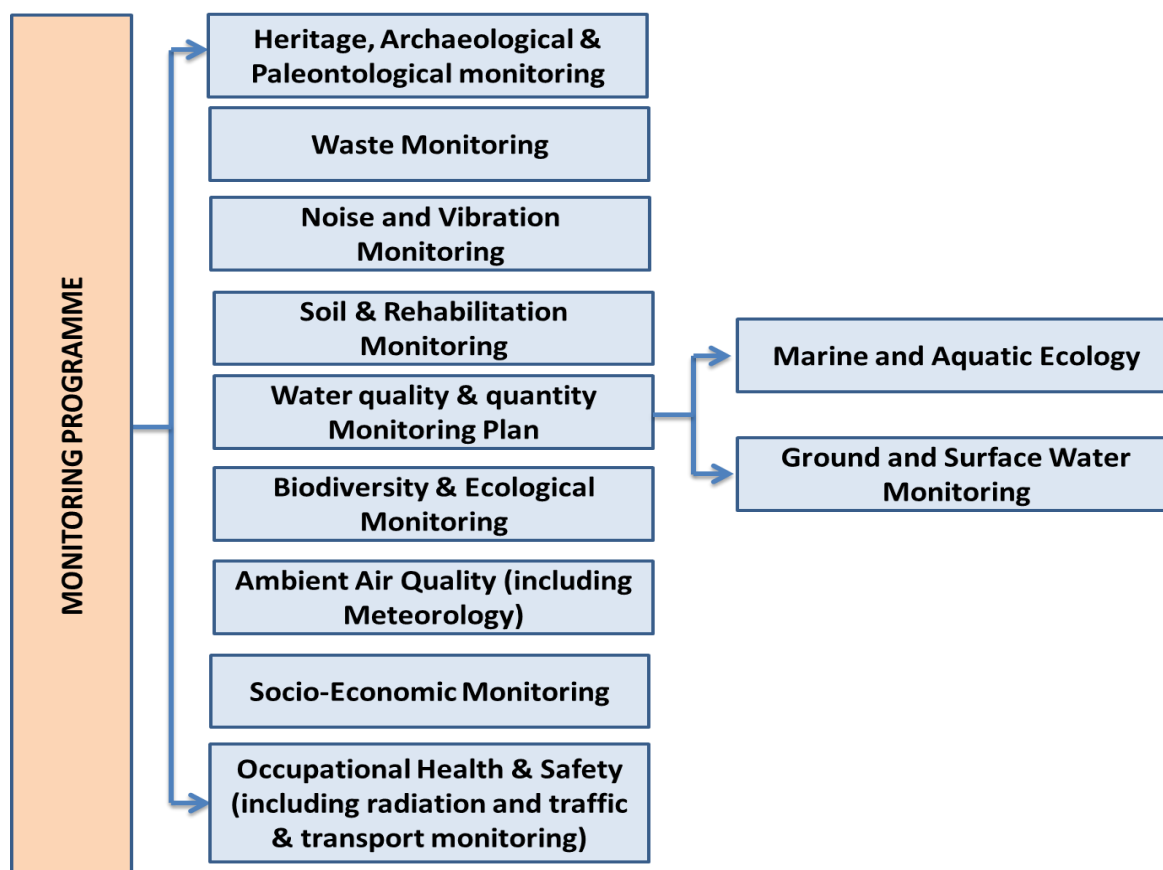


Figure 10.1: Summary of Structure of the Monitoring Programme

10.1.3 Monitoring Categories

Four monitoring categories shall be included and these are described below:

1. **Discharge (Emission) Monitoring:** - This will involve monitoring of contaminants being discharged or emitted from construction and operational activities, as well as decommissioning activities, into the environment. Discharge or emission monitoring will be undertaken either at the discharge point or within the local catchment area. Discharge monitoring will provide direct information concerning the concentrations and loads of contaminants being released from the operation, and will also serve as a link between ambient monitoring results and the operation itself.
2. **Ambient Monitoring:** - This involves the monitoring of background conditions and receiving environments that could be affected by project activities. While discharge monitoring should determine if environmentally significant releases have occurred, effects on the ultimate receptors within the receiving environment beyond the boundary of the facility can be determined only by ambient monitoring. Ambient monitoring will be undertaken for surface water (both upstream and downstream in project-affected rivers), groundwater, ambient dust, noise & vibration monitoring, workplace air quality, lighting and radiation (ionizing and non-ionizing).
3. **Investigation Monitoring:** - This will be completed as required to determine the occurrence, nature and extent of possible impacts following an environmental incident, such as oil spillage, or to verify/refute third-party claims of environmental impacts. For example, investigation monitoring may be undertaken upstream of a routine monitoring point to identify a source of contamination.

4. **Occupational Health and Safety Monitoring:** - The working environment will be monitored for occupational hazards relevant to the project. Occupational Health and Safety monitoring will be designed and implemented by accredited professionals as part of an occupational health and safety monitoring program with recognition for post-closure long term health concerns. As part of the monitoring programme, occupational accidents, diseases and dangerous occurrences and accidents will be documented for all facilities.

10.1.4 Monitoring responsibilities

Implementation of the environmental monitoring as well as the OH&S monitoring is primarily the responsibility of the EHS Manager who will be assisted by the OH&S and EAR officers who are directly involved in the implementation of the monitoring programmes. All community related monitoring will be managed by the VLAC manager who will in addition provide assistance with the community health and safety issues.

Zirco, through the EHS Manager, will ensure that bio-physical monitoring responsibilities are clearly defined within the Environmental Department. Where appropriate, Zirco will consider involving representatives from affected communities to participate in the monitoring activities. Where skills do not exist, or where significant impacts are involved, Zirco will retain external experts to verify its monitoring information. In instances where a third party has responsibility for managing specific risks and impacts and associated mitigation measures, Zirco will collaborate in the establishment and monitoring of such activities.

10.1.5 Quality Assurance / Quality Control

Zirco will implement a Quality Assurance / Quality Control (QA/QC) programme as part of the monitoring programme. The QA/QC programme will be described for each sampling component. The programme will include the following elements:

- 1) The regular maintenance and calibration of on-site monitoring equipment, as per the manufacturers' instructions;
- 2) The regular use of appropriately qualified and regulated external laboratories to verify on-site monitoring results;
- 3) The regular use of duplicate samples, split samples, field blanks, and laboratory blanks and a comparison of basic anion cation balances;
- 4) Chain-of-custody procedures for sample handling and transportation; and
- 5) Laboratory procedures manual for analytical methodologies.
- 6) All sample bottles shall be clearly labeled
- 7) Zirco will ensure that the results of all duplicates and blanks are checked against other samples for compliance. Where non-compliance is found, the laboratory will be notified and asked to re-run the test.
- 8) Standard sampling procedures for lab samples will be adhered to and the samples will be shipped to the lab within 48 hours as per procedure.

10.1.6 Review and Modification of the Monitoring Programme

Data from the monitoring programme will be continually reviewed trends will be identified. The monthly Environmental Report will subsequently become a basis for discussion on monitoring programme effectiveness, and the need (if any) for changes to sampling sites, sampling frequencies and analytical methods. The report will also include recommendations from relevant departments and conditions appended to issued permits, licences, and corrective measures identified in NCRs as well as any Environmental Authorisation regarding any necessary changes to the project.

Modification of the programme will also be required:

- 1) When the configuration or operation of the Project changes significantly; and/or
- 2) Where environmental or social impacts vary from initial predictions; and/or
- 3) In response to new company commitments, legislative / financing requirements or stakeholder concerns.

10.1.7 Reporting

Monitoring results will be compiled by the EHS and VLAC managers for submission to the General Manager on a monthly basis. Environmental monitoring results shall be incorporated into quarterly, bi-annual and annual reports.

10.2 Policy Guidelines and Regulatory Framework

The purpose of this section of the programme is to summarise the applicable Standards with which the project must comply and, in particular, to highlight the requirements within these Standards related to monitoring.

10.2.1 National Standards

South Africa has developed its own effluent and emission standards. These are contained in a number of documents that are presented in 4.3 of Chapter 4 of this report.

10.2.2 World Health Organisation Guidelines for Drinking Water Quality (2011)

The primary purpose of the World Health Organisation (WHO) guidelines for drinking-water quality (2011) is the protection of public health. The Guidelines provide the recommendations of the WHO for managing the risk from hazards that may compromise the safety of drinking-water. The guideline limit provided in the WHO guidelines will be considered in the context of managing the risk from other sources of exposure to these hazards, such as waste, air, food and consumer products.

10.2.3 The IFC Guideline documents

The relevant and applicable IFC guideline documents have been introduced in Chapter 4 and they include:

- International Finance Corporation Performance Standards on Environmental and Social Sustainability (2012)
- IFC General EHS Guidelines (2007)
- Environment, Health and Safety Guidelines for Mining (2007)

The standards, including discharge limits, recommended in these documents have been considered and incorporated in this monitoring programme. Performance Standard 3 (IFC, 2012) specifies that “*When host country regulations differ from the levels and measures presented in the EHS Guidelines, clients will be required to achieve whichever is more stringent*”.

10.3 Water Monitoring

Issues affecting ambient water quality mainly relate to surface run-off from areas subject to mining activities and effluent discharge and an increase in turbidity near cleared areas and the seepage of process water from backfill to the groundwater system. Water quantity, both ground and surface water, will be affected by increased water use associated with the mining operations.

The surface and ground water as well as marine specialist reports identified a number of mitigation measures, based on informed predictions, aimed at reducing potential impacts. In order to track impacts and the effectiveness of proposed mitigation measures, a pre-construction hydrology baseline must be established over a period of one year and key indicators must continue to be monitored throughout the life of the project. This baseline and subsequent monitoring must cover both water availability (quantity through water level) and quality for both surface and groundwater sources.

10.3.1 Surface Water Monitoring

The project area is drained by the Bitter and OutEEP rivers to the north of the Leeuvlei prospecting area. The OutEEP River is a tributary of the Bitter River. To the south is the Groenrivier, which defines the southern border of the Roode Heuvel prospecting area. All these rivers are ephemeral, meaning that they only flow temporarily after heavy rainfall. Most of the communities receive their water from boreholes, whilst some towns, such as Spoegrivier and Klipfontein, have their own desalination plant.

Required surface water monitoring parameter according to the South African Water Quality Guidelines (SAWQG) (DWAf 1996) is provided in Table 10.1. It defines the quality of environmental water that is recommended for different end use. It should be noted that until a statistically-valid baseline is established, the surface water monitoring results will be compared with the guideline limits provided in Table 10.1 in order to identify areas of concerns for the various end use as required by the guidelines.

The objectives of surface water monitoring are as follows:

- 1) To establish a comprehensive pre-development surface water baseline, including reference sites, covering both quality and quantity of resources.
- 2) To identify any Project-related impacts on surface water quality by monitoring water quality upstream and downstream of the Project site.
- 3) To assess the effectiveness of mitigation measures aimed at minimizing impacts of the mine on surface water resources.

In addition, aquatic bio-monitoring, based on changes to the composition of aquatic invertebrate communities, is regarded as a useful means to assess changes in the quality of water resources. The South African Scoring System Version 5 (SASS5) approach (or similar) will be adopted by Zirco to assist with the detection of ecologically-significant changes to surface water quality within the mining area.

If project-related contamination or sedimentation is identified and poses a risk to downstream water resource use or aquatic ecology, Zirco will undertake to mitigate the effects of the contamination without delay, compensate for any loss of water use, and prevent further deterioration. These measures may include changes to operational practices.

Table 10.1: Proposed Parameters for Surface Water Monitoring according to South African Water Quality Guidelines series Vol. 1–8

Parameters	WATER USE CATEGORIES						
	Aquatic Ecosystem	Domestic	Recreational	Industrial	Livestock Watering	Irrigation	Aquaculture
Alkalinity (mg/l)	NA	NA	NA	0-1200	NA	NA	20-100
Aluminium (mg/l)	0.005	0-0.15	NA	NR	0-5	0-5	0.03
Ammonia (mg/l)	0.007	0 - 1.0	NA	NR	NA	NA	0-0.025(a); 2.0-0.3(b)
Arsenic (mg/l)	0.01	0 - 0.01	NA	NA	0 - 1	0 - 0.1	0 - 0.05
Asbestos (fibres/l)	NA	0 – 1 x 10 ⁶	NA	NA	NA	NA	NR
Atrazine (mg/l)	0.01	0-0.002	NA	NR	NA	NA	< 0.0002
Beryllium (mg/l)	NA	NA	NA	NA	NA	0 - 0.1	NA
Boron (mg/l)	NA	NA	NA	NA	0-5	0-0.5	NA
Cadmium (µg/l)	0.15	0-5	NA	NA	0-10	0-10	0-0.2
Calcium (mg/l)	NA	0-32	NA	NA	0-1 000	NA	NA(c)
Carbon Dioxide (mg/l)	NA	NA	NA	NR	NA	NA	12
Chemical Oxygen Demand (mg/l)	NA	NA	NA	0-75	NA	NA	NR
Chloride (mg/l)	NA	0-100	NA	0-500	0-1500(d); 0-3000(e)	0-1.00	0-600
Chromium(VI) (mg/l)	0.007- 0.012(nn)	0-0.05	NA	NA	0-1	0-0.1	0.002
Cobalt (mg/l)	NA	NA	NA	NA	0-1	0-0.05	NA
Coliforms (counts/100 ml)	NA	0(f); 0-5(g)	0-150(f); 0– 130(h)	NR	0-200(f)	1(f)	NA
Coliphages (counts/100 ml)	NA	0-1	0-20	NR	NA	NA	NA
Copper (mg/l)	0.0003	0-1	NA	NA	0-0.5(i); 0-1(j); 0–5(k)	0 - 0.2	0.005
Cyanide (mg/l)	0.001	NA	NA	NA	NA	NA	0.05
Dissolved Organic Carbon	NA	0-5	NA	NA	NA	NA	NR

Parameters	WATER USE CATEGORIES						
	Aquatic Ecosystem	Domestic	Recreational	Industrial	Livestock Watering	Irrigation	Aquaculture
(mg/l)							
Dissolved Oxygen (mg/l)	80%-120% of saturation	NA	NA	NR	NA	NA	6–9(l); 5–8(m)
Endosulfan (µg/l)	0.01	NA	NA	NA	NA	NA	< 0.003
Enteric Viruses (TCID ₅₀ /10R)	NA	< 1	0	NR	NA	NA	NA
Faecal Streptococci	NA	NA	0-30	NR	NA	NA	NA
Fluoride (mg/l)	0.75	0-1	NA	NA	0-2(n); 0-6(o)	0-2	NA
Iron (mg/l)	NA	0-0.1	NA	0-10.0	0-10	0-5	0.01
Lead (mg/l)	0.0002	0-0.01	NA	NA	0-0.1(p); 0-0.5(q)	0-0.2	0-0.01
Lithium (mg/l)	NA	NA	NA	NR	NA	0-2.5	NA
Magnesium (mg/l)	NA	0-30	NA	NA	0-500	NA	NA
Manganese (mg/l)	0.18	0-0.05	NA	0-10.0	0-10	0-0.02	0.1
Mercury (µg/l)	0.04	0-0.001	NA	NA	0-1.0	NA	0-0.001
Molybdenum (mg/l)	NA	NA	NA	NA	0-0.01	0-0.01	NA
Nickel (mg/l)	NA	NA	NA	NA	0-1	0-0.20	NA
Nitrate/Nitrite (mg/l)	β	0-6(r & s)	NA	NA	0-100(r); 0-10(s)	0-0.5(t)	0-0.05(a)
Nitrogen (Inorganic) (mg/l)	β	NA	NA	NA	NA	0-0.5(t)	NR
Odour (Ton)	NA	1	NA	NA	NA	NA	NR
Organic Carbon (mg/l)	NA	0-5	NA	NA	NA	NA	NA
pH (pH units)	>0.5 deviation	6-9	6.5-8.5	5-10	NA	6.5-8.4	6.5-9.0
Phenol (ug/l)	30	0-1	NA	NA	NA	NA	1 000
Phosphorus (Inorganic) (mg/l)	Varied (β)	NA	NA	NA	NA	NA	0.1
Potassium (mg/l)	NA	0-50	NA	NA	NA	NA	NA
Protozoan Parasites (cysts or oocysts/10 l)	NA	< 1	NA	NR	NA	NA	NA(u)
Radionuclides (Bq/l)	Only Applicable to Domestic water use: 0-0.5(v); 0-1.38(w); 0-0.89(x); 0-0.228(y); 0-0.42(z); 0-11(aa); 0-0.42(bb)						

Parameters	WATER USE CATEGORIES						
	Aquatic Ecosystem	Domestic	Recreational	Industrial	Livestock Watering	Irrigation	Aquaculture
Selenium (mg/l)	0.002	0-0.02	NA	NA	0-50	0-0.02	0-0.3
Silica (mg/l)	NA	NA	NA	0-150	NA	NA	NA
Sodium (mg/l)	NA	0-100	NA	NA	0-2000	70	NA(cc)
Sodium Absorption Ratio	NR	NR	NR	NR	NR	0-1.5	NR
Sulphate (mg/l)	NA	0-200	NA	0-500	0-1000	NA	NA
Sulphides (mg/l)	NA	NA	NA	NA	NA	NA	0-0.001(dd)
Suspended Solids (mg/l)	NA	NA	NA	0-25	NA	0-50(ee)	<50(ff); <20000(gg)
Total Dissolved Solids (mg/l)	>15% increase	0-450	NA	0-1600	0-1000(hh); 0-2000(ii); 0-3000(jj)	40	NA(kk)
Total Hardness (mgCaCO3/l)	NA	NA	NA	0-1000	NA	0.2	20 – 100(oo)
Trihalomethanes (µg/l)	NA	0-100	NA	NA	NA	NA	NA
Turbidity (NTU)	NA	0-1	3.0(ll)	NA	NA	NA	25(mm)
Uranium (mg/l)	NA	NA	NA	NA	NA	0-0.01	NA
Vanadium (mg/l)	NA	0-0.1	NA	NA	0-1	0-0.10	NA
Zinc (mg/l)	< 0.002	0-3	NA	NA	0-20	0-1	0.03
Algae	<i>Only applicable to Domestic water use (0-1 µg/l chlorophyll; 0-50bg algal cells/ml; 0-0.8 of µg/l Microcystin), Recreational water use (0-15mg/l) and livestock watering (6.0 Blue-green algae colonies/0.5 ml counted in a 2 min. scan at 200x magnification; 2000 Microcystin cells/ml).</i>						

Notes: NA - Not available; NR - Not relevant; β – See relevant guideline for details; a - Cold-water species; b - Warm-water species; c - See Total Hardness guideline; d - Monogastrics & Poultry; e - Other livestock; f - Faecal coliforms; g - Total coliforms; h - *E.Coli*; i - Sheep & pre-weaned calves; j - Cattle; k - Horses, pigs & poultry; l - Cold-water species; m - Intermediate species & warm-water species; n - All other livestock; o – Ruminants; p - All other livestock; q – Pigs; r - NO₃; s – NO₂; t - Irrigation equipment; u - except *Ichthyophthirius* 15 – 50 ppm; v - Gross α activity; w - Gross β activity; x - 238 Uranium; y - 232 Thorium; z - 226 Radium; aa - 222 Radon; bb - 228 Radium; cc - See Total Dissolved Solids guideline; dd - H₂S; ee - Clogging of drip irrigation systems; ff - Clear water species; gg - Turbid water species; hh - Dairy, pigs & poultry; ii - Cattle & horses; jj – Sheep; kk - See Total Dissolved Solids guideline; ll - Secchi disc depth (m); mm - Clear water species; nn - Chromium (III); oo - No known adverse effects, recommended range for most fresh-water fish;

Source: DWAF, 1996

10.3.2 Groundwater Monitoring

It is the intention of Zirco to regularly monitor TDS and water level and annually monitoring for radioactivity in the ground water. Given that the existing ground water quality is not suitable for consumption (Zirco Kamiesberg Project Surface and Ground Water Assessment, 2014) and that the abstracted ground water is used by local farmers for livestock watering, the ground water monitoring will be benchmarked against the SAWQG for Livestock Watering (see Table 10.1 above).

The objectives of the groundwater monitoring are as follows:

- 1) To track trends in groundwater quality and levels relative to the pre-mining baseline
- 2) To determine whether livestock water sources are adequately protected from mine-related impacts.
- 3) To indicate when corrective or prevention measures are required to maintain water levels and quality.
- 4) To monitor the effectiveness of mitigation measures.

Groundwater level monitoring points to be included in the monitoring regime have been identified and discussed below.. Level monitoring data will be collected using an electrical contact tape or pressure transducer, to detect any changes or trends in groundwater flow direction. Up to two years post closure samples will be collected and based on the results the monitoring timeframe can be adjusted accordingly and monitoring will continue until a sustainable situation is reached.

10.3.3 Potable Water Quality

All potable water on site will meet the most stringent of the South African National Standards (SANS) 241-1:2011: Drinking Water Specifications and the WHO (2011) drinking water standards (Table 10.2).

Table 10.2: Drinking water quality guidelines applicable to Zirco Kamiesberg Project

Pollutant/Measure	Units	SANS 241-1: 2011	WHO 2011
Arsenic	mg/l	0.01	0.01
Barium	mg/l	-	0.7
Ammonia	Mg/l	1.5	-
Boron	mg/l	-	0.5
Bromin	mg/l	-	-
Chromium (total)	mg/l	0.05	0.05
Fluoride	mg/l	1.5	1.5
Colour	Mg/L Pt-Co	15	-
Cobalt	Mg/l	0.5	-
Manganese	mg/l	0.1	0.4
Free Chlorine	mg/l	5	-
Selenium	mg/l	0.01	0.01
Uranium	mg/l	0.015	0.015
Sodium	mg/l	200	-
Vanadium	Mg/l	0.2	-

Pollutant/Measure	Units	SANS 241-1: 2011	WHO 2011
Nitrate (NO ₃) as N	mg/l	11	-
Nitrite (NO ₂)	mg/l	0.9	-
Sulphate	mg/l	250	-
Total Dissolved Solids	mg/l	1200	-
Cadmium	mg/l	0.003	0.003
Cyanide	mg/l	0.07	0.07
Mercury	mg/l	0.006	0.006
Aluminium	mg/l	0.3	-
Iron	mg/l	0.3	-
Zinc	mg/l	5	--
Chloride	mg/l	300	-
Chlorine	mg/l	5	-
Chlorite	mg/l	-	0.7
Antimony	mg/l	0.02	0.02
Copper	mg/l	2	2
Lead	mg/l	0.01	0.01
Nickel	mg/l	0.07	0.07
Total Coliform	MPN/100ml	10	-
E. Coli	Count per 100ml	Not detected	Not detected
Turbidity	NTU	1	<5
Hardness	mg CaCO ₃ /l	-	100 - 300
Conductivity	mS/cm	170	-
pH		5.0 to 9.7	-
Total Organic Carbon	mg/l	0.01	-
Microcystin	mg/l	0.001	0.001
Phenols	mg/l	0.01	-

Note: The blue highlighted cells indicate the most stringent requirements that will be adopted

10.3.4 Point Source Discharge

This section details the components of the point source discharge (including effluent discharge, runoff and sanitary effluent) required for the establishment of the baseline monitoring data and for the continual monitoring of discharge effluent quality during the construction and throughout the life of mine. In the event of discharge of the process and sanitary effluent into the environment, certain discharge standards and guidelines are to be adhered to and are described below.

The General Authorisations in terms of Section 39 of the National Water Act No.36 of 1998 (Gov. Gazette NO.20526 8 Oct. 1999) is deemed applicable to the Zirco Kamiesberg project. The General Authorisations provide that the discharge of up to 2 000 m³ of wastewater (mine effluent and sanitary effluent) on any given day into a non-Listed Water Resource must adhere to the General Limit Values while wastewater discharge into a Listed Water Resource (see

Appendix A) must adhere to the Special Limit Values (Table 10.3 below). Discharge of Complex Industrial Wastewater² is however prohibited in both cases.

In terms of the IFC requirements, specific guidelines exist for discharge of mine effluent (including, pit decant water or drainage from TSF and HMC stockpiles as well as storm water run-off from the site) and sanitary effluent that are to be discharged into the environment. The specific guideline limits shown in Table 10.3 can be found in the EHS Guidelines for Mining (2007) and the General EHS Guidelines (IFC, 2007), respectively. In accordance with IFC (2012) Performance Standard 3 (*Resource Efficiency and Pollution Prevention*) and Good International Industry Practice (GIIP), the most stringent between the national and the international standards / guidelines will suffice and deemed applicable and a justification for the choice of use, other than the use of the most stringent, should be provided.

It should be noted that the prescribed levels should be achieved, without dilution, at least 95% of the time that the plant or unit is operating, to be calculated as a proportion of annual operating hours. Deviation from these levels in consideration of specific, local project conditions should be justified.

If the discharge is into a water resource, it should be noted that the quality of the receiving water resource as detailed in Table 10.1 above should not be exceeded. In cases where it is likely that storm water may have been contaminated by chemicals (such as hydrocarbons) directly or indirectly associated with the mining project operations, the monitoring parameters provided here will be updated accordingly to include such chemicals.

² Wastewater arising from industrial activities and premises, that contain (a) a complex mixture of substances that are difficult or impractical to chemically characterise and quantify, or (b) one or more substances, for which a Wastewater Limit Value has not been specified, and which may be harmful or potentially harmful to human health, or to the water resource (Identification of complex industrial wastewater will be provided by the Department upon written request).

Table 10.3: Discharge water quality guidelines applicable to the Zirco Kamiesberg Project

Pollutant/Measure	Units	RSA GENERAL AUTHORISATIONS (Gov. Gazette NO. 20526 8 Oct. 1999)		IFC EHS Guidelines	
		General Limit	Special Limit	Mine Effluent	Sanitary Effluent
Ammonia (ionized and un-ionised) as Nitrogen	mg/l	3	2	-	-
Arsenic	mg/l	0.02	0.01	0.1	-
Biochemical Oxygen Demand (BOD)	mg/l	-	-	50	30
Boron	mg/l	1	0.5	-	-
Cadmium	mg/l	0.005	0.001	0.05	-
Chlorine as Free Chlorine	mg/l	0.25	0	-	-
Chromium (VI)	mg/l	0.05	0.02	0.1	-
Chemical Oxygen Demand (COD)	mg/l	75c	30c	150	125
Copper	mg/l	0.01	0.002	0.3	-
Cyanide	mg/l	-	-	1	-
Cyanide (Free)	mg/l	0.02	0.01	0.1	-
Cyanide WAD	mg/l	-	-	0.5	-
Electric Conductivity	mS/m	70f	50f	-	-
Fluorides	mg/l	1	1	-	-
Iron (Total)	mg/l	0.3	0.3	2	-
Lead	mg/l	0.01	0.006	0.2	-
Manganese	mg/l	0.1	0.1	-	-
Mercury	mg/l	0.005	0.001	0.002	-
Nickel	mg/l	-	-	0.5	-
Nitrate/Nitrite as Nitrogen	mg/l	15	1.5	-	-
Nitrogen (total)e	mg/l	-	-	-	10

Pollutant/Measure	Units	RSA GENERAL AUTHORISATIONS (Gov. Gazette NO. 20526 8 Oct. 1999)		IFC EHS Guidelines	
		General Limit	Special Limit	Mine Effluent	Sanitary Effluent
Oil and Grease including soap	mg/l	2.5	1	10	10
pH	S.U.	5.5 to 9.5	5.5 to 7.5	6 to 9	6 to 9
Phenols	mg/l	-	-	0.5	-
Phosphorous	mg/l	10 _h	1 to 2.5 _h	-	2
Selenium	mg/l	0.02	0.02	-	-
Temperature	° C	<3°	<2°	<3°	-
Total Suspended Solids (TSS)	mg/l	-	-	50	50
Total Coliform bacteria	MPN _b /100ml	1000	0	-	400 _a
Zinc	mg/l	0.1	0.04	0.5	-

Note:

The blue highlighted cells indicate the most stringent requirements that will be adopted.

a: Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation

b: MPN = Most Probable Number

c: After removal of algae

e: Nitrogen (Total) is the sum of all nitrogen (Total Kjeldahl nitrogen-TKN plus Nitrate). TKN - The sum of organic-nitrogen (e.g urea) plus the ammonia. It is present in raw sewage. This must be converted for the entire process to be effective and high Dissolved oxygen within the system is required for the conversion. High TKN signifies no ammonification (conversion of organic-nitrogen to ammonia) and nitrification (conversion of ammonia to nitrite to nitrate) occurring.

f: General Limit = 70 Sm/m above intake to a maximum of 150 mS/m and Specific Limit = 50 mS/m above background receiving water, to a maximum of 100 mS/m

h: Ortho-phosphate as phosphorus

q: water used for irrigation

10.3.5 Water sampling / monitoring points

The location of all ground water quality sampling points is provided in Table 10.4 and Figure 10.1. Water monitoring points including community boreholes, rivers and wetlands will be identified for water quality monitoring and will include aquatic invertebrate monitoring. Control sampling points upstream of the project site are to be determined and included in the monitoring programme. In addition, downstream “effect” monitoring points will be identified for inclusion in the monitoring programme. In addition, sites for the monitoring of point source discharge including storm water run-off and sanitary effluent will also be identified by Zirco as part of its planning activities. This monitoring plan will then be updated accordingly.

It is important to note that despite the baseline data collection being conducted over the period of one year, the data obtained will nevertheless provide only a ‘snap shot’ of the water quality situation in the project area. Other variables, such as climate change, droughts and floods will also affect longer term variability in water quality parameters. In order to enable some interpretation of these longer term drivers, an offsite “control” monitoring site will be included in the monitoring plan. This area will not be affected by project activities and therefore changes measured here over time will provide some insight into longer term trends in water quality unrelated to project activities.

Table 10.4: Zirco Kamiesberg Groundwater monitoring points

Location & Sample ID	Coordinates		Site type	Water Use Category
	Latitude (south)	Longitude (east)		
Hydrocensus 2012				
ZIR01	-30.7452	17.64536	Borehole	Unused
ZIR02	-30.742	17.62974	Borehole	Livestock
ZIR03	-30.7053	17.62532	Borehole	Unused
ZIR04	-30.7357	17.66761	Borehole	Livestock
ZIR05	-30.6133	17.59311	Borehole	Livestock
ZIR06	-30.5993	17.6607	Borehole	Livestock
ZIR07	-30.6766	17.71211	Borehole	Livestock
ZIR08	-30.718	17.65561	Borehole	Livestock & Domestic
ZIR09	-30.78	17.69353	Borehole	Unused
ZIR010	-30.7582	17.63989	Borehole	Livestock
ZIR011	-30.7587	17.63707	Dug Sump	N / A
ZIR012	-30.8478	17.57605	Seawater	N / A
Extended Hydrocensus 2013				
GAT1	-30.7301	17.6849	Borehole	Livestock
GAT2	-30.7305	17.6855	Borehole	Unused
ZIR13	-30.7838	17.6028	Dug sump	N / A
ZIR14	-30.7814	17.6003	Borehole	Livestock
ZIR15	30.7463	17.5722	Borehole	Livestock
ZIR16	30.7528	17.5789	Borehole	Livestock
ZIR17	-30.8100	17.5986	Borehole	Livestock
ZIR18	-30.8054	17.6024	Borehole	Livestock
ZIR19	-30.8133	17.5901	Borehole	Livestock
ZIR020	-30.7670	17.6626	Borehole	Livestock
ZIR021	-30.8589	17.5751	Seawater	N / A

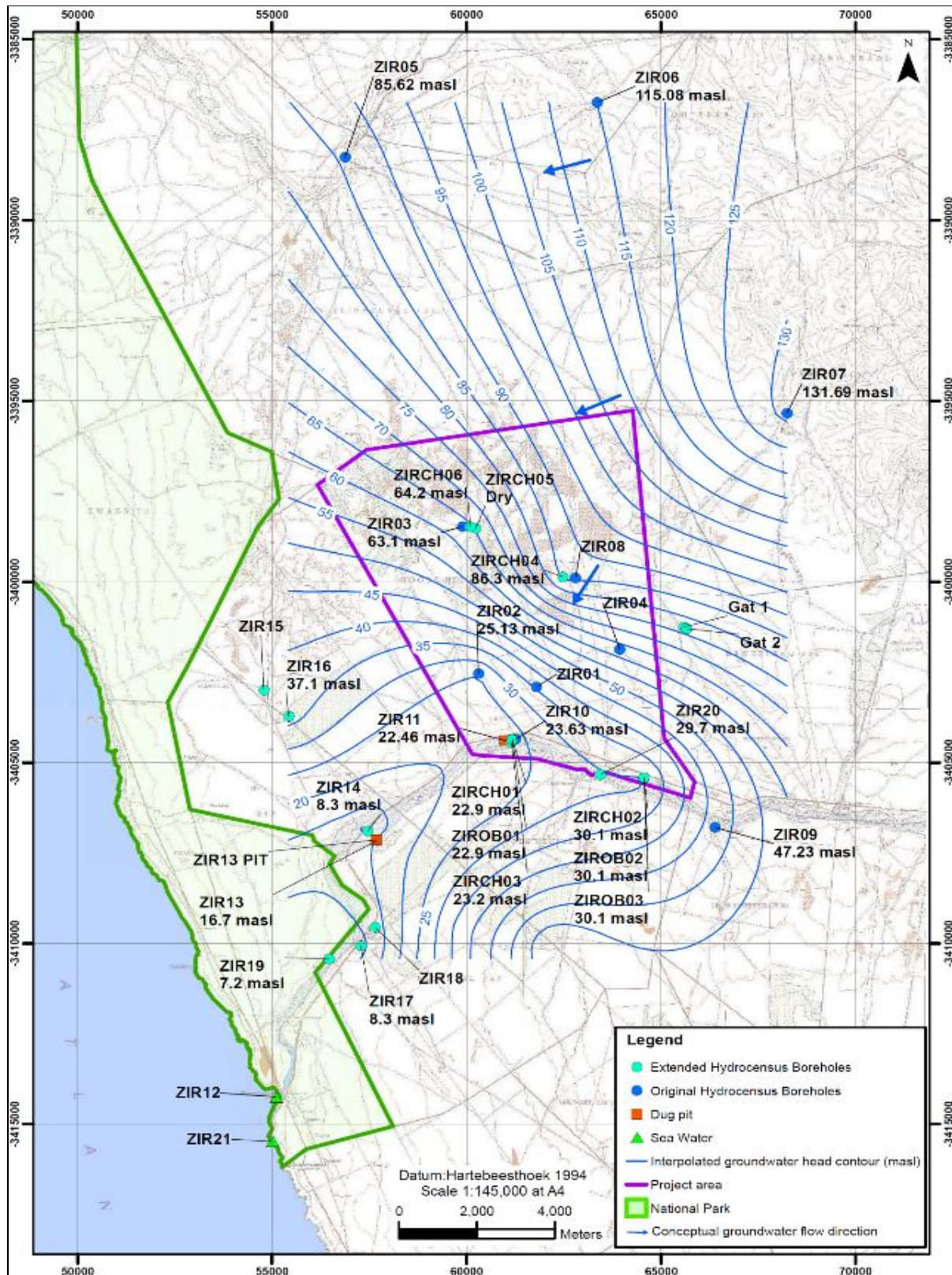


Figure 10.1: Map showing the location of ground water monitoring points
 (See Table 10.4 for names and coordinates of sampling points)

10.3.6 Monitoring Frequency

The proposed frequency of monitoring for surface and groundwater, including the bio-monitoring of invertebrates, is summarized in Table 10.5. The monitoring frequency may have to be adjusted depending on surface water availability and site logistics.

Table 10.5: Water, Sediment and Invertebrate Monitoring Frequency

Aspects	Requirement	Frequency
Potable water quality	<ul style="list-style-type: none"> Listed parameters in Table 10.2 All parameters are to be analyzed to determine the baseline. Based on the presence or absence of contaminants and project activities contaminants can be justified for removal and will require no further monitoring. 	<ul style="list-style-type: none"> Twice a month initially for one year (baseline) and then once every quarter. Monitor full suite of parameters once in a three year cycle.
Surface water quality	Listed parameters in Table 10.1 for applicable water use	Twice a month for the first year (baseline) and then once every quarter.
Groundwater quality	Radioactivity	Total U and Th to be monitored annually.
	pH, TDS, EC & T	Monthly during construction and operational phases
	Listed parameters in Table 10.1 for livestock watering	Quarterly during the construction and operational phases.
Water level	Groundwater level monitoring points	Every two weeks in Year 1 for baseline flow determination and monthly during construction and operational phases.
Sanitary and industrial effluent	Listed parameters in Table 10.3	Twice a month during the construction and operational phases for internal monitoring and once every quarter by a certified laboratory.
Invertebrate sampling and analysis	SASS5 Score and Shannon Weiner Diversity Index	Once a year for the life of the project

10.3.7 Quality Control Measures

Surface and Ground Water:

The following quality control measures will be applied:

- 1) Water sampling will always be done upstream of any water disturbance and positioned with the mouth facing upstream of water flow.
- 2) No overflow of water from the sample bottles will be allowed since some bottles are treated. No rinsing will be done when collecting water samples.
- 3) The right sample bottles will be used for each category of parameters namely chemical, physical and bacteriological. Shipment of samples will be done within 48 hours to the laboratory for analysis.
- 4) All the samples will be transported in cooler boxes to avoid significant change in temperature.

- 5) Samples will always be accompanied with shipping documents indicating the code for the sample as labeled on the bottle.

10.3.8 Contingency

If metal concentrations at farm water sources approach or exceed SAWQG Livestock Watering quality criteria and are higher than typical background concentrations, Zirco will undertake investigations to determine whether project activities are the cause. If so, the company will undertake all steps practicable to ensure that compliance with livestock watering guidelines or background concentrations is maintained. If required, alternative water supplies will be provided.

If ground water levels are reduced due to project related activities, similar corrective measures as for water quality will be implemented. In this case, measures to ensure that communities have continued access to water will be put in place.

If exceedance of the livestock watering guidelines or background concentrations is attributed to project activities, Zirco will endeavour to determine the cause of the exceedance and assist the community with the management of water quality issues for example by informing the community of contamination pathways and measures that may be implemented to prevent contamination or by informing relevant government institutions

10.4 Meteorology

It will be necessary to collect meteorological data to facilitate the analysis of water, erosion and ambient air quality monitoring data.

10.4.1 Objectives

The objectives of the meteorological monitoring are to compile a record of on-site climatic data to assist in the environmental management of the Project, in particular, the design and sizing of water management structures, to improve the accuracy of hydrological models and to aid in the interpretation of ambient air quality monitoring data.

10.4.2 Parameters, Frequency and Sampling Location

An on-site Automated Weather Station has been commissioned at the mine premises that measures hourly values for the following parameters: wind speed and direction, ambient temperature, relative humidity, barometric pressure, solar radiation, and precipitation. This allows for data to be collected continuously and is remotely downloaded and stored securely at regular intervals (at least monthly). The station has been donated to the Agriculture Research Council as part of their national network and they now undertake regular calibration and maintenance.

10.4.3 Quality Control Measures

The quality control of data obtained from the automated weather station will be managed according to the Guidelines on Quality Control Procedures for Data from Automated Weather Stations (2004).

10.5 Air Quality Monitoring

Air Quality Performance indicators are usually selected to reflect both the source of the emission directly and the impact on the receiving environment. Ensuring that no visible evidence of windblown dust exists represents an example of a source-based indicator, whereas

maintaining off-site dustfall levels to below 600 mg/m²/day represents an impact- or receptor-based performance indicator. Source-based performance indicators have been included in most international regulations.

- Source based performance indicators for the unpaved roads would be no visible dust when trucks/vehicles drive on the roads. Dust fallout in the immediate vicinity of the haul road perimeter should be less than 1200 mg/m²/day and less than 600 mg/m²/day at the sensitive receptors.
- From all activities associated with the proposed activities, dust fallout rates will not exceed 600 mg/m²/day outside the project area for on-site activities or at the sensitive receptor areas for on-site and off-site activities.

Depositional dust that may be generated from active construction and operational areas (e.g. access roads and construction sites) will be monitored within the project area and at suitable control sites and compared against the Air Quality Standard Limits SANS 1828 (Table 10.6). Duplicate samples and blank samples will be sent for analysis. The monitoring frequency will be monthly using fall out dust buckets.

Table 10.6: Acceptable dust fall rates as measured (SANS 1828) at and beyond the boundary of premises where dust originates

Areas	Site ID	Dustfall rate D (mg/m ² /day, 30-days average)	Frequency and Permitted Frequency of exceeding dust fall rate
Residential Area	Residential	D < 600	Monthly Two within a year, not sequential months
Non-Residential Area	Plant	600 < D < 1200	Monthly Two within a year, not sequential months

Background levels of gaseous pollutants, such as SO₂, Ozone, NO_x, NO₂, Benzene, and CO are always critical to determine if the environment is already under stress. The ambient air quality parameters that are to be measured and their applicable guidelines are shown in Table 10.7.

Ambient PM₁₀ and dust fall monitoring will be conducted on a continuous basis as part of mine's management plan. Dust fallout and ambient PM₁₀ monitoring can serve to meet various objectives, such as:

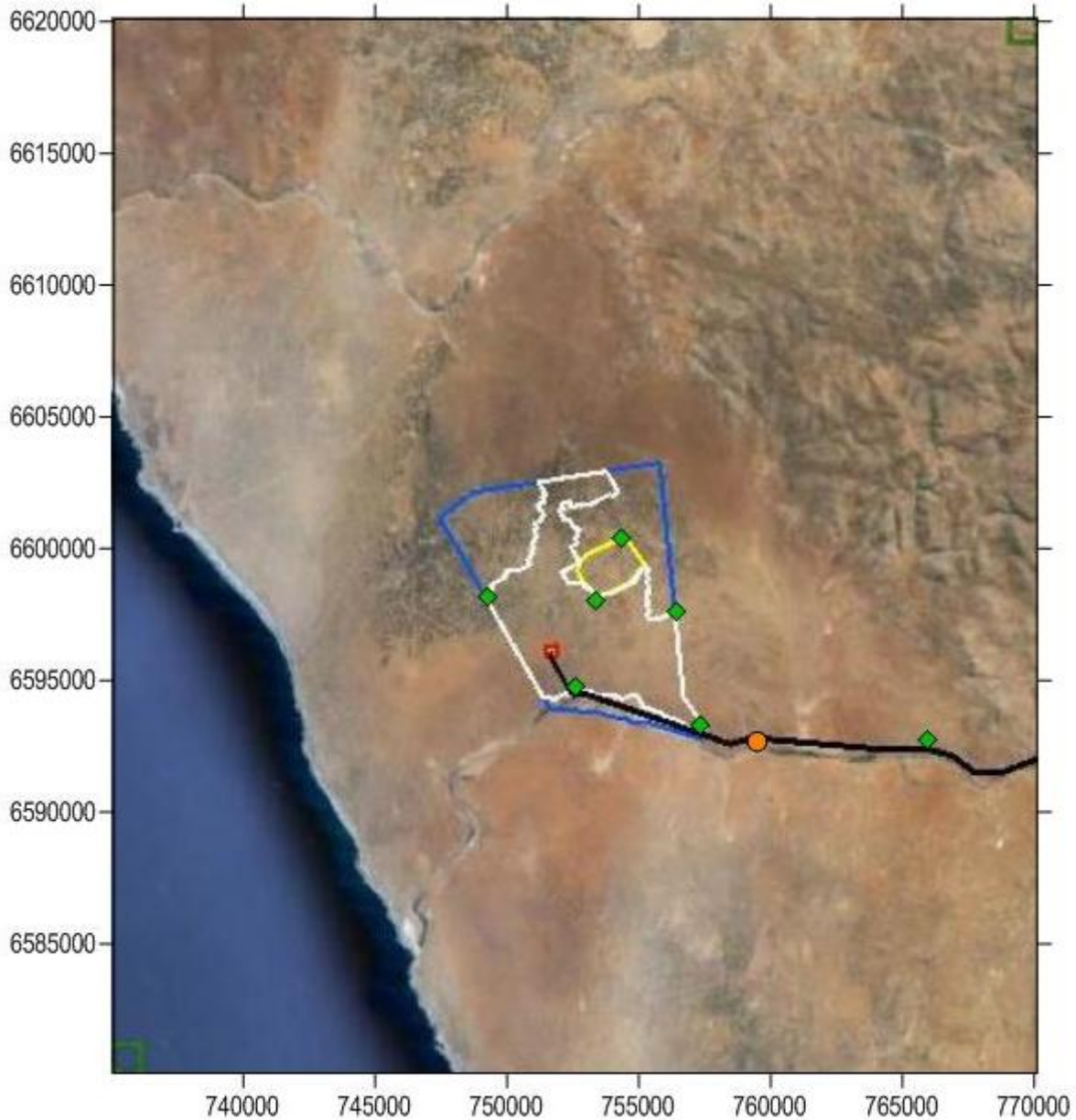
- Compliance monitoring;
- Validate dispersion model results;
- Use as input for health risk assessment;
- Assist in source apportionment;
- Temporal trend analysis;
- Spatial trend analysis;
- Source quantification; and,
- Tracking progress made by control measures.

Table 10.7: Applicable ambient air quality and emission standards

Pollutant	South Africa				WHO
	Averaging Period	Limit Value ($\mu\text{g}/\text{m}^3$)	Frequency of Exceedance	Compliance Date	
Ambient Air Quality					
NO₂	1 hour	200	88	Immediate	200
	1 year	40	0	Immediate	40
PM₁₀	24 hour	120	4	Immediate – 31 Dec 2014	
	24 hour	75	4	01-Jan-15	74
	1 year	50	0	Immediate – 31 Dec 2014	30
	1 year	40	0	01-Jan-15	
PM_{2.5}	24 hour	65	4	Immediate – 31 Dec 2015	
	24 hour	40	4	1 Jan 2016 – 31 Dec 2029	35.5
	24 hour	25	4	01-Jan-30	
	1 year	25	0	Immediate – 31 Dec 2015	15
	1 year	20	0	1 Jan 2016 – 31 Dec 2029	
	1 year	15	0	01-Jan-30	
SO₂	10 minutes	500	526	Immediate	500
	1 hour	350	88	Immediate	
	24 hour	125	4	Immediate	50
	1 year	50	0	Immediate	
Air Emission					
Ozone	8 hours	120	11	Immediate	-
CO	1 hour	30	88	Immediate	-
	8 hours	10	11	Immediate	-
Lead	1 year	0.5	0	Immediate	-
Benzene	1 year	10	0	Immediate	

10.5.1 Sampling Locations

According to the Air Quality Specialist study conducted, the proposed sampling air quality monitoring network is as shown in Figure 10.2 below. Specific coordinates for each sampling points will be identified in the Air Quality Monitoring Plan for the site.



- ◆ Dustfall sampling locations
- PM₁₀ sampling locations

Figure 10.2: Recommended air quality monitoring network for the Zirco Kamiesberg Project

10.6 Noise and Vibration Monitoring

Noise will be monitored monthly at the plant site and homesteads closest to the mining activities. Noise monitoring results will be compared with ambient international thresholds while occupational noise exposure within the mining facility will be compared to the guideline limits shown in Table 10.8.

Table 10.8: Ambient and Occupational Noise Level Guidelines

Ambient Noise	Applicability	Day time (07:00 – 22:00)	Night time (22:00 – 07:00)
		One hour LA _{eq} (dBA)	
	Beyond boundary of the facility	55	45
Occupational Noise	Applicability	Equivalent Level	Maximum
		8 hour LA _{eq, 8h} (dBA)	LA _{max, fast}
	Operational areas	85	110
	Control rooms and offices	50	-

Ground-borne vibration that may be generated from active construction areas and mining related activities will be monitored within the project area, at nearby homesteads and at suitable control sites. Monitoring results will be compared to international accepted safe PPV thresholds based on infrastructural types. The monitoring frequency shall be monthly and/or event based.

A monitoring plan will be implemented to determine potential sources of noise, any increases and decreases in noise levels, and determine the level of mitigation required. Components to be included in the proposed monitoring plan are discussed in Table 10.9 below.

Table 10.9: Ambient and Occupational Noise Monitoring

Method	Monitoring locations	Frequency	Target	Reporting
Monitoring in accordance with the IFC EHS guidelines; Noise measurement will be taken for a 24 hour period at each location	The noise measurements will be taken at the measurement locations to be identified at mine site and neighbouring communities.	To be conducted on a quarterly basis initially. Once it is established that the mitigation measures have decreased the specific noise levels from the mining activities, the noise monitoring will be carried out on a bi-annual basis thereafter.	Noise levels from the proposed mining activities should not result in a maximum increase in the existing background/ambient levels of 3dBA at the surrounding homesteads.	A report will be compiled quarterly/bi-annual, depending on the intervals of the monitoring programme then submitted to management to ascertain compliance with the required standards

10.7 Waste Disposal Facility and Practices

Various types of waste will be generated during the construction and operational phase as detailed in the Waste Specialist Study conducted. Major waste streams will be general and hazardous waste, including construction waste. Management practices and disposal facilities will require monitoring to ensure compliance with best waste management practices.

10.7.1 Objectives

The objectives of monitoring waste disposal facilities are:

- To minimize the impact of wastes on human and environmental health.
- To ensure compliance with the South African waste management legislation.
- To comply with the EIA waste management commitments.

10.7.2 Monitoring Parameters and Frequency and Sampling Location

Parameters will include the physical state of waste storage facilities, volumes of waste generated, waste separation, presence of disease vectors, compliance with licence conditions and state of housekeeping. Monitoring of water related contaminations resulting from waste activities are covered in section 10.3. See Appendix B for specific requirements relating to sewage disposal and land contamination.

Monitoring of waste management facilities will be conducted monthly.

Waste management will be monitored across the site as a whole.

10.7.3 Quality Control Measures

The waste management team will undergo basic training in waste management and records of their training will be maintained. Waste disposal log-books will be maintained and monthly averages used to identify areas where waste could not have been collected accordingly. Periodic waste discussions focused on lessons learnt will be held with the waste management team to identify areas of improvement. Periodic inspections and observations will be done to monitor waste management practices and behavior and all the waste management records will be maintained in record books for inspections. Best management practices will also be attained through adherence to waste management permit conditions and general recommendations in the Regulations.

10.7.4 Contingency

Zirco will ensure that non-compliances are attended to and where a storage facility cannot conform to the best practices perhaps due to location or other reasons, use of such facilities for waste management will be suspended until corrective measures are put in place.

10.8 Soil and Rehabilitation Monitoring

It is recommended that the success of the rehabilitation exercise be monitored from the commencement date and for five years subsequent to the final implementation phase. This recommendation is based on the need for clearer scientific understanding within the rehabilitation field, particularly with respect to indigenous rehabilitation and the natural processes of succession. In the first few years of mining specific Key performance Indicators will need to be developed.

This can be achieved by setting up an on-going research project in which records kept by the Rehabilitation Officer are analysed and assessed in a scientific basis. Coupled with this information, it is recommended that data be captured on a GIS system, to facilitate both management of rehabilitation and monitoring. The incorporation of general weather conditions affecting the success of rehabilitation should be incorporated into the monitoring programme.

The Rehabilitation Officer must compile quarterly monitoring reports to establish the success of the growth of planted species, the establishment of spontaneously germinating species, including weed species that are systematically removed. Any other important information will also be noted.

10.8.1 Rehabilitation Evaluation

In the 1980s and 1990s general reviews of rehabilitation were produced which gave the basic understanding of what is necessary to assess the success of rehabilitation, as is best exemplified in the publication by Ewel (1990). He listed six criteria, many of which were difficult to measure, such as:

- Sustainability – whether the new community can perpetuate itself,
- Nutrient retention – a measurable build up in the soil system of nutrients,
- Biotic interaction – species of different trophic groups forming various associations.
- Restoration status – whether the ecosystem has reached the status of the undisturbed ecosystems.

The other two criteria of Ewel are somewhat easier to measure:

- Invasability – invasion of new species into the newly formed ecosystem.
- Productivity – an increase in abundance or biomass over the period of measurement.

This paper and others (e.g. Westman, 1991) establish the principles behind assessing rehabilitation, but give very little detail on how this could be carried out. More recently a number of papers on the ways to measure the success of rehabilitation, or the techniques used for the rehabilitation process have been published (See CES 2004; or Ruiz-Jean and Aide, 2005).

Techniques such as those of Van Aarde *et al.* (1996) and Wassenaar and Van Aarde (2003) could be used to monitor the rehabilitation programme. These authors set various criteria to evaluate the success of the coastal forest restoration programme at the dune mining site at Richards Bay, South Africa. They reported on selected variables linked to various criteria, and used mainly quantitative analyses to determine whether the rehabilitated sites were developing towards a benchmark site. These included aspects of eco-system function, structure and composition. In an evaluation of the success of this specific rehabilitation process, simpler criteria had to be established.

10.9 Occupational Health and Safety Monitoring

Occupational health and safety (OH&S) monitoring programmes will verify the effectiveness of prevention and control strategies. The selected key performance indicators (KPIs) are to be representative of the most significant occupational, health, and safety hazards, and the implementation of prevention and control strategies. The OH&S monitoring programme will be designed and implemented by accredited professionals and will include plans for mitigating post-closure long term health concerns. Facilities will also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents.

As a minimum, the occupational health and safety monitoring programme will include:

- **Safety Inspection, Testing and Calibration:** This will include regular inspection and testing of all safety features and hazard control measures focusing on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used. The inspection will verify that issued PPE continues to provide adequate protection and is being worn as required. All instruments installed or used for monitoring and recording of working environment parameters will be regularly tested and calibrated, and the respective records maintained.
- **Surveillance of the Working Environment:** Zirco will document compliance using an appropriate combination of portable and stationary sampling and monitoring instruments. Monitoring and analyses will be conducted according to internationally recognized methods and standards. Monitoring methodology, locations, frequencies, and parameters will be established individually for each project following a review of the hazards. Generally, monitoring will be performed during commissioning of facilities or equipment and at the end of the defect and liability period, and otherwise repeated according to the monitoring plan.
- **Surveillance of Workers Health:** When extraordinary protective measures are required (for example, against biological agents and/or hazardous compounds), workers will be provided appropriate and relevant health surveillance prior to first exposure, and at regular intervals thereafter. The surveillance will, if deemed necessary, be continued after termination of the employment.
- **Training and Induction:** Training and induction activities for employees and visitors will be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises, including fire drills, will be documented adequately. Service providers and contractors will be contractually required to submit to the employer adequate training and induction documentation before start of their assignment.

10.9.1 Accident and Disease Monitoring

Zirco will establish procedures and systems for reporting and recording occupational accidents and dangerous occurrences, and incidents. These systems will enable workers to report immediately to their immediate supervisor any situation they believe presents a serious danger to life or health. The systems and the employer will further enable and encourage workers to report to management all:

- Occupational injuries and near misses
- Suspected cases of occupational disease
- Dangerous occurrences and incidents

All reported occupational accidents, occupational diseases, dangerous occurrences, and incidents together with near misses will be investigated with the assistance of a person knowledgeable/competent in occupational safety. The investigation will:

- Establish what happened
- Determine the cause of what happened
- Identify measures necessary to prevent a recurrence

10.9.2 Radiation Monitoring

Radiation exposure can lead to potential discomfort, injury or serious illness to workers and the larger community. As such, a radiation baseline will be established to identify hotspots and regular monitoring will be conducted. Table 10.11 provides ionizing radiation exposure guidelines for workers and the public.

Table 10.11: Effective dose limits for occupational and public ionizing radiation exposures

Exposure	Units	Limits		
		Mine workers* (min 19yr of age)	Apprentices & Students (16 - 18yr of age)	Visitors / Public
Five consecutive year average – effective dose	mSv/year	20		1
Single year exposure – effective dose	mSv/year	50	6	1
Equivalent dose to the lens of the eye	mSv/year	150	50	15
Equivalent dose to the extremities (hands, feet) or the skin	mSv/year	500	150	50

Source: International Atomic Energy Agency, 1999

* The occupational dose limit for women who are not pregnant shall be the same as that of men. Once pregnancy has been declared, the equivalent dose limit to the surface of the woman's abdomen shall be 2mSv for the remainder of the pregnancy.

As a minimum, prevention, control and monitoring strategies will include:

- Places of work involving occupational and/or natural exposure to ionizing radiation will be established and operated in accordance with recognized international safety standards and guidelines as described in Table 10.11.
- Exposure to non-ionizing radiation (including static magnetic fields; sub-radio frequency magnetic fields; static electric fields; radio frequency and microwave radiation; light and near-infrared radiation; and ultraviolet radiation) will be controlled to internationally recommended limits.
- In the case of both ionizing and non-ionizing radiation, the preferred method for controlling exposure is shielding and limiting the radiation source. Personal protective equipment is supplemental only or for emergency use. Personal protective equipment for near-infrared, visible and ultraviolet range radiation can include appropriate sun block creams, with or without appropriate screening clothing.
- Detection and monitoring measures will include the use of equipment such as portable radiation monitor, area radiation monitor and personal dosimeters. This equipment will be serviced regularly and operated by trained personnel. Monitors for internal radiation contamination may also be adopted as measures for internal contamination done on body excretions such as urine, or can be made directly on the body using a whole body counter or thyroid monitor, depending on what is being tested for.

10.10 Socio-Economic Monitoring

Zirco is responsible for developing and implementing all voluntary land acquisition and compensation strategies developed. Zirco will therefore assume responsibility for providing the funding for monitoring of affected persons and project affected people. Such monitoring is required to ensure that voluntary land acquisition is properly implemented, is in line with local and international standards, that grievances are being attended to, and that any necessary changes to the overall process are being done in good time and sensibly.

In order to be compliant with best practice monitoring will need to take place at two levels.

Internal Monitoring will be conducted by a suitably qualified person within the management of Zirco. The form that this monitoring takes is flexible and can be tailored to the personnel and

capacity of the management team. However it is strongly recommended that monitoring have at least three data sources. These would be:

- The Grievance
- Register results and minutes of the local level engagement programme as per the OP - Stakeholder Engagement
- Qualitative monitoring database developed as the baseline for the Social Impact Assessment for the project.

External Monitoring will be conducted through a contracted independent body so as to provide external third party verification of social monitoring data gathered by the internal monitoring team.

Monitoring reports are a valuable tool in identifying problems in the implementation of the resettlement project and should be used as such. The monitoring team will revisit the monitoring plans after each monitoring exercise to evaluate findings and take necessary steps to rectify issues that have been highlighted by the monitoring reports. A manual for the usage of the protocols will be developed by the independent monitor.

The external Monitoring Team will visit the project area upon completion of the first phase of the land acquisition and then two years later. The subsequent frequency can be determined after the first two visits. External monitoring will pay particular attention to the following aspects:

- Ensure that the land acquisition is fair and conducted within the confines of legal requirements and standards.
- Ensure that households who have lost crops and other forms of livelihood production have received fair compensation and that compensation rates are reviewed regularly.

11. DECOMMISSIONING AND CLOSURE PLAN

11.1 MINE CLOSURE PLAN

External Monitoring Conceptual Closure Plan

In accordance with South African law and IFC Requirements, a Mine Closure Plan for the Kamiesberg Project will be required. This plan must support the operation in achieving a post closure status that leaves behind a positive legacy in the community. Health, safety, social, environmental, legal, governance and human resource aspects will need to be considered and addressed. However, the project is currently at the early stages, and hence it is not possible to produce a detailed closure plan. Thus, it is recommended that all South African laws are adhered to and that the Integrated Mine Closure approach developed by the International Council on Mining and Metals (ICMM, 2008) be used as a guideline (Figure 12.1). This approach encourages planning for closure becoming part of the design of a mine operation in order to facilitate closure. When a project is designed, there is a lot of scope to do so with closure in mind. For example, designing mine infrastructure in relation to the community's requirements.

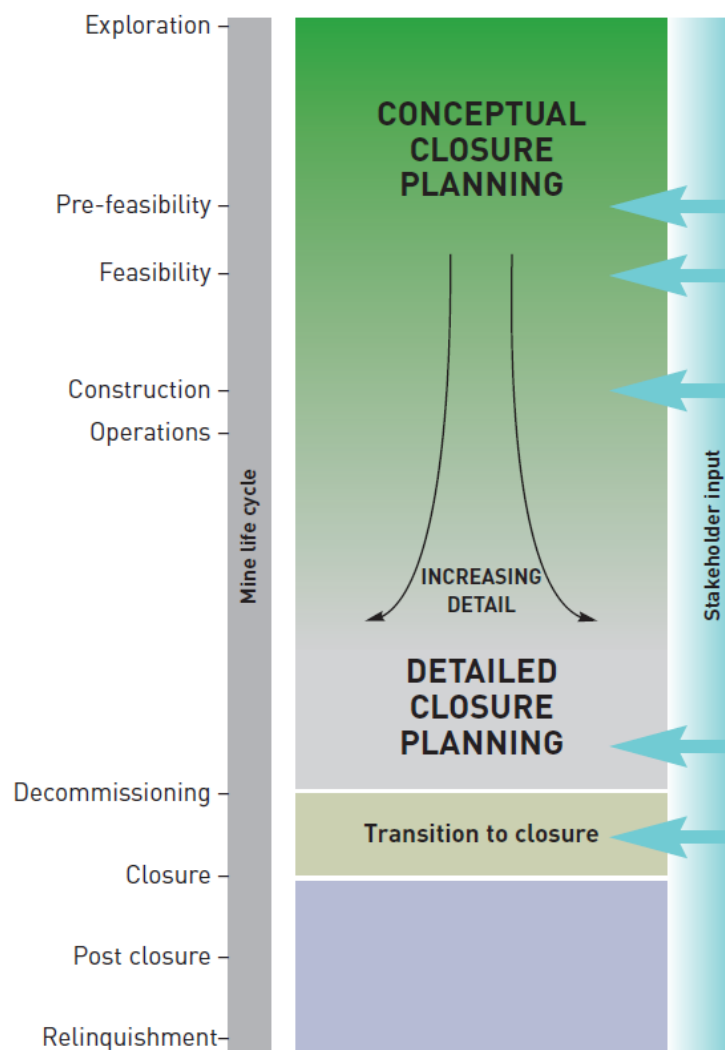


Figure 11.1: The integrated mine closure planning approach recommended by the ICMM (2008)

Thus, a mine closure plan for the Kamiesberg Project will be developed by Zirco, initiated at this early stage as a **Conceptual Closure Plan** (Figure 11.1). A conceptual closure plan should communicate an outcome and goals of the closure activities, whereas a detailed plan includes milestones, detailed methodologies of achieving these, monitoring and validation processes. This can only come later at the more detailed engineering design phase. It should however be noted that a Closure Plan for a heavy minerals mine may differ from the generic model in that rehabilitation (which forms part of the closure phase of the proposed development) will start within three years of the operation of the mine. The nature of heavy mineral mining projects allows for progressive and ongoing rehabilitation of the mine path which is often not possible with traditional hard rock mines. The mine void will be backfilled and revegetated on an on-going basis as mining progresses. This is substantially different from a hard rock mine where rehabilitation and closure generally takes place after all mining activities has ceased.

The Conceptual Closure Plan has been developed to guide the rehabilitation process, and is reported on in the specialist rehabilitation report³. However, any closure plan must be reviewed at regular intervals over the life of the mine. Any change to, or new development associated with the project as currently proposed, would automatically trigger a revision of the Conceptual Closure Plan and its budget to ensure that sufficient funds are available to cover any additional costs.

This section of the report therefore serves to provide some of the broader principles and methodologies that will be adopted by the company for closure planning, and essentially provides the outcome and objectives of the Conceptual Closure Plan.

The **target closure outcomes** of the mine closure plan are to:

1. Restore as much as possible of the mine area to a condition consistent with the pre-determined post closure land use objective.
2. Ensure that the mine area is left in a condition which poses an acceptable level of risk to public health and safety.
3. Reduce, as far as is practically possible, the need for post closure intervention, either in the form of monitoring or ongoing remedial works.
4. Minimise or prevent post-closure environmental degradation (to the soils, water and air), by ensuring that the mine area is left in a condition that is chemically and physically stable.
5. As far as practical, minimise the immediate negative economic impacts to local communities associated with mine closure and maximise the likelihood of lasting benefits to local communities. This will include leaving infrastructure in place that has a post mining value to the communities.

The standards against which the success of decommissioning, rehabilitation and closure of the mine area will be determined have yet to be formulated but should, as a minimum, comply with:

- The requirements of South-African Law;
- The targets set by the ICMM Mine Closure Toolkit (2008);
- The IFC Performance Standards and associated guideline documents;
- The Equator Principles;
- The company's Environmental Policy; and
- The company's Social Policy.

The **objectives** of the detailed mine closure plan are further expanded upon below:

³ A.M. Avis, R.A. Lubke & D van Eerden. May, 2014: Zirco Roode Heuwel Kamiesberg Project, Northern Cape, South Africa. Rehabilitation Strategies Recommended Rehabilitation Programme, Coastal & Environmental Services (CES), Grahamstown.

- **Physical Stability** - Mine structures that remain post closure should be physically stable such that they do not pose a hazard to public health and safety as a result of failure or gradual degradation. These structures should only erode and/or release solids into the environment to the extent that degradation of the surrounding area does not occur.
- **Chemical Stability** - The infiltration, leachate or run-off from the mine site or waste storage facilities should not endanger public health and safety or result in the pollution of soil, surface water or groundwater, or non-compliance with statutory water quality limits.
- **Land Use** - Post closure, the mine site should be compatible with the surrounding land, to the extent that it is both practical and economical to do so.
- **Social** - Post closure the mine should ensure that the communities impacted and dependent on the mine are suitably catered for. Social risks must be identified, and goals need to be defined and set for, inter alia, the following: Poverty alleviation, education, health care, employment and employability, improving social infrastructure. This will include leaving infrastructure in place that has a post mining value to the communities.

Social Components of Closure

Zirco recognizes the importance of public participation in all phases of the project. The company will therefore be guided by the approach recommended by the ICMM, as it is recognized that to achieve effective closure that is beneficial to the operating company and the community that hosts it, the views, concerns, aspirations, efforts and knowledge of various internal and external stakeholders must be brought together. For Zirco this will involve:

- Incorporating closure planning into the early stages of project development and operations;
- Collating the goals and views of various stakeholders (project owner, local community, government, and non-governmental organizations (NGOs)) at the early feasibility (EIA) stage of project development to inform closure and post closure goals;
- Acting to meet the goals by working with the relevant stakeholders within and outside Zirco;
- Using the concepts of risk and opportunity to both minimize liability and maximize benefits to all relevant parties;
- Using multidisciplinary expertise and multi-stakeholder processes to ensure that mitigation of risk in one area does not increase risks in another; and
- Ensuring that the social closure phase ties in with the infrastructural and environmental closure phases.

Thus, engagement with internal and external stakeholders will be undertaken throughout the life cycle of the project, and to achieve lasting benefits at a local and regional level, Zirco appreciates that the views of external stakeholders must be understood. To ensure that these benefits are delivered, Zirco will identify key external stakeholders and engage with them to foster a two-way understanding of what mutually beneficial outcomes are. These outcomes will be explained and presented in the Comprehensive Closure Plan.

11.2 DECOMMISSIONING, REHABILITATION AND CLOSURE OF SPECIFIC COMPONENTS

Mining area

The recommendation is to rehabilitate the entire site to natural vegetation. The overall rehabilitation plan for the mine site is therefore to achieve an indigenous vegetation cover, and

to focus the rehabilitation programme on re-establishing the type of vegetation that occurred before mining. The primary focus of the rehabilitation programme would be focused on re-establishing Sand Fynbos. A secondary focus would be to re-establish Strandveld in the eastern portions of the area to be affected by mining. The rehabilitation will be facilitated by the presence of various ecological corridors, as these areas will act as seed banks and a possible source of plants which could be transplanted from these areas. They also support various faunal groups, which play an important role in pollination and seed dispersal.

The rehabilitation programme will need to be guided by the mine plan. Once an area has been mined out, rehabilitation can start shortly thereafter, since mining activities (essentially bulk earth works) will move onto the next parcel of land. Thus, a rolling rehabilitation process can take place, and at the end of the mine life, the area mined in year one will support vegetation close to 20 years old. The sequence of rehabilitation will need to closely follow the sequence of mining.

In terms of radiation, to allow for the possibility of exposure from other sources, operators are required to apply constraints to the exposure levels and limit the annual public exposure to 1 mSv per annum from all (their) operations, the international level for this constraint is 0.3mSv/annum from a single source. This is in line with the IFC and is derived from the International Atomic Energy Agency (IAEA). It is important to note that international radiation protection programs do not hold the operator responsible for background induced radiation doses. However such programs do hold the operator responsible for any radiation dose above the natural background. Therefore the main purpose of any radiation management programmes that will be implemented in the future is to ensure that the exposures to both workers and members of the general public are kept as low as reasonably achievable above the existing natural background.

11.2.1 MSP, PCP, workshops, administration, fuel storage areas and other infrastructure

Certain infrastructure may remain post closure. No dedicated haul road will be constructed for the proposed development. As stated above and in the traffic and transport assessment, existing roads will be upgraded to meet the transport requirements for the proposed project. These upgrades will remain post closure and will not be decommissioned. In addition to this, it is assumed that the buildings of the administration block, workshop and maintenance area will remain to support post closure use. Once closure is complete, a decision to either demolish remaining facilities or hand them over to the KLM for conversion into social infrastructure (e.g. schools, clinic) will need to be made using a consultative process. Lastly, prior to closure the future use of the reverse osmosis plant and pipeline should be discussed with the relevant authorities and municipalities with a view to handing the system over to the KLM. This could be to the benefit of the local communities as potable water is a scare commodity within the region.

All other infrastructure will be decommissioned as follows:

- Any surface buildings and infrastructure which are no longer required will be demolished, unless specific directives to the contrary are received from the authorities. Such directives may result from communities' requests. This will need to be confirmed through a stakeholder engagement process undertaken as part of the closure plan goal refinement exercise.
- Foundations will either be removed or will be covered with a layer of soil, or soil forming material, the depth of which will need to be determined following appropriate trials.
- Non-re-useable materials including rubble and waste will be disposed of at suitable sites in accordance with the waste management and disposal plan that will be developed.
- Following the removal of the infrastructure a soil contamination assessment will be undertaken by an independent specialist and remediation and re-vegetation activities

implemented where necessary.

- Support infrastructure buried underground such as tanks and their pipes, other pipes and service tunnels will, depending on the proposed future use of the site, either be kept as is or be unearthed and removed from the site. If they are to be left *in-situ*, the integrity of all underground pipes and tanks will be assessed by an independent expert. If the integrity of sub-surface infrastructure is compromised, it will be removed.
- Remaining openings and access ways of support infrastructure will be blanked off.
- A detailed plan indicating the location of any remaining infrastructure will form part of the closure plan.
- Electrical equipment and infrastructure i.e. generators will be removed from the site. The soils in the vicinity of the generators will be assessed for contamination and appropriate decontamination measures will be implemented, in accordance with South African regulatory requirements.
- All disused mining plant and equipment such as the MSP, PCP, and heavy machinery will be removed from the site. It is not anticipated that any of this machinery or equipment will be contaminated. However, the mine will confirm this before any machinery or equipment is removed from the site. If any of the machinery or equipment is found to be contaminated it will be appropriately decontaminated before being removed.
- During the mitigation and rehabilitation works, particular attention will be paid to the places where equipment will be parked. The mine will assess these sites and if the soils are contaminated appropriate remedial measures will be taken in compliance with South African regulatory requirements.
- There will be a landfill on site for general waste. The design of this dump has not yet been finalized. However the following design principles will apply:
 - The dump will be designed according to generally acceptable environmental standards and in compliance with South African legislation.
 - The dump will be well managed at all times and wastes deposited will be covered in an ongoing manner.
 - On completion of the land fill the covers will be completed and re-vegetation of the cover undertaken.
 - The slopes of the dump will be designed to ensure that erosion is properly controlled at all times and stability of the slopes ensured.
 - The closure plan for the mine will include details for the closure of the landfill and will ensure that the closure of this specific facility meets the requirements of South African legislation and international best practice. Post-closure monitoring of these facilities may be required.

11.2.2 General Surface Rehabilitation

General surface rehabilitation should ensure the surface topography emulates the surrounding area, is free draining (and does not allow storm-water to accumulate anywhere), has a “neat” appearance and is re-vegetated. Special attention must be given to shaping and removal of heaps of excess material, scrap and waste.

11.2.3 Post closure mine site inspection, environmental monitoring and reporting

The post closure period usually comprise of three phases:

- Active phase, years 1-2
- Passive phase, years 3-5
- Inspection phase, years 5-8

However in the case of heavy mineral mining rehabilitation can take place progressively. In addition to this only relatively small portions (30-300 ha) are mined at any one time. For this

reason a slight variation of these phases may be required.

Zirco will have a retrenchment strategy in place prior to closure to be compliant with IFC Performance Standard 2. In addition to this, during the active two year period the company will continue supplying specific social services to surrounding communities in line with the corporate social responsibility agreements associated with the project. The passive three year period will entail the handover of the infrastructure and services to the local entity (Kamiesberg Local Municipality). Zirco proposes that at the same time it will provide advice on technical or social issues that may arise during this 3-year period with a final sign off taking place in the 5th year post closure.

Zirco will implement a programme of post closure environmental inspection and monitoring to assess the success of mine reclamation and verify that the various components of the closed mine are not adversely impacting adjacent watercourses and groundwater, and do not pose a potential health risk and/or danger to the public. The regularity of the monitoring will be dependent on the aspect being monitored, for example dust and groundwater monitoring will be ongoing and will be initiated prior to construction to obtain baseline values, whereas biodiversity monitoring will take place progressively throughout the operational and closure phases. An independent consultant will conduct the site inspection and environmental monitoring.

Zirco proposes that post closure environmental inspection and monitoring be conducted annually, due to the fact that rehabilitation will be progressive and due to the dryness of the area it is not expected that there will be any growth prior to the rainy season. It is expected that final inspection and monitoring will be conducted 5 years after mine closure but this will depend on the success of the closure and rehabilitation process. The findings of this inspection will determine whether or not any further post closure site inspection is necessary.

Post closure environmental inspections will focus on but not be limited to:

- Surface and ground water quality and quantity;
- Success of establishing a vegetation cover on the mine (including associated infrastructure) area, workshops and fuel storage areas;
- Prevalence of alien invasive plants;
- Soil fitness (chemical characteristics, including nutrients, soil structure and soil profile. The latter will include the depth of the topsoil cover);
- Topography;
- Erosion potential;
- Radiation levels;
- Any activity by the general public or persons unknown that may adversely affect the stability of disused mine structures, pose a danger to the community or possibly result in environmental degradation; and
- The condition of site access roads, bridges and culverts.

Consultations will be held with local stakeholders to listen to and record any issues of concern pertaining to the closed mine site. As far as could be considered reasonable, the company should address stakeholder related concerns associated with the closure.

Due to the fact that rehabilitation of the heavy minerals mine is progressive, monitoring and inspection should be ongoing throughout the operation phase of the project. In addition to this an external consultant will produce an annual post-closure environmental monitoring report at the end of years 1 and 2 and a final post closure environmental report at the end of year 5. These post closure environmental reports will be submitted to the DMR and the DENC and made available to all stakeholders. The reports will present the findings of the mine site inspections/walkovers and the results of the environmental monitoring programmes. Where reclamation activities have not obtained the desired result, the consultant will make

recommendations on what additional reclamation work is required to achieve full reclamation. Any areas of concern will be highlighted. The reports will include a post closure photographic record of mine reclamation.

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APPENDIX A: SOUTH AFRICA LISTED WATER RESOURCES

LISTED WATER RESOURCES	
1	Hout Bay River to tidal water
2	Palmiet River from Kogelberg Dam to its estuary
3	Lourens River to tidal water
4	Steenbras River to tidal water
5	Berg and Dwars Rivers to their confluence
6	Little Berg River to Vogelvlei weir
7	Sonderend, Du Toits and Elandskloof Rivers upstream and inclusive of Thee Waterskloof Dam
8	Witte River to confluence with Breede River
9	Dwars River to Ceres divisional boundary
10	Olifants River to the Ceres divisional boundary
11	Hlsloot and Smalblaar (or Molenaars) Rivers to their confluence with Breede River
12	Hex River to its confluence with Breede River
13	Van Stadens River to tidal water
14	Buffalo River from its source to where it enters the King Williams Town limits
15	Klipplaat River from its source to Waterdown Dam
16	Swan Kei River to its confluence with the Klipplaat River
17	Great Brak River
18	Bongola River to Bongola Dam
19	Kubusi River to the Stutterheim limitsy
20	Langkloof River from its source to Barkly East limits
21	Kraai River to its confluence with the Langkloof River
22	Little Tsomo River
23	Xuka River to the Elliot limits
24	Tsitsa and Inxu Rivers to their confluence
25	Mvenyane and Mzimvubu Rivers from sources to their confluence
26	Mzintlava River to its confluence with the Mvalweni River
27	ngwangwana River to its confluence with Umzimkulu River
28	Umzimkulu and Polela Rivers to their confluence
29	Elands River to the Pietermaritzburg-Bulwer main road
30	Umtamvuma and Weza Rivers to their confluence
31	Umkomaas and Isinga Rivers to their confluence
32	Lurane River to its confluence with the Umkomaas River
33	Sitnundwana Spruit to its confluence with the Umkomaas River
34	Inudwini River to the Polela district boundary
35	Inkonza River to the bridge on the Donnybrook-Creighton road
36	Umlaas to the bridge on District Road 334 on the farm Maybole
37	Umgeni and Lions River to their confluence
38	Mod River to the road bridge at Rosetta
39	Little Mooi and Hlatikula Rivers to their confluence
40	Bushmans Fverto Wagendnft Dam
41	Little Tugela Rver and Sterkspruit to their confluence

42	M'Lambonjwa and Mhlawazeni Rivers to their confluence		
43	Mnweni and Sandhlwana Rivers to their confluence		
44	Tugela Rwer to its confluence with the Kombe Spruit		
45	Inyamvubu (or Mnyamvubu) River to Craigie Burn Dam		
46	Umvoti River to the bridge on the Seven Oaks-Rietvlei road		
47	Yarrow River to its confluence with the Karkloof River		
43	Incandu and Ncibidwane Rivers to their confluence		
49	Ingogo River to its confluence with the Harte River		
50	Pivaan River to its confluence with Soetmelkspruit		
51	Slang River and the Wakkerstroom to their confluence		
52	Elands and Swartkoppie Spruit to their confluence		
53	All tributaries of the Komati River between Nocitgedacht Dam and its confluence with and including Zevenfontein Spruit		
54	Seekoespruit to its confluence with Buffelspruit		
55	Crocodile River and Buffelskloofspruit to their confluence		
56	All tributaries of the Steelpoort River down to its confluence with and including the Dwars River		
57	Potspruit to its confluence with the Waterval River		
58	Dorps River (or Spekboom River) to its confluence with the Marambanspruit		
59	Ohrigstad River to the Ohrigstad Dam		
60	Klein-Spekboorn River to its confluence with the Spekboom River		
61	Blyde River to the Pilgrims Rest municipal boundary		
62	Sabie River to the Sabie municipal boundary		
63	Nels River to the Pilgrims Rest district boundary		
64	Houtbosloop River to the Lydenburg district boundary		
65	Blinkwaterspruit to Longmeer Dam		
66	Assegaai River upstream and inclusive of the Heyshope Dam		
67	Komati River upstream and inclusive of the Nootgedacht Dam and the Vygeboorn Dam		
68	Ngwempisi River upstream and inclusive of Jericho Dam and Morgenstond Dam		
69	Slang River upstream and inclusive of Zaaihoek Dam		
70	All streams flowing into the Olifants River upstream and inclusive of Loskop Darn, Witbank Dam and Middelburg Dam		
71	All streams flowing into Ebenezer Dam on the Great Letaba River		
72	Dokolewa River to its confluence with the Politzi River		
73	Ramadiepa River to the Merensky Dam on the farm Westfalia 223, Letaba		
74	Pienaars River and tributaries as far as Klipvoor Darn		
75	Crocodile River and tributaries as far as Roodekopjies Dam		
76	Elands and Hex River and trributaries as far as Vaalkop Dam		
77	Molopo River and Tributaries as far as Madimola Dam		
RAMSAR LISTED WETLANDS:		PROVINCE	LOCATION
78	Barberspan	North-West	26°33 S 25°37 E
79	Blesbokspruit	Gauteng	26°17 S 28°30 E
80	De Hoop Vlei	Western Cape	34°27 S 20°20 E
81	De Mond (Heuningnes Estuary)	Western Cape	34°43 S 20°07 E
82	Kosi Bay	KwazuluNatal	27°01 S 32°48 E

83	Lake Sibaya	Kwazulu-Natal	27°20 S 32°38 E
84	Langebaan	Western Cape	33°06 S 18°01 E
85	Orange River Mouth	Northern Cape	28°40 S 16°30 E
86	St Lucia System	Kwazulu-Natal	28°00 S 32°28 E
87	Seekoeivlei Nature Reserve	Free State	27°34 S 29°35 E
88	Verlorenvlei	Western Cape	32°24 S 18°26 E
89	Verloren Valel	Mpumalanga	25°14 S 30°4 E
90	Nylsvlei	Northern Cape	24°39 S 28°42 E
91	Wilderness Lakes	Western Cape	33°59 S 22°39 E

APPENDIX B: SOIL STANDARDS AS PRESCRIBED BY DWAF 2006
Sludge Management and Monitoring

The stabilized sludge can then be dried and either disposed at the proposed landfill or alternatively, applied as a soil conditioner during rehabilitation of the mine, provided that levels of toxic constituents is sufficiently low. If soil application is adopted, soil contamination should be avoided and the soil standard prescribed by the AfDB and DWAF (2006) should be adhered to (Appendix C and D). The required limits for the permissible utilisation and disposal of treated sewage sludge as prescribed by the DWAF (2006) are detailed in Appendix D and they including Vol.1 Selection of Management Options; Vol.2 Requirements for the agricultural use of sludge; Vol.3 Requirements for the on-site and off-site disposal of sludge; Vol.4 Requirements for the beneficial use of sludge; and Vol.5: Requirements for the thermal sludge management practices and for commercial products containing sludge.

VOLUME 1: SELECTION OF MANAGEMENT OPTIONS
Table 1a: The South African wastewater sludge classification system

Classification	Best quality	Intermediate quality	Worse quality
Microbiological class	A	B	C
Stability class	1	2	3
Pollutant class	a	b	c

Table 1b: Metal limits to determine the pollutant class for the preliminary classification of wastewater sludge to assess possible management options

Aqua regia extractable metals (mg/kg)		Pollutant class		
		a	b	c
Elements for classification (risk based limits)	Arsenic	<40	40-75	>75
	Cadmium	<40	40-85	> 85
	Chromium	< 1 200	1 200 –3 000	> 3 000
	Copper	< 1 500	1 500-4 300	> 4 300
	Lead	< 300	300-840	> 840
	Mercury	< 15	15-55	> 55
	Nickel	< 420	420	> 420
	Zinc	< 2 800	2 800-7 500	> 7 500
Elements for benchmarking purposes to identify potential risks (20th percentile for class a, between 20th and 80th percentile for class b and 80 th percentile values for class c)	Antimony	<1.1	1.1-7	>7
	Boron	<23	23-72	>72
	Barium	<108	108-250	>250
	Beryllium	<0.8	0.8-7	>7
	Cobalt	<5	5-38	>38
	Manganese	<260	260-1225	>1225
	Molybdenum	<4	4 to 12	>12
	Selenium	<5	4 to 12	>12
	Strontium	<84	84-205	>205
	Titanium	<0.03	0.03-0.14	>0.14
	Vanadium	<85	85-430	>430

VOLUME 2: REQUIREMENTS FOR THE AGRICULTURAL USE OF SLUDGE
Table 2a: Pollutant limits for the agricultural use of wastewater sludge in South Africa

Aqua regia extractable metals	Pollutant class (mg/kg)		
	a	b	c
Arsenic	<40	40-75	>75
Cadmium	< 40	40-85	> 85
Chromium	< 1 200	1 200 –3 000	> 3 000
Copper	< 1 500	1 500-4 300	> 4 300
Lead	< 300	300-840	> 840
Mercury	< 15	15-55	> 55
Nickel	< 420	420	> 420
Zinc	< 2 800	2 800-7 500	> 7 500

Note: A 90% compliance is required to comply with a pollutant class.

Table 2b: Limits for metals in soils (mg kg-1)

Parameters	Total investigative level#	Total maximum threshold#	Maximum available threshold*
	(TIL)	(TMT)	(MAT)
Arsenic	2	2	0.014
Cadmium	2	3	0.1
Chromium	80	350	0.1
Copper	100	120	1.2
Mercury	0.5	1	0.007
Nickel	50	150	1.2
Lead	56	100	3.5
Zinc	185	200	5

- Total digestion method (Aqua regia, EPA 3051)

* - NH₄NO₃ extraction method

VOLUME 3: REQUIREMENTS FOR THE ON-SITE AND OFF-SITE DISPOSAL OF SLUDGE**Table 3a: Metal limits based on the TCLP test for the disposal of sludge**

TCLP extractable metals	Pollutant class (mg/l)		
	a	b	c
Arsenic (As)	≤0.43	0.43 – 4.3	>4.3
Cadmium (Cd)	≤0.031	0.031 – 0.31	>0.31
Chromium (Cr III)	≤4.7	4.7 – 47	>47
Chromium (Cr VI)	≤0.02	0.02 – 0.2	>0.2
Copper (Cu)	≤0.1	0.1 – 1	>1
Lead (Pb)	≤0.1	0.1 – 1	>1
Mercury (Hg)	≤0.022	0.022 – 0.22	>0.22
Nickel (Ni)	≤1.14	1.14 – 11.4	>11.4
Zinc (Zn)	≤0.7	0.7 - 7	>7

TCLP - Toxicity Characteristic Leaching Procedure

VOLUME 4: REQUIREMENTS FOR THE BENEFICIAL USE OF SLUDGE**Table 4a: Metal limits for soil receiving high sludge loads**

Parameters	Total Maximum Threshold (TMT)	Maximum permissible level (MPL)
	mg/kg	mg/kg
Arsenic	2	20
Cadmium	3	5
Chromium	350	540
Copper	120	375
Lead	10	150
Mercury	1	9
Nickel	150	200
Zinc	200	700

VOLUME 5: REQUIREMENTS FOR THE THERMAL SLUDGE MANAGEMENT PRACTICES AND FOR COMMERCIAL PRODUCTS CONTAINING SLUDGE

No metal limits are stipulated for the thermal treatment of sludge. However, a general risk-based equation is proposed to determine the pollutant limits for sludge destined for complete combustion and co-combustion.

$$C = CRSC \times 86400 / DF \times (1 - CE) \times SF$$

Where:

- C* = The pollutant limit (allowable daily concentration of As, Be, Cd, Cr, Pb, Hg or Ni in sludge, in mg/kg of total solids, dry-weight basis)
- CRSC* = Chronic Risk Specific Concentration of a pollutant (the allowable increase in the annual average ground-level ambient air concentration for a pollutant at or beyond the property line of the site in $\mu\text{g}/\text{m}^3$)
- DF* = Dispersion Factor (in $\mu\text{g}/\text{m}^3/\text{g}/\text{s}$, based on an annual average air dispersion model)
- CE* = Sewage sludge incinerator control efficiency for As, Be, Cd, Cr, Pb, Hg or Ni (in hundredths, based on a performance test)
- SF* = Sludge feed rate (in $\text{ton}_{\text{dry}}/\text{day}$)
- 86400 = Time conversion factor (number of seconds per day)